

Study on the Impact of Technology on Rural Development: Information and Communication Technology

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Abstract: The present study focuses on finding out the impact of information and communication technology on rural development. Rural development is very crucial for overall development of nation. As 65.07% of total population are living in rural areas and it is equally important to strengthen the rural economy which contribute significantly to the GDP of the country. Before the introduction of ICT rural people were facing many obstacles in day-to-day life as well in selling their Agri products and availing benefits of government schemes. Through ICT they are getting ample of opportunities, still the rate of growth is not satisfactory. So, the present paper focuses on impact of effectiveness of ICT policy on agriculture development, education, rural economic development and e-governance in rural development and providing appropriate suggestions & strategies for the development in rural areas.

Findings: Introduction of ICT in rural India is proving them ample of opportunities with autonomy in conducting their daily affairs. Impact is significant and positive, still it is not satisfactory as infrastructural set up of technologies is not up to the mark, and peoples are not aware about ICT in all respect. It acquainted new challenges for its successful implementation.

Conclusion: this paper concludes that ICT is crucial for rural development, with proper knowledge and complete awareness it can be implemented successfully. Proper policy and framework will enhance rate of growth and development.

Key words : ICT(information and communication technology), Rural development

1. INTRODUCTION

The soul of India lies in its villages: Mahatma Gandhi

This famous citation made by Mahatma Gandhi decades ago, still has its applicability. In the country

Several tools of ICT for rural citizens:

ICT TOOLS		
KISAN SMS PORTAL Provide latest news and information in local language	KISAN CALL CENTER Expert advisory system for farmers	KISAN VIKAS KENDRA Serve as backbone of ICT. Link scientific community and rural citizens/ farmers

like India where rural population is the core of society and actual representatives of real India. Being an Indian it is our responsibility to cooperate Indian Government to build a system that ensures basic technological infrastructure to the rural people in an effective and efficient manner. The fruits of nation's progress should be shared by all sections of the society without any bias for this The Ministry of Rural Development in India, the apex body for framing policies, regulations and acts regarding development of the rural sector.

(Census of India, 2011) According to the provisional population count released by the census of India, India's total population in 2011 was 1.21 billion, up from 1.03 billion in 2001 adding 181 million people in one decade and India's total rural population was 0.83 billion which is 68.8% to the total India's population. The rural poverty is mainly due to the lack of proper infrastructural facilities in rural India ICT is major key factor in development of our nation. Deprived of the help of government it cannot be implemented in rural areas. As Government grants the authority to the organizations for implementing the technology in rural areas with this it also provides various other services to the citizen through internet or other media like markets, health, and education.

ICT is applicable since 1990's. while providing information to citizens it also generated advanced concepts for wealth generation for rural citizen. A study by Wilson (2000) concludes that in a developing economy like India, ICT has developed an education, governance, health, human rights promotion, communication, economic growth and other areas. Its implementation in supply chain of farm products reduced cost by great margins.



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E-NAM	E-GOVERNANCE	E-CHAUPAL
Virtual market platform for Agri products	Application based service to connect rural citizen & government	Conglomerate to link farmers directly to internet

Technology plays vital role in the advancement of living standard in rural areas. As its major function in enhancement of rural life it deliver information and create awareness in all respect. Every individual need information, because it is indispensable for development. For instance, ICT enables farmers in rural areas to become aware about advanced techniques and various resources of farming that leads to further production and thus more income. The Department of Information Technology (DoIT) has been established in January, 2004 with the vision of promoting expansion of technology for overall development and growth of the country. ICT has always been prolific for rural development in India.

2.REVIEW OF LITERATURE

Numerous studies have been conducted on this issue, and respective researchers presented their different perspectives. Few of them have been reviewed.

- Rao, T.P. Rama (2004) studied that the rural e-Governance applications in the recent past have presented the important role the Information and Communication Technologies (ICT) in the realm of rural development. This paper presented a brief review of the technologies, the rural ICT projects and the issues associated with the use of ICT for rural e- Governance applications.
- Boateng, M.S. (2012) has stated the Information and Communication Technologies (ICTs) hold incredible potential for rural development in Ghana in the areas of agriculture, health, Micro and Small Enterprises (MSEs), and education. Using the theoretical sampling method, this paper took closer look at the ICT scene in Ghana from 2000 to 2011 with emphasis on the role of ICTs in rural development.
- Patel, Sami and Sayyed, I.U. (2014) their study revealed many ways in which ICT is useful in exchanging information with effective communication like information kiosks which provide not only the basic services like email, helps in education, health services, Agriculture and Irrigation, online trading, community services etc. ICT is useful in predicting the results related to the agriculture specially plant physiology. Leaf protein study is an important study which helps to solve protein deficiency and malnutrition. Present study

deals with role of IT in Agriculture.

- Sharma, Parveen (2011) [6] this paper focused on the examination of several ongoing projects which were aiming to provide IT-based services to rural populations in India, These projects are distinguished by the goal of commercial sustainability, which supports scalability and, therefore, more widespread benefits. How can information technology (IT) impact on rural economy and life of rural India to rural development?
- Matto, Asra (2015) studied that the Information Technology in present era and is helping to exchange the information in faster and efficient way by the right time. Information Technology is taking lead in all the agricultural activities of a nation and has transformed the whole world into a global village with a global economy. Information technology has played a significant role in enhancing the quality of life in rural areas and guided Indian farmer to get relevant information regarding agro-inputs, market support, management of farm, agri business, agro finance, crop production technologies and agro processing.
- Anwesha Banerjee, ICT in agriculture: BRIDGING BHARAT WITH INDIA. This study focused on state of rural development through ICT. It examined different initiatives with their impact, i.e. how these changed the agriculture scenario.

3.OBJECTIVES

Objectives are like driving and motivating factors which assist and direct researcher to conduct study effectively. The key objectives this research study is to examine the current status of awareness and use of ICT in the rural areas. The objectives are as stated below-

- To ascertain the level of awareness regarding ICT in rural areas.
- To identify the importance of Information technology is to helpful in the growth of agriculture.
- To disclose the influence of ICT in the development of rural activities.
- To find digital resources used by rural people.
- To recommend suitable strategies for enhancing the effectiveness of ICT in rural development.

4. RESEARCH METHODOLOGY

Research Methodology is the specific procedure or technique used to identify, select, process and analyze information about a topic. Descriptive and qualitative method was used by researcher to identify and describe the characteristics of population. In order to achieve the research objectives secondary methods were used. The data has been collected from different sources like articles, research paper, government websites, etc.

5. DATA ANALYSIS

5.1 Different Rural Activities and ICT

• ICT and Agriculture

Agriculture primary sector of economy, provide employment to the majority of the rural population in country like India. In Indian scenario, where the agriculture sector contribute in nation's GDP to great extent. As per latest data 70% of rural citizen's livelihood is dependent on agriculture. In past decade, with the arrival of ICT tools, significant contribution of ICT is realized in achieving agricultural development objectives.

ICT empowered rural people by providing better access to natural resources, improved agricultural technologies, effective production strategies, markets, banking and financial services; local and national policies related to agriculture etc.

Advent of ICT resulted in

- Enhanced knowledge of crop cycle, use of techniques, various fertilizers, methods of cropping and many more.
- Increase in public investment.
- E-market for Agri products, as 585 Agricultural Produce Market Committee (APMC) markets were linked to Electronic National Agricultural Market (eNAM) in 14 states in India by 2018.
- ICT empowered farmers with climate forecasting measures and techniques to solve them. With help of ICT accuracy of information increased.
- Extended the reach of farmers at national as well as international level.
- Various initiatives have been taken like Gyandoot project (MP), Center for Alternative agriculture media, I kisan project (Andhra Pradesh), Automated milk collection (Gujrat) and many more.

• ICT and animal husbandry

Animal husbandry is another major activity in rural areas, it is concerned with the management, rearing

and breeding of domestic animals, which aims to improve their quality. It is the second major source of livelihood in rural areas. There are various technologies available which make this work easier and efficient, like remote monitoring technologies, pasture and feeding technologies, automated dairy installations, herd management systems.

Mobile based applications are also there which is specifically designed for this like e-Gopala, Farm GRAZE, I Livestock, so on.

5.2 ICT and Rural Schools of India

In present era ICT has become significant part of education, it includes ICT education, ICT enabled education, ICT aided education. The ICT revolution has changed the learning process of childhood up to the real world. It extended the reach of students, empowered them with ample of opportunities and sources of information and knowledge.

Even after advent of ICT students are facing several challenges, even I witnessed it when I went to my village, i.e. Pandoli (Chittorgarh, Rajasthan). Students have to travel many kilometers as there is no school in their village, if it is there then not equipped proper facilities. Condition of ICT in this area is very poor.

Problems faced in rural education in Rural India

- Lack of teachers due to low pay scale
- Unskilled tutors, not skilled to teach ICT enabled education.
- Most of the schools don't have proper infrastructure.
- In proper Transport facility.
- Lack of funds to install new technologies

5.3 ICT and Rural Economic Development

If we have look over past decades there are substantial evidence available of positive and significant impact of ICT on economic development by refining the business environment in rural areas. ICT provided easy access to market and business information, extended the reach of rural customers to financial services, as well as guided the local communities to organize and link themselves to external world.

In rural areas of country like India, the advancement and economic development is directly associated with level of income generation and Livelihood opportunities. ICT enhanced it by improving access of rural people and small business to wider market area. It



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benefited them by allowing them to get advantage of increased new market areas, ample of opportunities and various sources of income.

ICT infrastructure not only enhances income sources but also help in getting economies of scale, as it reduces many cost associated with business activities. It promoted greater inclusion of individuals by overcoming barriers like physical

distance, time and social standing. The immediacy and scope of ICTs also promoted faster, more efficient, and ultimately better decision making across all fields in rural regions. Figure 2 tries to conceptualize how the driving forces behind ICT adoption translate into economic and social benefits.



5.4 ICT and livelihood assets

ICT impacted livelihood assets in numerous ways depending on their context and localities. Some of these are.

- **Human capital :** Enhanced access to education and training through distance learning Programs and educational tools for wide range of formats. The impact of increasing information flow resulted in well trained and educated youth, not only equipped to perform rural activities but in effective manner by using latest methods,
- **Financial Capital:** ICT strengthened rural financial institutions and rural bank by enabling them to stay connected to external world. Due to this people are well informed and aware about various financial services and government schemes, this provided them with adequate funds to purchase new equipment for farming and to invest in small industries.
- **Social Capital:** to some extent ICT reduced social gap as Improved 'networking' connected rural India with urban India. The reduction in the cost and time taken to pursue social networking goals have a positive impact at a household level with family members spending less time away and less money on transport. Expanded social networks also resulted in increased opportunities for employment both locally and away.
- **Physical Capital:** Communication channels established by ICT are used for access to the markets and market information helps to improve choices for the sale of goods on local

markets as well as global market, these channels increased the reach of rural people as now they can connect to outer world easily.

Key Findings from Data Analyzed

- ICT is providing ample of opportunities in all respect to rural people.
- Enabled people to connect with local, regional and national economy, access to market. A
- Facts showing sources of information: 8% of farmer rely on television, 13 % on radio and input supplier each, 17 % on other Farmer and remaining on kisan portals as source of information.
- There are 13, 996 schools in 6 38000 village of India only 9 % of these have access to ICT.
- Technology based infrastructure is unsatisfactory.
- E- governance enhanced relationship between rural people and government of India.
- Reach to all financial and banking services.
- It uplifted the livelihood of rural people to good extent.

6. CONCLUSION AND RECOMMENDATIONS

It can be concluded that ICT is the key factor for rural development. With its use rate of growth can easily be increased with development in all respect. The awareness of ICT is crucial for increasing the interest of people in ICT who belongs to rural areas. As awareness only can result in positive impact.

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10 Depiction of enforced identity in *Hazaar Chaurasi Ki Maa*—the novel and the film

Ritu Mohan

Introduction

The word "Naxalism" represents the activities of the people who follow the Maoist ideology (Awasthi 1). These are common tribal people who had been living in the forests for many years. They were poor and oppressed ones who were completely dependent upon the forests for their survival. And when the government declared certain forest areas as forests reserved for conservation and research, it was an alarm for the residents of these areas. Not only that, the government, in the name of globalization and industrialization, also started constructing dams and bridges on the rivers flowing inside the forests. Regarding this, these tribal people expressed their strong remonstrations. The government, in response, offered good compensation and promised to rehabilitate these people appropriately. But the government betrayed these people. They were neither rehabilitated properly nor given fair compensation. It was a big shock for these people. They, consequently, decided to fight for their rights. And, in 1967, in a village named "Naxalbari," located in the state of West Bengal, the Naxalite movement started for the first time, when a clash between the tribal people and the local landlords took place. These landlords attacked the tribal people with the help of local goons (Awasthi 2). This clash later became more violent and spread to many other states like Bihar, Andhra Pradesh, Tamil Nadu and Uttar Pradesh.

The government declared these Naxalite people equivalent to terrorists and started operations against the activities of these people, as some of the leaders among them stated their own politics and tried to run a parallel government. Thus, this movement, which was started against exploitation and inequalities, went astray from its direction. And from then to now, a lot of encounters have taken place between the Naxals and the paramilitary forces. Numerous people from both sides have been killed. It is worth mentioning here that, many innocent people have been killed in these clashes who were not even Maoists or Naxals.

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Some ways are there to increase the awareness among rural people and ensuring successful implementation of ICT, such as

- Rural development policy and involvement of local governments
- Formation of young farmer association
- Establishment of direct connection between Rural centres and external agencies
- For schools: more ICT supported education, proper teacher training programs, engaging students to use ICT tools, introducing parents about benefits of multimedia education.
- Establishment of community learning and Information Centers (CLIC) Market Information Centres and Tele Centres in remote areas.
- Reduction in taxation on ICT related components, products and services.
- Partnership with NGOs to encourage use of ICT by spreading awareness and educating them.

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Analysis of optical properties of selectively filled photonic crystal fiber and its applications: Review	Monika Kiroswal	RPSGOI ECE DEPARTMENT	Sensors Letters	2021	1546-1971	http://www.aspl.com/sensorlett/	DOI: https://doi.org/10.1166/asl.2020.4552	[Scopus]
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Broadband mid-infrared supercontinuum generation in AlGaAs photonic crystal fibers by liquid infiltration and red-dfing approaches	Monika Kiroswal	RPSGOI ECE DEPARTMENT	Journal of Computational Electronics	2022	1572-8112	https://www.springer.com/journal/11062	10.1007/s11081-022-02001-9	Yes [SCIE/Scopus/UGC Care]
Design and analysis of ethanol-infiltrated photonic crystal fiber for wavelength conversion	Monika Kiroswal	RPSGOI ECE DEPARTMENT	Journal of Optics	2022	0972-2281	https://www.springer.com/journal/12596	10.1007/s12596-022-00982-1	Yes [Scopus/ UGC Care]
Comprehensive Review and Analysis on Applications and Advantages of Soft Computing Based Maximum Power Point Tracking in Solar PV Energy System	Sandeep Kumar	RPSGOI ECE DEPARTMENT	International Journal on Recent Technologies in Mechanical and Electrical Engineering	2022	2349-7947	http://www.ijrmee.org	http://www.ijrmee.org/ISSN_2349-7947_Volume_9_Issue_3_2022_Article	YES


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Comprehensive Review and Analysis of SVPWM Technique for CSI and VSI Systems	Sandeep Kumar	RPSGOI ECE DEPARTMENT	International Journal on Recent Technologies in Mechanical and Electrical Engineering	2022	2349-7947	https://www.ijrteme.org	http://www.ijrteme.org/ISSN: 2349-7947 Volume, 9 Issue, 3, 577-Article	YES
Machine Learning based CAD System for Thyroid Tumor Characterization using Ultrasound Images	Nirranjan Yadav	RPSGOI ECE DEPARTMENT	International Journal of Medical Engineering and Informatics	2022	1755-0653	https://www.ijmedinfo.com/home.php?cc=administration	doi: 10.1504/IJMEI.2022.10049164	Yes [Scopus/UGC Careless]
Applications of photonic crystal fibers in optical communication: Review Article	Manika Kisorwal	RPSGOI ECE DEPARTMENT	Journal of Optical Communications	2022	2191-6320	https://www.degruyter.com/journal/key/joc/61	publication/224623166_Applications_of_photonic_crystal_fibers_in_optical_communication	[Scopus]
Ultra-broadband dispersion-compensating lithium based photonic crystal fiber for mid-infrared applications	Manika Kisorwal	RPSGOI ECE DEPARTMENT	Journal of Optics,	2022	0972-2281	https://www.springer.com/journal/12596	10.1007/s12596-022-00860-w	Yes [Scopus/ UGC Care]
Hemoglobin sensor based on external gold-coated photonic crystal fiber	Manika Kisorwal	RPSGOI ECE DEPARTMENT	Optics and Laser Technology	2022	0030-1902	https://www.sciencedirect.com/journal/optics-and-laser-technology	sciencedirect.com/journal/optics-and-laser-technology/S003019022100990	[SCI-Scopus]
Assessment of Encoder-Decoder based Segmentation Models for Thyroid Ultrasound Images	Nirranjan Yadav	RPSGOI ECE DEPARTMENT	Medical & Biological Engineering & Computing	2023	0140-0118	https://www.springer.com/journal/11317	https://doi.org/10.1007/s11517-023-028	Yes [SCIE/Scopus/UGC Careless]
Deep Learning-based CAD system Design for Thyroid Tumor Characterization using Ultrasound Images	Nirranjan Yadav	RPSGOI ECE DEPARTMENT	Multimedia Tools and Applications	2023	1573-7724	https://www.springer.com/journal/11042	https://doi.org/10.1007/s11042-023-1713	Yes [SCIE/Scopus/UGC Careless]



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Numerical investigation of gold plated single-core photonic crystal fiber-based refractive index sensor

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Surface plasmon resonance (SPR)-based single-core photonic crystal fiber (PCF) biosensor is investigated with external gold coating. All the geometrical parameters such as a gold layer, an analyte layer, a lattice period and cladding air holes are optimized to enhance the sensing ability of the sensor by introducing the finite element method. The designed sensor is able to achieve the highest amplitude sensitivity (AS) of 2258.95 RIU^{-1} with an acceptable refractive index sensitivity (RIS) of 6000 nm/RIU over the analyte refractive index (ARI) span of 1.31–1.40. This sensor can detect a slight index alteration in the sensing medium using a resolution of 1.66×10^{-5} and a high figure of merit (FOM) of 79.91. With the enhanced modal behavior with simple geometry, the resulting sensor can be suitable for real-time monitoring in biological, biochemical and bio-imaging applications.

Keywords: Photonic sensors; confinement loss; sensitivity; figure of merit; resolution.

PACS numbers: 42.81.Pa, 42.81.-i

1. Introduction

An optical sensor (OS) is a refined system that changes over the light beams into electrical signs which can distinguish the change in optical properties and reaction of encompassing conditions or gauge the force of electromagnetic (EM) waves. Optical fibers (OFs) provide a helpful strategy for the execution of optical detecting by guiding light to and gathering light from the estimation area, supposed extrinsic sensors, and by utilizing the actual fiber as the transducer, alleged intrinsic sensors.¹ Generally, optical fiber sensors (OFSs) work by estimating changes in light spread brought about by outer stimuli going from physical to biological

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Numerical analysis on the supercontinuum generation through $\text{Al}_{0.24}\text{Ga}_{0.76}\text{As}$ based photonic crystal fiber

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Abstract. In this paper, supercontinuum generation dynamics in a highly nonlinear $\text{Al}_{0.24}\text{Ga}_{0.76}\text{As}$ based photonic crystal fiber has been presented. The simulated geometry exhibits a low order of dispersion 4.21 ps/nm.km with a high nonlinear coefficient $2.35 \text{ W}^{-1} \text{ m}^{-1}$ at a pumped wavelength of 3.25 μm . The analyzed results of the proposed fiber structure make it promising to generate the broad supercontinuum spectrum expanding from 1.75 μm to 7.75 μm stimulated at a peak power of 2.5 kW with 50 fs pulse duration. Effects of higher order dispersion coefficients, peak power and pulse duration on spectrum broadening have been computed and analyzed.

Keywords. AlGaAs nonlinear material; photonic crystal fiber; nonlinearity; dispersion; supercontinuum spectra.

1. Introduction

The age of wideband sources has consistently been of incredible interest because of colossal applications in numerous science and innovation zones. Supercontinuum spectrum (SCS), perceived in current days as the 'white-light laser' measure is discerned to be probably the effective method to get wideband transmission [1, 2]. The marvel of super-continuum has been accomplished in various types of structures with different media, for example, solids, glasses, fluids, and gases [3]. These optical structures incorporate photonic crystals, microwires, transmission fibres, and so on. Among these various structures, an extraordinary class of fiber called photonic crystal fiber (PCF) is getting attraction in the research field, as this sort of fiber has strong light confinement ability [4].


As of now a lot of research has been shown on PCF-SC in all pump ranges including continuous wave (CW), nanosecond (ns), picosecond (ps), and femtosecond (fs) in the course of most recent decade [5–8]. PCF has gained extensive attention for nonlinear applications, including frequency metrology, nano-imaging, sensors, tunable wavelength division multiplexing, etc. [9–12]. The main requirements to generate broad spectra in PCF are nonlinearity and low order dispersion profile. Researchers are exploring the different waveguides, including PCF infiltrated with nonlinear optical materials such as chalcogenide [13, 14], tellurite [15, 16], bismuth [17, 18], and

semiconductor materials, for example, silicon and AlGaAs [19, 20]. Extremely confined propagation modes with high nonlinearity can be achieved because of the high linear and nonlinear refractive index of optical material with wide transparent range. Alamed *et al.* [21] presented a supercontinuum spectrum covering from 1.2 to 9.3 μm in a 0.5 cm long As_2Se_3 based PCF. Ali *et al.* investigated a chalcogenide core PCF and achieve the SC spectrum of 2656 nm and 1766 nm at wavelengths of 1550 nm and 1300 nm, respectively [22]. Sharma and Kumar demonstrated a lead-silicate based PCF for generating three octave spanning spectrum from 0.9 to 7.2 μm [23]. Dhouf *et al.* [24] exhibited an $\text{As}_{1.2}\text{Se}_{0.2}$ based PCF to generate a 3-dB flat-top coherent SC spectra spanning 2.9–4.57 μm . A Ge-As-Se based PCF has been proposed for broadband supercontinuum spectrum covering 1–16 μm mid-infrared regions [25]. Pumped with an all-normal dispersion regime, Medjoui *et al.* have investigated and analyzed a coherent supercontinuum spectrum by applying a laser pulse of 50 fs width with a power of 20 KW in a 1 cm long Ga-Sb-S based PCF [26]. Chromatic dispersion and higher-order dispersion (HOD) has a significant impact on spectral broadening. In this context, Karim *et al.* have numerically studied the influence of HOD on spectra in a nonlinear material As_2Se_3 based PCF [27]. A new PCF approach with multi-material is displayed and produced a broad spectrum ranging from 1.6 to 4.2 μm at 2.5 μm [28].

Recently, Aluminum Gallium Arsenide (AlGaAs) semiconductor material based optical waveguides have received more attention for nonlinear photonics applications [29].

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Design and analysis of broadband supercontinuum generation in highly nonlinear LiGaSe₂-based photonic crystal fibre

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Abstract. A numerical investigation of LiGaSe₂-based photonic crystal fibre for broad supercontinuum spectrum at -30 dB intensity level has been studied in this paper. The proposed structure is simulated by the finite element method and provides a zero-dispersion wavelength of 2.46 μm . Higher-order dispersion coefficients are considered to generate a supercontinuum spectrum spanning 2.15–14.6 μm . An input pulse of 30 fs is injected into a small-length photonic crystal fibre with a low input power of 660 W at a pump wavelength of 2.5 μm . This mid-infrared broad spectrum has potential applications in optical coherence tomography, spectroscopy and medical bio-imagery field.

Keywords. Nonlinear optics; photonic crystal fibre; nonlinearity; finite element method; chromatic dispersion.

PACS Nos. 42.65.-k; 42.65.Wi; 42.81.Qb

1. Introduction

Photonic crystal fibres (PCFs) are getting more attention in the photonics field for the growth of the mid-infrared supercontinuum (SC) spectrum [1]. Supercontinuum generation (SCG) is a phenomenon that expands an energy pulse while propagating through an optically nonlinear medium. This magical process was first introduced by Alfano and Shapiro [2,3]. Linear characteristics like chromatic dispersion and nonlinear characteristics like self-phase modulation (SPM), cross-phase modulation (XPM), four-wave mixing (FWM), stimulated Raman scattering (SRS) and soliton dynamics are the soul of this SCG process [4]. Due to high absorption loss in the mid-infrared range (MIR), conventional silica-based PCFs have limitations in enhancing the SC spectrum's bandwidth. Nonlinear material-based photonic crystal fibre has a great potential to overcome these limitations. Chalcogenide glasses and other nonlinear optical materials like tellurite, fluoride and nematic liquids are the most attractive for the SC spectrum at longer wavelengths [5,6]. These materials are doped (infiltrated) in the core or cladding region to enhance the optical properties of the existing fibres.

The most commonly used region in the infrared spectroscopy is the mid-infrared region since molecules can

soak up radiations in this regime to set off vibrational excitation of effective groups. These vibrational transitions of a molecule have been of immense importance to scientific researchers in diverse fields [7]. Towards this, PCF infiltrated with nonlinear material generates broad spectra expanding from the near to mid-infrared region.

The selected materials must have a wide transparency window with low absorption losses, high linear and nonlinear refractive indices and high thermal stability [8]. Several numerical investigations have been done on silica, bismuth [9,10] and tellurite [11] microstructured fibres. Huan *et al* [12] investigated a broadband SCG spectrum with a bandwidth of 2900 nm in a 5 cm long tellurite-based PCF. Saini *et al* [13] presented a theoretical and numerical computation of SC spectra covering 1.2–15 μm using spiral PCF. Xing *et al* [14] have done simulations to study the generation of SC at -20 dB intensity level in a PCF with 2 cm length. A wide SCG spectrum with a bandwidth of 3.7 μm was presented in a 10 mm PCF by Balani *et al* [15]. Chromatic dispersion and higher-order dispersion (HOD) have significant impact on spectral broadening. In this context, Karim *et al* have numerically studied the influence of HOD on spectra in As₂Se₃-based PCF [16]. A new PCF approach with multimaterial is displayed which generated a wide spectrum covering 1.6–4.2 μm




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Design and analysis of highly sensitive solid core gold-coated hexagonal photonic crystal fiber sensor based on surface plasmon resonance

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Abstract. A surface plasmon-based hexagonal photonic crystal fiber sensor is numerically computed and studied covering a large span of analyte refractive index from 1.33 to 1.40. Structural design parameters are optimized to improve the sensor performance. Investigation of sensor sensitivity has been performed by analyzing the electromagnetic behavior of light using finite element method-based mode solver. The studied sensor yields the maximum amplitude sensitivity of 2958.84 RIU⁻¹ at analyte RI of 1.39 and moderate wavelength sensitivity of 8000 nm RIU⁻¹ at analyte RI of 1.40. The observed results are also presented by changing the gold layer thickness, lattice period, and air hole diameter. The reported plasmonic sensor is an appealing aspirant in the field of biochemical sensing, biomolecule detection, and biological sample recognition. © 2021 Society of Photo-Optical Instrumentation Engineers (SPIE) [DOI: 10.1117/1.5260086]

Keywords: photonic crystal fiber; detection; resonant wavelength; resolution; sensor sensitivity.

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1 Introduction

Sensors are essential devices that detect the component amount of an estimation article and convert this amount into a readable signal, which is shown on an instrument. Furthermore, detecting technology is an innovation that utilizes sensors to gain data by sensing the physical, chemical, and biological properties and converting them into coherent signal. In recent years, optical sensing technique (OST) gained attention due to its numerous applications in different aspects of science and technology from industry to real life.^{1,2}

In the present era, surface plasmon resonator (SPR)-based photonic sensors have become the primary technique in OST.³ Furthermore, SPR has been an important research subject for recent 20 years due to its accommodation in real-time sample detection, nonobtrusive, high affordability, and label-free handling.⁴ Initial prism-based SPR sensors⁵ and optical fiber-based SPR sensors⁶ had some limitations in terms of numerical aperture and complexity in fabrication. SPR sensors using photonic crystal fiber (PCF) are used to overcome these limitations and become popular because of appealing properties, such as design flexibility, tunable dispersion and birefringence, tight light confinement, and single-mode function.⁷ These SPR-PCF sensors are proving themselves as a suitable candidate in various areas such as water testing, salinity testing,⁸ gas, liquid, and drug detection,⁹ food safety,¹⁰ biochemical sample recognition, and blood component detection.¹¹

Internal coating and external coating are two well-known approaches for plasmonic material coating. In internal coating, metal is coated at the inner layer of the air hole.¹² Although this approach provides high sensor performance, it has two major drawbacks: first, the uniform metal deposition during fabrication is a challenging task, and second, the analyte injection into the microns-sized air hole limits its real-time application.¹³ The external coating approach has been utilized to resolve these drawbacks,¹⁴ where metal layer is circulated on the external boundary of PCF. The analyte layer is in direct contact with plasmonic metal layer. In general, detecting



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Design and analysis of highly nonlinear, low dispersion AlGaAs-based photonic crystal fiber

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 published online March 4, 2021

Abstract: An AlGaAs-based standard photonic crystal fiber structure is reported for low dispersive nonlinear optics applications. By employing a finite element solver with perfectly matched layer boundary condition, the key propagation characteristics are investigated over a broad wavelength span (1–5 μm) by taking the different air filling fraction values. The proposed work provides an effective fundamental mode area of 7.30 μm^2 with nonlinearity in the order of $6.325 \text{ W}^{-1}\text{km}^{-1}$ at a low absorption wavelength of 1.55 μm and zero-dispersion wavelength close to 3 μm .

Keywords: finite element method; nonlinear material; nonlinearity; photonic crystal fiber.

1 Introduction

Conventional optical fibers have two fundamental parts core and cladding, and both are solid with a minute difference in refractive index, which is liable for guiding the light wave [1]. A modification is done by Russell (1990a) in the structure of standard optical fiber based on light directing mechanism of 2D photonic crystal; this modified structure is known as Photonic Crystal Fiber (PCF) [2]. Modification is done in the cladding region by inserting the rings of air holes along the full fiber length. The core can be solid or hollow, depending on the application's requirement. Reflected light from the air holes' periodic arrangement is collected through missing one air hole in the center (solid core). This light-guiding conduct is called modified total internal reflection, and fiber is considered as index guiding photonic crystal fiber. When reflected light is collected towards a low refractive index

hollow core, this phenomenon goes under the photonic bandgap guiding technique [3, 4].

A typical PCF structure is made by fused or pure silica as foundation material, and air holes are inserted in that region. From last decade to improve the optical parameters like tunable dispersion [5], endlessly single-mode propagation [6], high nonlinear coefficient [7], small mode area [8], and birefringence [9], various kinds of nonlinear materials (semiconductor, organic, inorganic and semiorganic) are utilized. These materials have good thermal and mechanical properties along with the high estimation of third-order Kerr nonlinearity. High nonlinear PCF is truly attractive for the various nonlinear optics applications. Two methodologies can enhance the nonlinear coefficient in PCFs initial one is core diameter reduction, and the subsequent one is to alter the air hole size in the cladding. Various low loss PCF structures have been examined to accomplish high nonlinear coefficient. X. Li et al. exhibited pentagonal silica-based PCF to acquire the nonlinearity of $33.2 \text{ W}^{-1}\text{km}^{-1}$ at 1.55 μm [10]. Z. Fan et al. reported defected core silica PCF with high nonlinearity nearly $25.32 \text{ W}^{-1}\text{km}^{-1}$ at 2 μm wavelength [11]. Fabrication of defected core PCF is a little bit difficult; to resolve this, S. Vyas et al. demonstrated a simple hexagonal $\text{Ge}_{12}\text{As}_{10}\text{Se}_{73}$ chalcogenide glass-based PCF to achieve the high nonlinearity value of $2317 \text{ W}^{-1}\text{km}^{-1}$ at a pumping wavelength of 3.1 μm [12]. S. Z. Sinaev et al. presented all circular air holes hexagonal PCF to obtain the high nonlinearity of $96.51 \text{ W}^{-1}\text{km}^{-1}$ at an active wavelength of 1550 nm [13].

Generally, the achievement of high nonlinearity with a low magnitude of chromatic dispersion is a challenging issue. The combined effect of high nonlinearity and low dispersion will unavoidably make the situation for soliton pulses, significant for supercontinuum generation. A simple AlGaAs [14, 15] solid core PCF with all circular air holes is designed to observe the stated condition. This high refractive index material (AlGaAs) can be utilized for wavelength conversion [16] and to produce nonlinear impairments in optical waveguide [17]. Repeated arrangement of air holes is made in a triangular fashion to create a hexagonal cladding with Λ pitch period. The central air hole is deprived of to produce a solid core, which makes it index-guiding photonic crystal fiber. By availing the PCF's structuring adaptability, air filling fraction (f/A) is varied to upgrade the existing fiber's optical properties. By

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REVIEW

Analysis of Optical Properties of Selectively Filled Photonic Crystal Fiber and Its Applications: Review

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This article represents the last decade (2009–2019) of progress achieved in the field of photonic crystal fiber. This review's primary focus is on the hybrid core photonic crystal fiber by introducing different geometries filled with nonlinear materials that can be solid, semi-solid, liquid, and gaseous. High nonlinearity and high birefringence can be achieved with good agreement in all other optical properties like confinement loss, numerical aperture, scattering loss, low dispersion, and effective area. Depending on all the above parameters, supercontinuum generation is also reviewed over ten years. Based on the present scenario, the future scope and all related applications have been discussed.

Keywords: Photonic Crystal Fiber, Nonlinear Materials, Supercontinuum, Birefringence, Effective Core Area.

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1. INTRODUCTION

Technology is getting advanced to send the information within milli-second over a broad distance in the present era of wired and wireless communication. Optical fibers are playing a vital role in the world communication field. Nowadays, this communication media acts as a backbone for wireless communication to send the data faster using light medium. Researchers are developing this media by capturing its properties with fixed and dependent parameters like design inflexibility, low radiation sensitivity, and poor polarization maintenance. To obtain the advanced properties that are unavailable in conventional fibers, Photonic Crystal Fibers (PCF) came into Russell's limelight in the 1990s to trap the light inside the hollow core region by a 2D photonic crystal by creating a photonic

band-gap structure [1]. PCF, a category of optical fiber presenting a new development in light propagation with its numerous advantages over conventional optical fiber. A photonic band-gap is a periodic arrangement of air-filled capillaries around the core area over the entire fiber length. This micro-structured band-gap has the property of molding the light behavior in constructive or destructive mode to confine the light tightly [2]. Photonic crystal fiber is defined by three key elements as shown in Figure 1 the hole to hole length of air voids is cladding by center (lattice period) A , the diameter of the cladding air holes d , and D the core diameter. Depending on PCF type's core can be solid or hollow, and generally, silica is used as background material.

PCF has many design features than conventional fiber such as hybrid core structure, background materials, air void arrangement, lattice length, number of cladding rings. The design flexibility provides good control over different parameters like nonlinearity, dispersion, effective mode area, splicing loss, scattering loss, and leakage loss [3].

A comprehensive review has been published based on newly developed hybrid guiding mechanisms, compares with a discussion on the emerging field of PCF application [4]. As per the sensing applications requirement [5], physical and biomedical sensors were reviewed according to their utility in different application fields. In other article [6], different physical quantities like temperature,

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Despeckling filters applied to thyroid ultrasound images: a comparative analysis

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Abstract

The speckle noise is an intrinsic artefact present in ultrasound images that masks the diagnostically important information, thus makes it hard for the radiologists to analyze them. Therefore, a suitable despeckling algorithm, which will retain the diagnostically important features such as structure, edges and margins are required. In this study the performance of 64 despeckling filters algorithms used for the analysis of thyroid nodule ultrasound images is compared. These 64 filters are divided into 9 categories namely Linear, Non-linear, Total Variation, Fuzzy, Fourier, Multiscale, Nonlocal Mean, Edge Preserving, and Hybrid filters. A total of 820 thyroid US images have been taken from two different benchmark datasets. Out of these 820 thyroid US images, 200 are benign and 620 are malignant. The performance analysis of despeckling filters has been carried out by calculating structure and edge preservation index metric. It has been observed that fast bilateral filter and edge-preserving smoothing filter yields optimal performance with respect to the preservation of image structures like edges and margins of benign and malignant thyroid tumors. Based on the criterion followed in real time clinical practice for differential diagnosis between benign and malignant thyroid ultrasound tumors, it is observed that the images filtered by DsF_EPSF filter yields better diagnostic quality images in terms of preservation and enhancement of important diagnostic information.

Keywords Despeckling filters · Image quality assessment metrics · SEPI metric · Speckle noise · Digital database of thyroid ultrasound images (DDTI)



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Objective assessment of segmentation models for thyroid ultrasound images

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Abstract

Ultrasound features related to thyroid lesions structure, shape, volume, and margins are considered to determine cancer risk. Automatic segmentation of the thyroid lesion would allow the sonographic features to be estimated. On the basis of clinical ultrasonography B-mode scans, a multi-output CNN-based semantic segmentation is used to separate thyroid nodules' cystic & solid components. Semantic segmentation is an automatic technique that labels the ultrasound (US) pixels with an appropriate class or pixel category, i.e., belongs to a lesion or background. In the present study, encoder-decoder-based semantic segmentation models i.e. SegNet using VGG16, UNet, and Hybrid-UNet implemented for segmentation of thyroid US images. For this work, 820 thyroid US images are collected from the DDTI and ultrasoundcases.info (USC) datasets. These segmentation models were trained using a transfer learning approach with original and despeckled thyroid US images. The performance of segmentation models is evaluated by analyzing the overlap region between the true contour lesion marked by the radiologist and the lesion retrieved by the segmentation model. The mean intersection of union (mIoU), mean dice coefficient (mDC) metrics, TPR, TNR, FPR, and FNR metrics are used to measure performance. Based on the exhaustive experiments and performance evaluation parameters it is observed that the proposed Hybrid-UNet segmentation model segments thyroid nodules and cystic components effectively.

Keywords Thyroid ultrasound · Semantic segmentation · SegNet · U-Net · Hybrid-UNet

Introduction

The thyroid is located lower behind the front neck, a small gland in the shape of a butterfly. It regulates human metabolism. It releases a secret hormone that controls human activities, including energy, heat, heart rate, temperature, and oxygen [1, 2]. The human body is harmed when the release of hormones is improper due to the nodule's aberrant growth

[1, 2]. Various imaging modalities like mammogram, Ultrasound (US), CT Scan, thermal images, and MRI have been widely used to detect thyroid nodules at an initial stage so that the patient's chance of survival can be increased [3–5]. The limitation of mammogram, MRI, CT, and thermal imaging lie in ionizing, cost, and availability, which might be harmful or easy to use to the patient [3, 4, 6]. US imaging modality is most popular to identify thyroid nodules as an initial screening test over MRI, CT, and thermal imaging [7, 8]. Owing to the disadvantages of the other imaging modalities, the US is considered as a first-line treatment to identify thyroid nodules due to its cost, availability, and no harm to the patient [9]. Low contrast and speckle noise often degrade US images' visual quality, which affect the radiologists' interpretation [10, 11]. The presence of speckle-noise reduces contrast resolution, making it more difficult to identify lesions during diagnosis [12, 13]. Over the past two decades, computer-based research of thyroid tumor US images has been extensively examined. The main objective of this work is to improve detectability during thyroid nodule

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Broadband mid-infrared supercontinuum generation in AlGaAs photonic crystal fibers by liquid infiltration and rod-filling approaches

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Abstract

This paper numerically investigates the supercontinuum generation in a regular dispersion zone (normal + anomalous) and an all-normal dispersion zone in a photonic crystal fiber (PCF). The novelty of this fiber is that both stated dispersion zones are obtained in a single proposed solid-core fiber using the infiltration and rod filling approach by employing the finite element method. This fiber is composed of AlGaAs material in place of conventional fused silica to obtain high nonlinearity over a large wavelength span when a 14 kW peak power, 50 fs initial energy pulse is applied into a 5 mm-long PCF to obtain a spectrum bandwidth of a 10.22 μm region for anomalous dispersion pumping and a 10.05 μm region for all-normal dispersion pumping. These results reveal that the proposed unique structure can be suitable for molecular fingerprinting, medical bio-imaging, and disease detection in the mid-IR window.

Keywords Liquid infiltration · Photonic crystal fiber · Dispersion · Chalcogenide rod filling · Supercontinuum spectrum

1 Introduction

With the continuous evolution of optical fiber technology, photonic crystal fibers, sometimes called holey fibers, and micro-structured fibers provide numerous possible applications [1]. Because of their demanding properties, which are unattainable in traditional optical fibers, these photonic crystal-based fibers are marking their presence in fiber communication, including fiber lasers, amplifiers, bio-imaging, sensors, efficient power transmission, optical logic gating, and nonlinear photonics [2–5]. Photonic crystal fiber (PCF) structure comprises a center core enclosed by a cluster of air capillaries (ACs) arranged at particular angles. Because of these ACs, the cladding's effective refractive index is lower than the solid core area, and light is propagated by modified total internal reflection inside the core. The size and shape of capillaries and the gap between two capillaries can be modified to control the optical behavior of the propagating light, and thus the light propagation-dependent characteristics such as dispersion, fundamental mode area, mode confinement loss, nonlinearity, and birefringence can

be controlled in the desired manner [6, 7]. A porous core can be an effective method to enhance the overall performance of fiber [8]. PCF design with all these degrees of freedom makes it better than existing regular fibers.

For nonlinear optics applications, supercontinuum sources are promising for generating a broad spectrum with a single input wavelength. Low dispersion and high nonlinearity parameters are important for this broad spectrum [9]. To achieve better fiber performance, several nonlinear optical materials with high third-order Kerr nonlinearity such as chalcogenide, tellurite, silicon, and doped silica materials are attracting attention for supercontinuum generation (SCG) in place of conventional fused silica [10, 11]. Single-material-based PCF can be effectively fabricated using traditional and modern fabrication methods [12, 13]. After fabrication, it is not easy to alter the fiber's optical characteristics to make it tunable for the desired application, so liquid infiltration of air capillaries (holes) is an effective approach to solve this post-fabrication problem [14]. Dispersion properties can be engineered with selective air hole liquid filling and rod filling techniques [15]. With the optimized parameters, light is more confined, so high-power femtosecond pulses can be propagated through the PCF, which is helpful to generate SC in all wavelength ranges from visible to infrared (near + mid).

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RESEARCH ARTICLE

Design and analysis of ethanol-infiltrated photonic crystal fiber for wavelength conversion

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Abstract In this article, ethanol (liquid)-infiltrated photonic crystal fiber (LIPCF) has been investigated and its properties have been analyzed for broadband wavelength conversion using the modulation instability phenomenon. With the help of the selective air-holes infiltration technique, dispersion engineering has been performed without modification to existing fiber structure and wavelength conversion span can be tuned by varying the pump wavelengths in the normal + anomalous dispersion regions (LIPCF-1) and all normal dispersion regimes (LIPCF-2). The simulated and studied results illustrate that the normal dispersion pumping close to zero dispersion in LIPCF-1 and LIPCF-2 exhibits the maximum wavelength shift of 29.799 μm and 7.088 μm , respectively. Besides this wavelength conversion, gain spectra are also analyzed for both PCFs by varying the pump wavelengths and peak powers. The suggested infiltrated PCF structure is found to be appropriate for wide-tunable wavelength converters and parametric amplifiers in the all-optical domain.

Keywords Photonic crystal fiber · Modulation instability · Dispersion · Infiltration · Wavelength conversion



Introduction

In the era of high-speed communication, an optical fiber plays a crucial role in enhancing system performance. Although improvement in the conventional fiber design is still going on for numerous applications, none of them can be compared with the appealing properties of photonic crystal fiber (PCF) [1]. PCF provides facilities to improve fiber performance in terms of controllable dispersion, polarization maintenance, low modal loss, desirable numerical aperture, and variable effective mode area. These parameters can be achieved by modifying the fiber's geometry, which includes the shape and size of air-holes, lattice period, number of air-hole rings, and host materials [2]. The orientation of air-holes also affects the performance of the PCF [3]. PCFs are becoming a hot research topic due to various applications in the telecommunication field [4], sensors [5], amplifiers [6], optical logic gates [7], couplers [8], etc.

In theory, numerous techniques have been developed to improve the PCF's linear and nonlinear optical properties. Especially, the PCFs prove themselves promising candidates in nonlinear optics. Non-silica technology may be an effective way of increasing the nonlinear coefficient of the PCF [9]. Dispersion, along with nonlinear impairments such as self-phase modulation (SPM), cross-phase modulation (XPM), and four-wave mixing (FWM), plays a crucial part in nonlinear optics applications, including new amplified frequency generation [10], optical sensing, switching [11, 12], etc. Dispersion engineering is possible by modifying the dimensions of air-holes, the layers of air-hole rings in the cladding zone, and the core area [12]. Different techniques are approached by researchers to achieve flat dispersion with a low value, like dispersion tailoring [13], tapering [14], and infiltration of liquids in cladding air-holes [15].

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Comprehensive Review and Analysis on Applications and Advantages of Soft Computing Based Maximum Power Point Tracking in Solar PV Energy System

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Abstract

For both production and daily living, electricity is essential. Power generation, power transmission, power conversion, and power consumption make up the four components of the power system. It is difficult to set up transmission and distribution systems for minimal power demands on isolated farms, forest farms, and islands. The past ten years have seen the discovery and publication of several methods for finding MPP. These technologies differ in many ways, including the types of sensors used, their complexity, price, speed of detection, accuracy in tracking changes in light and temperature, the materials required for the application or user data, etc. There are several methods, including P&O, ear networks, open or short-circle volumes, current probe, and fuzzy logic controllers. The majority of these techniques provide at least locally, however others, such open or short circular circuits, only provide an average MPP. This is not an issue because the V-P curve often has just one meaningful value. However, there will be more than one maximum in these curves if the PV curve is somewhat obscured. This research article provides a thorough analysis of the various renewable energy sources, as well as their maximum point tracking methodologies and comparison outcomes.

Keywords: MPPT, P & O, I & C, Solar and Wind Hybrid Power System.

I. INTRODUCTION

Global energy demand is constantly growing, and fossil fuel exploration is a priority. These oils are not durable but pollute the environment. The expansion in worldwide energy request and increment consideration regarding natural issues has prompted the investigation of renewable energy sources, for example, solar and wind [17]. The use of renewable energy (RES) is affected by the scarcity of fossil fuels and the unfavorable climate because renewable energy is a large part of the energy obtained from solar and wind. Energy from the sun and wind is a natural source that its use will not damage and is becoming increasingly popular. In order to reduce the demand for electricity in the traditional power generation sector, the optimal use of these natural resources is essential for power generation [20]. The electricity grid connects power plants, transmission lines, or allotment lines to provide power to users. In power plants, electricity comes from renewable or non-renewable energy sources. The current is then transmitted from one place to another through the transmission line. Finally, the power is distributed among the users using distribution feeders [24].

The current trend in the developing economy has led to the expansion of renewable power. Over the past three years, Figure 1 shows that renewable energy and biomass energy account for a significant part of current renewable energy consumption. The recent development of solar photovoltaic knowledge or reliable introductions of projects in countries/regions such as Germany and Spain have also brought significant growth in the solar photovoltaic market [30]. It is expected that there will be more than other renewable energy sources in the solar photovoltaic market. In 2019, more than 115 countries set political goals to achieve their predetermined role through renewable energy compared to 45 countries in 2005. Most of the objective is ambitious, reaching 30-90% of national production through renewable energy [7].



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Comprehensive Review and Analysis of SVPWM Technique for CSI and VSI Systems

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Abstract

Power electronics has seen substantial technical development during the last three decades. Recently, it has been applied in a range of commercial, residential, and aviation applications. Low-power, high-frequency power electronics that must accommodate switching-mode power supplies on demand and high-power, low-frequency power electronics that must accommodate switching-mode power supplies are polarized in opposite ways.

The main goal of this paper is to build SVPWM Model in a systematic manner, use it to compare and contrast Voltage Source Inverters and Current Source Inverters (CSI), and apply it to both of these devices. Based on space vector theory, a three-phase VSI and CSI are developed. The simulation results are found using MATLAB/Simulink for efficiency.

Three-phase inverters are suggested for the SVPWM system. In VSI and CSI modulation, this modulation strategy is essential. We'll meticulously develop the SVPWM Model, using it to compare VSI and CSI on a number of variables, such as load parameters, frequency, and modulation index.

Keywords: SVPWM, CSI, VSI, MOSFET, Voltage Source Inverter

1. Introduction

Researchers are putting up their best efforts to maximize efficiency and meet the demand for electric drives [27]. This includes using the Space Vector Pulse Width Modulation (SVPWM) technology to create or organize converter drives. Voltage source inverter (VSI) or current source inverter (CSI) is two main drives. The VSI design has shown to be beneficial in industrial markets, with the faster dynamic response, improved dependability, and the ability to run without de-rating. VSI's fully included intending to save money by increasing efficiency, reducing installation time, and removing the need for connecting power [34].

A wide range of applications is possible because of the fast dynamic comeback for rapid motor torque modification or load change. Minimum components are used to extend the meantime to failure (MTTF), a crucial metric in critical uptime applications. All of these elements combine to create a durable, high-quality industrial design.

In the current environment, the use of force hardware devices in power systems is exceptionally high. Controlling the power stream in a long-distance transmission line is an urgent need. The powerful drives are delegated either immediate or backhanded change drives—the immediate arrangements with cyclo-converters, while circuitous converter manages VSI drives. The VSI is additionally arranged into 2-level High force VSI or Multilevel VSI.

2. Literature Survey

S Pradeeps et al. (2018) It has been shown that pure air shielding technology (SVPWM) is used to implement and control a converter, and SVPWM pulse is supplied to the converter, and THD analysis is performed on the converter of various details. Shalini et al. (2020) have investigated the Voltage source inverters (VSI) that give desirable inverter output voltage. They control the drives in most medium and large power applications. One of the most effective switching control systems to control inverter outputs is space vector-PWM (SVPWM). An efficient SVPWM approach is modelled and implemented in a two-level Three-Phase VSI in this research. The SVPWM module mainly consists of an Angle generation unit (AGU), Phase-locked Loop (PLL), Sector generation unit (SGU), time duration module (TDM), Switching time generator (STG) Module, and lastly, SVPWM gate pulse generation (GPG) module [9].

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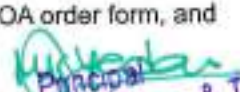
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Applications of photonic crystal fibers in optical communication

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Abstract: Photonic crystal fiber is a category of optical fibers, getting great attention by its promise to offer a range of optical characteristics that are not achievable in conventional optical fibers. Engineered dispersion and nonlinear characteristics of photonic crystal fiber (PCF) make it an attractive candidate for nonlinear optics and advanced optical networking in the all-optical domain. An optical network consists of different optical components such as laser sources, amplifiers, regenerators, and converters for proper signal transmission over long distances. In recent years, the performance of the components has been improving by employing the appealing properties of PCF. The PCF's application on such components is discussed, and the simulated results on gain amplification, regeneration, conversion, fiber laser are reviewed. These developments reveal that the enhanced performance provided by PCF makes it suitable for different optics applications.

Keywords: de-multiplexers; parametric amplifiers; photonic crystal fibers; regenerators; wavelength converters.

1 Introduction

In this high-speed era of communication, an optical network (ON) is a crucial part of any wide network that uses a light signal to transmit different types of information like audio, video, text, images, etc., over long distances with low attenuation. These ONs rely on optical components like optical sources, regenerators, amplifiers, switches, de-multiplexers, buffers, and optical detectors to transfer huge amounts of data at a very high speed using optical fibers. Each component has its own merits and demerits to

work with integration in an optical network. High nonlinear photonic crystal fibers (PCFs) [1] contribute their optical properties to enhance all-optical component processes performance. PCF is a bunch of air hole tubes arranged in a particular fashion. These photonic crystal fibers are guided by a photonic band-gap mechanism, making them confining new and improved optical properties. In this band-gap mechanism, some wavelengths are prohibited from transmitting over the micro-structured air hole arrangement. This prohibition of wavelengths is responsible for the confinement of light inside the core area. PCFs are mainly divided into solid-core PCF, and the second one is hollow-core PCF [2]. Former PCF is guided by modified total internal reflection, and later one PCF is guided by band-gap mechanism. PCF can be single-mode over a long distance or endlessly single-mode [3]; it can provide a small or large value of mode field diameters with engineered dispersion profile [4], effective polarization control employing high birefringence property [5], effective mode area to achieve high nonlinearity [6]. Nonlinear optics in PCF is a great part of the research, and remarkable progress has been recorded in the structure and fabrication [7–9].

There are different types of nonlinear impairments which are useful in many aspects in different areas of science and technology, such as self-phase modulation (SPM), cross phase modulation (XPM), four-wave mixing (FWM), stimulated Brillouin scattering (SBS), and stimulated Raman scattering (SRS) [10]. These entire nonlinear phenomena with dispersion characteristics are widely used in many applications like medical imaging, optical coherence tomography, frequency metrology, super-continuum generation, etc. [11–13]. These nonlinear effects can be utilized to perform optical functions with a low bit error rate and improved efficiency like optical amplification, wavelength conversion, optical regeneration, and optical demultiplexing in the all-optical domain [14]. Short length with high nonlinearity PCFs can achieve all these optical functions at low power consumption [15]; still, attenuation loss is a little higher than conventional optical fiber, which can be reduced by applying proper polishing, etching, and dehydration techniques [16].

Recent progress in PCF has opened a new phase of advanced technology to improve the existing techniques

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Ultra-broadband dispersion compensating lithium-based photonic crystal fiber for mid-infrared applications

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Abstract Triangular lattice-based hexagonal photonic crystal fiber (PCF) has been introduced with high negative dispersion and nonlinearity. Dispersion and nonlinearity are numerically examined by using the finite element method. A maximum negative dispersion of -1054.73 ps/(nm km) with a high nonlinearity of 136.44 W⁻¹ m⁻¹ is accomplished at 5.6 μ m. The negative dispersion curve covers a broad mid-infrared range from 3.2 to 10 μ m. The simulated results reveal that the reported PCF is appropriate for dispersion compensation and nonlinear optics applications such as supercontinuum spectrum, wavelength conversion, etc.

Keywords Photonic crystal fiber · Nonlinear material · Dispersion compensation · Negative chromatic dispersion · Nonlinearity · Finite element method

Introduction

Coxial and twisted pair cables have some communication restrictions; Kao investigated a new form of fiber for high-speed transmission known as optical fiber [1]. This boron-doped glass fiber reformed the communication techniques universally. With the development in communication devices, wide bandwidth and high-speed data transmission can be acquired. However, all the devices are suffered with positive dispersion [1]. Therefore, to ensure signal

integrity, the dispersion compensation system is needed to counterbalance the protracted positive dispersion over long-distance transmission links [2–4]. Dispersion prompts pulse broadening, which seriously constrains the transmission channel limit and covers the existing fiber's scope. Dispersion compensation has become a hot exploration theme in optical transmission.

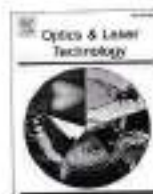
Photonic crystal fibers (PCF) with the solid or hollow core region encompassed by air holes rings rest inside the whole fiber length have been spellbinding us and attracting researcher consideration on account of the distinctive highlights that cannot be practiced in standard optical fibers [5–7]. PCF maintains unique and exceptional characteristics such as tunable and controllable dispersion [8], single-mode activity [9], high birefringence [10], large mode area (LMA) [11], and high nonlinear parameter [12], which are unreachable in conventional fibers.

PCF can successfully ease this issue. Dispersion compensating photonic crystal fiber (DC-PCF) [13], it can remunerate the optical fiber dispersion, accordingly lessening the all-out dispersion of the whole communication link and inevitably upgrading the signal standard. The hypothesis and manufacturing process of PCFs keep on being an intriguing issue. Lately, numerous investigations have been carried out on dispersion-compensated PCFs. To nullify the positive dispersion over telecommunication windows, Hoque et al. [15] presented a single-mode PCF to acquire a negative dispersion curve with a value from -386.57 to -971.44 ps/(nm km). Li et al. [16] reported a dispersion compensating pentagonal PCF with dispersion of -611.9 ps/(nm km) at the transmission range from 1.46 to 1.625 μ m. Hybrid cladding PCF is also an excellent candidate to obtain a large negative dispersion from -242.22 to -762.6 ps/(nm km), covering the large wavelength span of about 1300 to 1650 nm [17]. Air hole

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Hemoglobin sensor based on external gold-coated photonic crystal fiber

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ABSTRACT

A highly sensitive photonic crystal fiber-based hemoglobin sensor is numerically simulated and studied. Variations of the fundamental mode loss and dependent sensitivities (wavelength and amplitude) are analyzed in the reference of gold layer thickness, lattice period, cladding air holes size, and different analyte refractive indices. This sensor structure offers the highest amplitude sensitivity of 2080 RIU⁻¹ with a resolution of 4.80×10^{-6} RIU at a hemoglobin refractive index of 1.38. Additionally, this sensor can be fabricated in the length of millimeter with high-quality factor of 239. This amended surface plasmon resonance-based sensor might be suitable for recognizing diseases related to a blood disorder.

1. Introduction

Optical sensors-based electronic devices have been considered an option in contrast to traditional fragile, less versatile, and unbending low voltage devices [1]. Aside from some impediments such as high fabrication cost, complex structure, slow reaction time, these electronic devices are also influenced by noise or interference [2,3]. As of now, optical physical sensors are applied to detect and examine the complex environment and its adjacent elements such as electric and magnetic field, stress, temperature, pressure, humidity, strain, and torque, etc. having significant applications in environmental monitoring, apparel sensors, food quality monitoring, early cancer detection and robotics [4–6]. Therefore, these devices tracked down the chief substitute for the analyte refractive index, chemical and biological sample detection because of its benefits of reasonable cost, less structure, higher resolution, speed response, and minimal size [7].

Photonics sensors-based applications are refreshing quickly for the evolution of sensing devices. Surface plasmon resonance (SPR) based fiber sensors are becoming red theme because of their characteristics and wide application in different zones of mechanical to real life. These highly sensitive plasmonic sensors are fundamentally used to detect and investigate different tests such as salinity testing [12], bio-sensing, chemical and gas detection, bio-imaging, real time monitoring, blood component recognition, and disease recognition [13–15]. Introduced prism-based photonic sensors were massive and also not appropriate for remote sensing techniques. In 1993 R. C. Jorgenson [16] investigated an

SPR sensor based on optical fiber to defeat the restrictions of a prism-based sensor. In this coordinated innovation time, the need for compact size devices at a reasonable cost, so photonic crystal fiber (PCF) based photonic sensors are acquiring consideration of the researchers [17]. Sensor sensitivity depends on the fiber's confinement loss. This loss can be altered by applying engaging properties of PCF such as controllable dispersion and birefringence, effective light confinement, and endless propagation [18]. These PCF sensors offer low resonance peaks with significant design. When leakage light strikes the boundary of PCF then it stimulates free electrons of deposited plasmonic material. Various materials such as gold, silver, copper, graphene, platinum, and nitrides are used on the outer boundary of the PCF to create a plasmonic effect [19,20]. When the oscillation frequency of light photons and emitted electrons coincides, the maximum loss occurred; this mechanism is referred to as SPR [21].

Until now, numerous high-sensitive PCF blood sensors have been accounted for in theory; some of them are experimentally proved their performance. Blood is the most essential liquid in the human body, which plays out immeasurably significant capacities in our body, like oxygen circulation; it additionally gives supplement to cells and eliminates the unwanted material from the body [22]. Blood contains various components with different refractive indices like, Glucose (1.40) Proteins (1.40), Platelets (1.39), hemoglobin (Hb) (1.38), Ethanol (1.36), plasma (1.35), Cypton (1.34), and water (1.33) [22]. Photonic biosensor is an extreme gadget for identification of blood related disorders and these gadgets are more dependable, precise, financially savvy, little size,

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Assessment of encoder-decoder-based segmentation models for thyroid ultrasound images

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Abstract

Encoder-decoder-based semantic segmentation models classify image pixels into the corresponding class, such as the ROI (region of interest) or background. In the present study, simple / dilated convolution / series / directed acyclic graph (DAG)-based encoder-decoder semantic segmentation models have been implemented, i.e., SegNet (VGG16), SegNet (VGG19), U-Net, mobileNetv2, ResNet18, ResNet50, Xception and Inception networks for the segment TTUS (Thyroid Tumor Ultrasound) images. Transfer learning has been used to train these segmentation networks using original and despeckled TTUS images. The performance of the networks has been calculated using mIoU and mDC metrics. Based on the exhaustive experiments, it has been observed that ResNet50-based segmentation model obtained the best results objectively with values 0.87 for mIoU, 0.94 for mDC, and also according to radiologist opinion on shape, margin, and echogenicity characteristics of segmented lesions. It is noted that the segmentation model, namely ResNet50, provides better segmentation based on objective and subjective assessment. It may be used in the healthcare system to identify thyroid nodules accurately in real time.

Keywords Semantic segmentation · Despeckling · SegNet · U-Net · DeepLabv3+

Abbreviations

ROI	Region of interest
MRI	Magnetic resonance imaging
CT scan	Computerized tomography
US	Ultrasound
DAG	Directed acyclic graph
DL	Deep learning
SSD	Single-shot detector
YOLO version-X	You Only Look Once
R-CNN	Region-CNN
mIoU	Mean intersection over union
mDC	Dice coefficient



Thyroid tumor US
Computer-aided diagnosis

1 Introduction

A thyroid nodule stands out among the most diagnosed nodular disease or lesions in the grown-up population over the last 20 years [1]. It is a serious issue among all age groups therefore, its cure is an essential requirement in the current scenario [2]. It is a common disorder in the thyroid gland, primarily benign but associated with multiple pathologic conditions [3, 4]. Global research revealed that 45 lacs thyroid cancer patients worldwide, with 6 lacs new cases and 44,000 deaths yearly [3, 5–8]. Different imaging modalities have been used in the initial stage of cancer treatment so that the survival rate of the patients can be increased [9]. The most common imaging modalities used to identify thyroid lesions are ultrasound (US), thermal imaging (TI), magnetic resonance imaging (MRI), X-ray, and computerized tomography (CT) scan [9, 10]. The X-ray, MRI, CT scan, and TI limitations are ionizing radiations, high cost, and less availability [9–11]. Owing to the disadvantages of these modalities, the US is considered the first exam to visualize thyroid abnormalities [9, 10, 12]. It is most commonly used for soft tissue due to its visualization,

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Deep learning-based CAD system design for thyroid tumor characterization using ultrasound images

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Abstract

Computer-Aided Diagnosis (CAD) system is preferred for automatic thyroid tumor ultrasound image characterization instead of manual assessment by the experts. Segmentation and control despeckling are the important pre-processing stages required to develop an effective CAD system. This work primarily aims to design an efficient CAD system for thyroid tumor characterization using ultrasound (US) images. Here, Edge Preserving Smoothing despeckling filter and encoder decoder-based ResNet50 segmentation model are used as pre-processing stages of the proposed CAD system to enhance its performance for thyroid tumor characterization. Extracting the image features using pre-trained models effectively captures the underlying textural and morphological characteristics exhibited by thyroid tumors in ultrasound images. The pre-trained models learn by automatic feature extraction representing the underlying characteristics using multiple stages by convolution with various filters. The pre-trained neural network classifies tumors more accurately due to learning the extract multiple sets of features. Accordingly, fifteen (15) deep learning-based pre-trained models have been utilized in the present work to extract information from the thyroid tumor US images and train the PCA-SVM classifier. These pre-trained models have been taken from different categories of deep learning algorithms, including Series / DAG / Lightweight architectures, namely AlexNet, VGG16, VGG19, Darknet19, Darknet53, GoogleNet, DenseNet201, ResNet18, ResNet50, ResNet101, EfficientNetb0, NasNetMobile, MobileNet, SqueezeNet, and ShuffleNet for characterization of thyroid tissues. An exhaustive set of experiments have been conducted, and the best-performing pre-trained models have been selected as optimal feature extractors based on classification accuracy. Thus, the features extracted from the best-performing pre-trained network, i.e., ResNet50, are fed to the PCA-SVM classifier to yield an efficient CAD system for classifying TTUS images. The optimal CAD design proposed in the present work yields 99.5% classification accuracy to distinguish between benign and malignant thyroid tumors.

Keywords Computer-aided diagnosis system · Thyroid tissue characterization · Pre-trained models · Semantic segmentation · PCA-SVM classifier


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Three British Film-Adaptations of *Macbeth*: A Comparative Study

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ABSTRACT

Film adaptations open up new possibilities of self-discovery for a film director as they provide him a chance to transmute his own creativity with that of the source text. The same case is with Shakespearean film adaptations. While exploring Shakespeare's multiverse, each filmmaker voyages towards self-fulfillment. Since Shakespeare himself was an important part of popular culture right from his own time and till now, there could be significant differences in the films based on a single play. Macbeth was one of the plays that make Shakespeare fascinating and is distinguished by the generosity of its literary insight. Macbeth is one of the ideal examples of Shakespeare's classical tales which have great influence on masses belong to any age. The present paper seeks to offer a comparative study of three acclaimed UK based films inspired from Macbeth. The point, here, is that the directors of these three films belong to the same culture – but they have translated the play in their own way while making certain additions and omissions. They have updated the 16th century's play in the contemporary scenario. However, in spite of such diversity of approach, there is ultimately a basic unity in the directors' response to Shakespeare. The films have chosen for the comparative analysis are – Macbeth (1978) by Trevor Nunn, Macbeth (1997) by Jeremy Freeston and, Rupert Goold's Macbeth (2010).



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Macbeth and Shakespeare in Love: A Rejoinder to the "Tragedy"

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ABSTRACT

No matter how many forms Shakespeare and his plays have taken over the centuries and across the globe, Shakespeare appears as the founder of the culture and the carrier of the civilization. Tracing the facts which are evident in these discussions, Shakespeare clearly remains an important part of our lives. But while these debates can reveal how Shakespeare is deployed across the socio-political spectrum, they also offer a chance to interrogate the mode of his entry into our world. His most celebrated tragedies have been inducted and adapted in theater and cinema in such a way that even the word "tragedy" becomes connotation of successful adaptation of a rendering of a tale that always enjoys pertinence in society. It therefore seems that these "tragedies" invokes an adapter to represent them to the masses again and again in order to stop the repentance of a "tragic tale" and to repeat the "courage for achieving their love" without scaring from the "tragic end." The film directors from different nationality and are different at socio-cultural level, have, adapted Macbeth and Romeo and Juliet in a sense that their time span and vernacular atmosphere allow them. Macbeth and Romeo and Juliet thus being among the most appreciated tragedies of English literature, established Shakespearean plays as unique representations of contemporary culture. This paper therefore aims to explore how Macbeth can be termed as a thriving tragedy and why Shakespeare in Love can be considered as a tribute to Romeo and Juliet.




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Depiction of Gender-based Abuse in *Lap Players* and *Wetlands*: An Analysis

RITU MOHAN

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ABSTRACT

*Are women made only for reproduction and to be 'used' by men? Whether women should participate in professional work or they are supposed to be inhabited in the four walls of 'home' glorifying their motherhood only. These questions unleash an unending debate in present day globalized world which can prevail in any society. Of course, a well-developed nation like Germany is also not an exception. Critically acclaimed and immensely popular, female authors are invigorating German literature with captivating stories that examine the socio-political and gender politics which shape European life these days. The present paper aims to critically analyze young German feminist writer Charlotte Roche's noted novels *Wetlands* (2008) and *Lap Players* (2011). With an autobiographical touch, Roche in her novels portrays women's feelings and desires of a life full of satisfaction. *Wetlands* explores sex within marriage, and longing-ness for love in family and outside. *Lap Players*, a huge ironic response to the demography debates, is filled with brutal experiences in the way of womanhood. Therefore, the concern here is to investigate Charlotte Roche's success and importance for interpretation and representation of feminist discourse on women's bodies, sexuality, and sexual empowerment where she tries to justify herself as an active feminist writer through her literary works which were highly criticized by critics and her family as well.*

INTRODUCTION

In summer 2011, as European stock markets tumbled and European Union leaders tried to stave off the impending


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Two Film Adaptations of *Hamlet* in Perspective: A Comparative Scrutiny

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ABSTRACT

Shakespeare's works are a vital part of the world's literary heritage having a distinctive universal appeal. Shakespeare didn't spend his life in libraries but in the streets of London for he was concerned with the aesthetics of life. His plays, instead of being temporal, ascertained timeless and become the indistinguishable part of lingua franca from context to context and genre to genre. All generations and cultures therefore have their own reasons for liking Shakespeare. In the era of globalization, Shakespeare's cultural capital has experienced an invigorating transformation. Like translation into many languages, his plays are well adapted into films across the globe including India. One of the most celebrated plays – Hamlet has been, directly and indirectly adapted in Indian films several times. But, two noteworthy rendering of Hamlet are – Vishal Bhardwaj's Haider and Vidhu Vinod Chopra's Eklavya: The Royal Guard. Both the films were highly acclaimed and have been in news for long time. Haider was set amidst the insurgency-hit Kashmir conflicts while Eklavya: The Royal Guard, having historical Rajputana background tried to weave a contemporary tale of power and betrayal where selfishness and greediness traverse hand in hand with the echoes of Dharma and Duty. This paper therefore is an attempt to make a comparative analysis how the two veteran film directors of modern Hindi cinema have transformed Hamlet of Denmark into an Indian context.



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arguably the heroic mood stemming from the feeling of energy, but that it incorporates various secondary "rasas" such as "comedy," "eroticism," "pathos" and even "terror" – but "aversion" and "disgust" which would be indecorous in the light of heroism. The film ends denoting the closure of harmony and peace, the Shakespearean 'full close' to a complex and beautiful film. It brings out yet more potential from the richly multi-dimensional play itself.

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Representation of Lady Macbeth in Select Film Adaptations of *Macbeth*

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ABSTRACT

Shakespearean plays have been interpreted and reinterpreted frequently across cultures in different time span. The translators transformed the characters of the plays according to their 'own' mindset. The film directors who adapted the plays followed the same path and constructed new settings for their 'target audiences' belonging to a particular culture. A film director, in a sense, is a visual translator. A lot of films, across the globe, have been made inspired from the Bard's plays. There are more than hundred film and TV adaptations of *Macbeth* only. All the directors had taken the raw stuff and included their personal insight. They made their own dialogues and altered the soliloquies and other narratives. Sometimes they are dwarfed and over interpreted some characters. They portrayed them in a more negative sense. Nevertheless, the women are on trial, for female characters are presented sometimes more villainous. The present study is an attempt to interpret and analyze the cinematic character of Lady Macbeth in selected film adaptations of *Macbeth* worldwide. All the films chosen for the study are different from each other in their genre, plot, time, age and, of course the national culture. The five films adaption taken for the study are – *Magbool* by Vishal Bhardwaj (India), *Macbeth* by Orson Welles (USA), *Throne of Blood* by Akira Kurosawa (Japan), *Macbeth* by Roman Polanski (UK) and, *Macbeth* by Geoffrey Wright (Australia). The prime focus of the paper would be to analyze how they characterized Lady Macbeth in their



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Psychological Analysis of Macbeth's Character in Akira Kurosawa's *Throne of Blood* and Roman Polanski's *Macbeth*

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ABSTRACT

*Shakespeare's Macbeth has long been one of the most gripping tales interpreted and adapted in films produced in every continent of the world. Macbeth is a tragic tale of ambition studied through the prism of temptation. The sheer diversity of the spectrum of treatments and translations, this play receives, might bear differences at the level of plot and characterization. In this way, every film bears a different ethnographical and cultural identity and reflects the perception of the respective director. Macbeth is posited distinctively in various film adaptations. Strong religious and anti-institution messages are found in the same story line and these films seem to generate a much more unified response from their audience. Macbeth – who was a royal hero – turns into a villain and murders the “sleep” inviting life-long restlessness. During this journey of transformation Macbeth undergoes certain circumstances. Whether it was his own over-ambitiousness or he was induced by four wired women – the three witches and his wife Lady Macbeth. His complex mental situation is, therefore, a subject of critical study. This paper tries to present a comparative analysis to explore how Macbeth (the character) is perceived and portrayed by Shakespeare and, then in its two film adaptations – Akira Kurosawa's *Throne of Blood* (from Asia) and Roman Polanski's *Macbeth* (from Europe). The prime focus would be on the observation of the psychological situation of Macbeth while meeting with the three witches and thereafter; his situation before and after murdering the king; his response on*



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A novel approach to band gap engineering of Nano-Ca(OH)₂: Nanocomposites with Ag₂O

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ABSTRACT

Band gap engineering (BGE) is an important tool to tune the energy band gap of wide band gap semiconductors e.g., Ca(OH)₂ which promises to show many wonderful functional applications e.g., solar blind photodetectors. The current work reports about the successful reduction in optical energy band gap (E_g) through BGE of chemically synthesized Ca(OH)₂ nano particles (CHNPs) by microstructural tuning achieved through in-situ Ag₂O incorporation to achieve the formation of the Ca(OH)₂-Ag₂O nanocomposites. The CHNPs and (3–15 atom%) Ag₂O-incorporated CHNPs nanocomposite powders are characterized by the conventional x-ray diffraction (XRD), x-ray photoelectron spectroscopy (XPS), field emission scanning electron microscopy (FESEM), energy dispersive x-ray (EDX) spectroscopy, Fourier transform infrared (FTIR) spectroscopy, thermo-gravimetric analysis-differential thermal analysis (TGA-DTA) and ultraviolet-visible (UV-Vis) UV-Vis spectroscopy techniques. The results reveal that systematic incorporation of nano Ag₂O can very effectively reduce the magnitude of direct optical band gap energy values (E_g) by as much as 33%. These results are explained in terms of microstructural variables e.g., nanocrystallite size, lattice strain, lattice parameters, dislocation density, presence of Ag⁰, Ag⁺ states present on the surfaces of the nanocomposite powders, variation in microstructure, presence of surface functional groups, thermal stability, and optical absorption characteristics. The possible mechanisms active behind the reduction in the (E_g) values are suggested. Further, a schematic model of the band gap reduction mechanism is presented. Furthermore, the implications of the present results for designing CHNPs for futuristic applications e.g., optoelectronics are also presented.

1. Introduction

Currently, the ceramic based wide band gap semiconductors e.g., oxides, hydroxides, and ceramic oxide/hydroxide-based nanocomposites enjoy extraordinary research importance for huge prospects in advanced applications e.g., blind solar photodetectors for space technology related appliances. Such advanced applications also include but are not necessarily limited to e.g., LED development [1],

photoluminescence, optoelectronic activity, environmental remediation [2], photovoltaic performance [3], energy generation [4], photocorrosion resistance [5], sulfamethoxazole degradation [6], toxic dye removal [7], and red laser application [8].

However, to extract the maximum operational potential of such wide band gap materials the utilization of the band gap engineering (BGE) concept is very much necessary. In this context, it is worth noting that Calcium Hydroxide [Ca(OH)₂] is also a very important material with a

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Tuning the antimicrobial efficacy of nano-Ca(OH)₂ against *E. coli* using molarity

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ABSTRACT

The present work reports on tuning the antimicrobial efficacy of nano-Ca(OH)₂ against *E. coli* by appropriately tuning the molarity of the reactants. Thus, the phase pure nano-Ca(OH)₂ powders are developed by an inexpensive chemical precipitation technique using equimolar concentrations (e.g., 0.4, 0.6, 0.8, and 1 M) of [Ca(NO₃)₂·4H₂O] and NaOH solutions. The characterizations by the XRD, FESEM, TEM, FTIR, DTA, TGA, UV-Vis spectroscopy, and agar plate well diffusion methods show that the higher the molarity of reactants, the higher the nanocrystallite size, the lower the optical band gap energy and the higher the (%) increase in inhibition zone diameters (D_{iz}) for exposure periods in the range of 6–48 h. These results are discussed in terms of relative variations in the microstructure, lattice strain, thermal stability, optical band gap energy, defect structure, and the amount of (OH⁻) ions. Further, the possible mechanisms of antimicrobial behavior are suggested. Finally, the implications of these results in terms of microstructurally tuned nano-Ca(OH)₂ materials development for prospective futuristic applications are highlighted.

Introduction

Calcium hydroxide [Ca(OH)₂] is an age-old material [1]. However, it is also an ever-evolving material [1–19]. It possesses a myriad of excellent properties. It is biocompatible. It also has antibacterial,

antimicrobial, and antifungal properties as well as controllable chemical reactivity. It can also store thermal energy due to high enthalpy. It has reasonable mechanical properties to act as good filler material. Therefore, these properties attract many researchers for various applications of it. The

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Effect of Molarity on Methylene Blue Dye Removal Efficacy of Nano $\text{Ca}(\text{OH})_2$ Harish,^[a] Pushpendra Kumar,^{*(a)} Anshu Soni,^[a] Anand Gupta Chakinala,^[b] Rahul Singhal,^[c] Rajendra Prasad Joshi,^[d] and Anoop Kumar Mukhopadhyay^{*(a, e)}

With the increase in demand of textiles products, the polluted groundwater problem in the world is increasing proportionally and leading to environmental and health problems. Hence in this present work, we report on the dye removal efficacy of nano $\text{Ca}(\text{OH})_2$ by changing the molarity of the reactants. In the process, the chemical precipitation technique is used to synthesize the phase pure nano $\text{Ca}(\text{OH})_2$ powders using equimolar concentrations (e.g., 0.4 M, 0.6 M, 0.8 M and 1 M) of $[\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}]$ and NaOH solutions. The prepared material was characterized using XRD, FTIR, and UV-Vis spectroscopy. The results from the characterization study show, that the dye

removal behaviour is complex and is sensitive to a simultaneous combination of many factors e.g., the molarities of the reactants, the resultant nanocrystallite size, band gap energy, the concentration of the dye and, the temperature of adsorption. Therefore, these results are discussed in terms of relative variations in the microstructure, lattice strain, band gap energy, defect structure, and the amount of (OH^-) ions. Further, the probable mechanism of dye removal behaviour is suggested. Finally, the consequences of these results in terms of microstructurally tuned nano $\text{Ca}(\text{OH})_2$ materials development for prospective futuristic applications are highlighted.

Introduction

Calcium Hydroxide $[\text{Ca}(\text{OH})_2]$ is a material that has tremendous potential in terms of both fundamental science and technological applications. Therefore, it continues to attract the attention of many researchers from around the world. Further, the easy synthesis of calcium hydroxide by simple chemical methods with varying synthesis conditions makes it even more appealing to work on this material. Calcium hydroxide is extensively used in several applications e.g., Portland cement production,^[1,2] cultural heritage conservations,^[3,4] and vaterite blocks fabrication,^[5] which is important for advanced bio

applications. Similarly, a very important emerging area of research is its utilization for nano-priming action on seed embryos e.g., *Indian Gram seeds*.^[6] Rigorous efforts are currently underway to extend the inherent biocompatibility and antibacterial capacities of $\text{Ca}(\text{OH})_2$ for a wide variety of applications such as intercanal medication for postoperative pain in root canal therapy,^[7] advanced bone restoration,^[8] endodontics,^[9] and antimicrobial activity.^[10] It is also utilized for thermochemical energy storage.^[11] Recent efforts are also directed to use it in geopolymers to increase the bulk density and compressive strength,^[12,13] and for aqueous naphthalene degradation.^[14] It also shows excellent promise for biomass conservation,^[15] and wastewater treatment.^[16]

Wastewater released from textiles, mining, and agricultural industries poses a great environmental threat to all living species. Hence, low-cost wastewater treatment with efficient materials is essential to avoid health complications. Several research groups are working on wastewater treatment by different means. In a recent review,^[17] it is proposed that polymer-based materials, bio-adsorbents, metal oxides, and carbon-based materials show better efficiency to remove pollutants from wastewater. The mechanism to remove pollutants from wastewater is discussed here in terms of π - π interaction, ion exchange, surface complexation, and electrostatic attraction.^[18] Both cotton and graphene oxide are also reported to be used to design a Rayon-Graphene Oxide (RGO) composite to remove methylene blue (MB) from water.^[19] The re-usability of the designed composite is verified with high removal efficiency up to five cycles.^[20] The nanocomposite made of nickel oxide and carboxymethyl cellulose is also reported to be used to remove MB dye from wastewater through a spontaneous and endothermic process.^[21] Further, the roles of pH, nanocomposite concentration, contact time,

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Synthesis, Characterization, and Antibacterial Activity of Calcium Hydroxide Nanoparticles Against Gram-Positive and Gram-Negative Bacteria

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Calcium hydroxide nanoparticles (Ca(OH)₂ NPs) are of great interest in the development of new products due to their antibacterial properties. Chemical precipitation process was used for synthesizing Ca(OH)₂ NPs. The synthesized Ca(OH)₂ NPs were characterized by using X-ray Diffraction (XRD), Field Emission Scanning Electron Microscopy (FESEM), Fourier Transmission Infrared Spectroscopy (FTIR), UV-Visible spectroscopy, DLS (Dynamic Light Scattering) techniques. Ca(OH)₂ NPs were assessed for antibacterial activity against gram-positive bacteria (*Bacillus subtilis*, *Staphylococcus aureus*) and gram-negative bacteria (*Escherichia coli*, *Pseudomonas aeruginosa*). The results showed reasonable bactericidal activity and flash out that the

antibacterial activity of Ca(OH)₂ had an important inhibitory activity against *B. subtilis* and *P. aeruginosa* which are gram-positive and gram-negative bacteria respectively. Reactive oxygen species (ROS) generation of Ca(OH)₂ NPs were also studied and shows significant results against both gram negative and gram positive bacteria. From the analysis of the results, it was observed that Ca(OH)₂ shows the best antibacterial activity against gram-positive bacteria *B. subtilis*. Further, the possible mechanisms of antibacterial behaviour of Ca(OH)₂ against each bacteria were suggested. These outcomes indicate that Ca(OH)₂ could be utilized as a functional antibacterial material.

Introduction

Ca(OH)₂ is used in many biological applications like endodontic treatment,^[1] antibacterial activity,^[2] endotoxin activity,^[3] anti-biofilm efficacy,^[4] wound healing,^[5] root resorption,^[6] root

closure,^[7] and root canal infections.^[8] Further, Ca(OH)₂ is extensively recommended as an antibacterial agent for different clinical situations because of its compatibility and capability for mineralized tissue formation.^[9] Furthermore, it has several applications in other fields like food production, depilatory products, anti-aging products, hair care products, cosmetic products etc. because of its antibacterial efficacy. The antibacterial efficacy increases the growth factors and the release of enzymes which give rise to the rate of drug release.^[10] In addition, as the detergent addition in Ca(OH)₂ reduces the surface tension, it helps in enhancing and accelerating its antibacterial efficacy.^[11] It is also one of the most common compounds used for sterilization due to its high pH, low water solubility, and insolubility in alcohol.^[12] These properties allow it to last for a longer period of time and be absorbed by vital tissues.^[13] When it comes in contact with aqueous solutions or liquids, it dissociates into calcium (Ca²⁺) and hydroxyl (OH⁻) ions.^[14] The dissociation is behind the high alkalinity of calcium hydroxide. Due to this, Ca(OH)₂ is bactericidal in nature.^[15] This happens as it inhibits the enzyme activities which are necessary for bacteria life such as cellular division, metabolism, and cell growth.^[16] Moreover, the induced alkalinizing effect leads to the destruction of protein structure and cellular membranes in antibacterial and dental applications. It also has the ability to induce hard tissue formation, tissue dissolution, and the neutralization of microbial by-products.^[17]

The presence of a thick peptidoglycan cell wall is noted in gram-positive bacteria along with teichoic acid. On the other hand, gram-negative bacteria have a thin peptidoglycan layer with the absence of teichoic acid. These differences affect the

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RESEARCH ARTICLE

Optical band gap enhancements of chemically synthesized α -Ni(OH)₂ nanoparticles by a novel technique: Precipitator molarity variation

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Abstract

Nickel hydroxide nanoparticles (NHNPs) are extremely important semiconducting materials for applications in energy storage and energy harvesting devices. This study uses a novel variation in molarity of the sodium hydroxide (NaOH) precipitator solution to enhance the direct optical band gap in the NHNPs chemically synthesized by using nickel nitrate hexahydrate ($\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$) as the precursor. The simple, energy benign chemical precipitation route involved the usage of 1 M ($\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$) solutions as the precursor and 0.4 M, 0.6 M, and 0.8 M NaOH solutions as the precipitator solutions. The simple variation in precipitator molarity induces an increase in pH from about 6.9 to 7.5 of the reactant solution. As the molarity of the precursor solution does not change, the change in pH of the reactant solution is equivalent to the change in the pH of the precipitator solution. The NHNPs characterized by X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM), dynamic light scattering (DLS), Fourier-transform infrared (FTIR) and ultraviolet-visible (UV-vis) techniques confirm a reduction of the nanocrystallite size from about 6.8 to 4.5 nm with a concomitant enhancement in the direct optical band gap energy from about 2.64 to 2.74 eV. The possible mechanisms that could be operative behind obtaining microstructurally tuned (MT)-NHNPs and band gap engineering (BGE) of the MT-NHNPs are discussed from both theoretical and physical process perspectives. Further, the implications of these novel results for possible future applications are briefly touched upon. The reported results might be useful to assess the material as an active electrode to improve the performance of batteries.

Open Research

DATA AVAILABILITY STATEMENT


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Influence of Impurity on the Properties of Chemically Synthesized Calcium Hydroxide

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Here we report synthesis and characterization of chemically synthesized calcium hydroxide (Ca(OH)₂) with and without deliberate presence of NaNO₃ as an impurity. Calcium nitrate tetrahydrate (Ca(NO₃)₂·4H₂O) is used as precursor and alkaline NaOH solution is used as precipitant to synthesize the Ca(OH)₂ samples. The samples were characterized by XRD, FESEM, FTIR spectroscopy, DTA, TGA and UV-Vis spectroscopy techniques. From the UV-Vis spectroscopy results, it is found that the Ca(OH)₂ with NaNO₃ impurity has higher bandgap than the sample without NaNO₃. The weight loss in TGA is also more for the Ca(OH)₂ with impurity than the one for without impurity. The results are discussed in terms of composition formed during synthesis process.

Keywords: Calcium hydroxide, NaOH, NaNO₃, TGA-DTA, Impurity, Chemical synthesis.

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1. INTRODUCTION

Calcium hydroxide is represented as Ca(OH)₂. It is an odorless white colored ceramic hydroxide. It is non-toxic and biocompatible in nature. It is usually used in dentistry, industries, agriculture, and biomedical applications. Some other applications of calcium hydroxide include thermochemical heat storage [1, 2]. It is noted that the semipermeable encapsulation of calcium hydroxide can be used for thermochemical heat storage by using the micrometer sized particles [1]. It is also used for cultural heritage conservation [3, 4], network structure development [5], and bone restoration [6]. It is also an important material for Portland cement production and hardening [7, 8]. Other researchers also reported on the effect of surface area of Ca(OH)₂ nanoparticles, on the carbonation kinetics for material construction; environmental and art preservation applications [9]. For all such advanced applications [1-9], the purity of the material matters a lot. If there is an impurity present in the given material, it will have a different electronic structure. This different structure will act as a perturbation factor for the original electronic structure of the phase pure material. Further, the impurity material will have elastic moduli values; different than that of the basic material. As a result, there will be elastic mismatch stress developed in the material due to the presence of impurity. The consequent elastic mismatch strain will try, to distort the lattice. Therefore, the electronic structure will be affected. Hence, there is a genuine chance that the optical band gap may be affected. For instance, the studies on magnesium nitrate impurity in the contribution of NO_x emissions during the thermal decomposition of the solar salt for thermal energy storage; has been reported [10]. As mentioned earlier, one of the

most potential material for thermochemical heat storage is Ca(OH)₂/CaO [1, 11]. Stress induced change in band gap is also reported in literature [12]. However, despite having great potential for application of Ca(OH)₂ in thermochemical heat storage application; the effect of impurity, that might affect material properties and might produce harmful byproduct; has not been studied in any significant details yet. Hence, we report here the effect of sodium nitrate impurity on the structural, morphological, surface functional, thermal, and optical properties of calcium hydroxide.

2. EXPERIMENTAL DETAILS

2.1 Materials

The chemical precipitation method was used to synthesize calcium hydroxide at room temperature. Calcium nitrate tetrahydrate (Ca(NO₃)₂·4H₂O) and sodium hydroxide (NaOH) pro analysis products of analytical grades (Merck, Bengaluru, India) were used in the process. All chemicals were used in the as received condition. First, an aqueous solution of 3M Ca(NO₃)₂·4H₂O was prepared. Next, another aqueous solution of 3M NaOH was also prepared. Both the solutions had 100 ml volume. Here, the Ca(NO₃)₂·4H₂O solution was used as a precursor. Further, the NaOH solution was used as a precipitator. The precipitator was added dropwise into the solution of Ca(NO₃)₂·4H₂O. The whole process was carried out under continuous stirring at the rate of 1200 rpm at room temperature. The following reaction results in the formation of calcium hydroxide:



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The results were presented at the International Conference on Multifunctional Nanomaterials (ICMN 2020)


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Utilization of green reductant Thuja Orientalis for reduction of GO to RGO

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ABSTRACT

It is well known that graphene (G), graphene oxide (GO) and reduced graphene oxides (RGO) are materials of today with immense application potentials. However, to realize the same large scale, reproducible, sustainable synthesis techniques such as greener methods which avoid utilization of toxic chemicals for synthesis, must be adopted. It is in this context, that here we report the reduction of GO to RGO by the extract of Thuja Orientalis (TO) seeds. As such, TO is a well-known bio-resource for medicinal and various other biotechnological applications as it contains Alpha Tocopherol, the major constituent of vitamin E. To the best of our knowledge, despite the wealth of literature, the current work makes a pioneering effort in applying TO seeds extract for reduction of GO to RGO. Thus, the reduction of GO, synthesized by the well-known modified Hummer's method to RGO by TO extract, is confirmed from the results obtained by ultra-violet visible (UV-Vis) spectroscopy, Fourier transform infrared (FTIR) spectroscopy, transmission electron microscopy (TEM), high resolution transmission electron microscopy (HRTEM), energy dispersive X-ray (EDX) analysis, selected area electron diffraction (SAED), Raman spectroscopy, X-ray photoelectron spectroscopy (XPS), X-ray diffraction (XRD), atomic force microscopy (AFM) and especially, gas chromatograph mass spectrometry (GCMS) techniques. Furthermore, the GCMS study is used to identify the compound Alpha Tocopherol responsible for reduction of GO to RGO. Based on current experimental evidences and literature views, the possible mechanism of reduction is suggested. Finally, the implications of present studies in the perspective of large scale, sustainable synthesis of RGO for various technological applications are discussed.



1. Introduction

Graphene (G), graphene oxide (GO) and reduced graphene oxides (RGO) are materials evolving today more than yesterday both in terms of basic science and application perspective [1–3]. They provide a unique combination of electrical, optical, mechanical, thermal as well as biocompatibility and biotechnological properties [3–9]. Hence, they continue to foster a wide range of research interests [1–9]. Graphene is synthesized usually by the "Tape" method [10], chemical vapor deposition (CVD) [11], hydrothermal method [12], supercritical fluid processing [13] and of course, chemical exfoliation [14]. The most well-known Hummer's method [15,16] produces a water-soluble GO obtained by controlled oxidation of graphite. Subsequently, GO is

chemically reduced to get RGO [17]. A significant amount of recent research is devoted to GO and GO-composites for supercapacitor [18], sensor [19] and intercalation applications [20]. RGO and RGO-composites enjoy today even further enhanced research focus mainly due to their importance for energy storage [21], energy production e.g., proton exchange membrane (PEM) fuel cells [22], anodes of Li-ion batteries [23–25] and biomedical applications [26–30]. However, highly toxic and explosive chemical e.g., hydrazine used for the synthesis of GO is not eco-friendly [17] and hence, is far from recommended.

Therefore, the major focus for large scale production of RGO is now on plant extracts used as green reductants, Table 1 [29–49]. Accordingly, many mechanisms are suggestively proposed but the

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Efficient adsorption of methylene blue on hybrid structural phase of MoO₃ nanostructures

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HIGHLIGHTS

- Mixed phase molybdenum oxide (mp-MoO₃) has been synthesized using internal combustion method using urea as a fuel.
- The mp-MoO₃ possesses higher methylene blue adsorption efficiency as compared to hexagonal (h-MoO₃) and orthorhombic (o-MoO₃).
- The adsorption efficiency was attributed to the improved surface charge, surface area and increased porosity in the material.

ARTICLE INFO

Keywords:
Molybdenum oxide
Mixed-phase
Methylene blue
Adsorption
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ABSTRACT

Mixed phase molybdenum oxide (mp-MoO₃) nanocomposite (NC) along with hexagonal (h-MoO₃) and orthorhombic (o-MoO₃) nanoparticles (NPs) were synthesized via easy and cost-effective internal combustion method using water/ethanol mixture, water, and methanol solvents. The formation mechanisms of h-MoO₃, o-MoO₃, and mp-MoO₃ have been investigated using different physical methods such as XRD (X-ray diffraction), FTIR (Fourier transform infrared spectroscopy), FESEM (field emission scanning electron microscopy), HRTEM (high resolution transmission electron microscopy), and SAED (selected area electron diffraction). The potential of prepared NPs and NC on the adsorptive removal of methylene blue (MB) was investigated through the adsorption batch process with variation in the adsorbent dosage, pH, and temperature of the solution. The confirmation of dye adsorption over adsorbent surfaces has been elucidated by employing FTIR and FESEM after the adsorption process. The influence of different NPs and NC on the adsorption efficiency indicates the possibility of physical, chemical as well as electrostatic interaction between adsorbent-adsorbate interface. Thermodynamical parameters were calculated and analyzed for the validity of the adsorption phenomenon. Various kinetic study models such as pseudo-first-order (PFO), pseudo-second-order (PSO), and Intra-particle diffusion (IPD) were fitted to the experimental data to explore the rate-controlling step and for understanding the adsorption mechanism. The mp-MoO₃ NC was observed to have the best adsorption efficiency as well as a better adsorption rate. Therefore synthesized mp-MoO₃ NC showed great potential for dye adsorption and would be seen as the futuristic adsorbent materials for sustainable water treatment technology.

1. Introduction

Organic dyes are the complex aromatic compounds that can be hazardous when discharged into water bodies without proper treatment [1]. Large scale industrialization has increased the consumption of various dyes laden chemicals for productions [2]. After uses, these dye-laden infused substances are directly disposed into the environment and thereby affects flora and fauna. These effluents in water increase the COD (chemical oxygen demand), decrease the visibility, and reduce the photosynthesis process affecting humans as well as aquatic life [3,4].

The vast use of MB in leather, paper, textile, and cosmetics industries produces highly toxic, carcinogenic, stable untreated substance and contaminates water [5–7]. Therefore the remediation of the polluted water becomes necessary. In this context, various methods such as flocculation, coagulation, ion-exchange, photodegradation, membrane separation, extraction, chemical oxidation, adsorption, and biological treatment are used frequently by the researchers for wastewater treatment [8–11]. Among these methods, the adsorption process possesses the advantage of its low cost, effectiveness, simplicity, less residual, and reuses of adsorbents [12]. A large variety of substances such as activated

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Synthesis of MoO_3 Nanostructures by Solid State Reaction Method for Selective Adsorption of Cationic Dyes

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The ecosystem and living things are severely hampered by the water pollution caused by organic compounds containing dyes and pigments. The cost-effective removal of organic dyes has therefore attracted a lot of attention in recent years. Herein, we report the removal of textile dyes from water via effective adsorption by nanostructured MoO_3 material. The MoO_3 have been synthesized via the solid state reaction method. The adaptation to multi-phases at effectively high temperatures and solvent-free conditions, as well as their scalability and simplicity, offers a lot of potential for this method. Powdered X-ray diffraction technique (PXRD) confirms the formation of pure-orthorhombic phase of MoO_3 (o- MoO_3). Field emission scanning electron microscope (FESEM) micrographs reveals the formation of stacking layer structure of MoO_3 . The surface charge and surface area has been investigated by using Zeta potential and BET-BJH technique. The adsorption capacity of MoO_3 has been investigated for two common dyes: Methylene Blue (MB), and Methyl Orange (MO). The adsorption studies show that the material effectively and quickly adsorbs MB dye with adsorption capacity (759.3 mg/g), which is attributed to strong electrostatic interaction of O^- ions of MoO_3 with MB dye. Further, isotherm and kinetic studies suggest that adsorption follows Langmuir and Pseudo-second-order kinetics model respectively.

Keywords: Water pollution; Cationic dyes; MoO_3 ; Electrostatic interaction

1 Introduction

Dyes are essential part of industrial processes for a wide range of products. But their discharge in hydrosphere produces undesirable colour and restricts the penetration of sunlight, which compromises the photochemical and biological activities of aquatic life. That needs to be treated to reduce their toxic content before being released into water bodies. Thus, researchers and scientists are searching for different methods that can treat these dyes before releasing to the environment¹. Adsorption procedure is one kind of surface phenomenon where adsorbate is amassed adsorbent's active surface portion. Therefore, adsorbent with high surface area and charge are highly recommendable. Among various transition metal oxides, MoO_3 has received particular attention to remove dye from aqueous solutions, due to its high adsorption effectiveness, low cost, and effective synthesis².

The present report discusses the synthesis and characterization of o- MoO_3 , which selectively adsorbs a primary amine containing MB dye from its aqueous solution. The adsorption studies show that MoO_3

material exhibits significantly higher adsorption capacity and can be reused in multiple cycles without undergoing any considerable loss in adsorption activity. Further, adsorption phenomenon has also described by using kinetic and isotherm models.

2 Materials and Methods

2.1 Synthesis

High purity AHM (Ammonium Heptamolybdate Tetrahydrate) $((\text{NH}_4)_6\text{Mo}_7\text{O}_{24}\cdot 4\text{H}_2\text{O})$ was used for the synthesis of MoO_3 nanoparticles. Solid-state synthesis is commonly used to cause a chemical reaction from solid starting materials to form a new solid with a well-defined structure. In this method, raw material grinded properly in the dry-grinding mode for 1h followed by wet grinding using methanol for another 1h by agate mortar and pestle to obtain homogeneous mixtures of nanoscale size. The calcinations of the prepared mixtures was carried out at an optimized temperature of 400 °C by using covered alumina crucibles in a high-temperature muffle furnace with a 3 °C/min heating rate for 4 h. After cooling, the powder was grinded again thoroughly for half an hour. The greyish colored MoO_3 nanostructures are to be obtained.

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MoO₃ adsorption kinetics and isotherm study with varied dye concentration

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ABSTRACT

The effect of varying methylene blue dye concentrations on the adsorption activity of molybdenum oxide nanostructures has been investigated. The removal percentage and maximum adsorption efficiency were determined by varying the dye concentration from 20 to 150 mg/L. The adsorption rate constants, nature and type of adsorption were determined using pseudo-first-order, pseudo-second-order, and intraparticle diffusion kinetics models. Four different isotherm, that is, Langmuir, Freundlich, Temkin and Dubinin–Radushkevich models were used to understand the interaction of the adsorbate–adsorbent at interface and to calculate maximum adsorption efficiency. The mixed phase shows adsorption efficiency of 633.1 mg/g while orthorhombic phase gives much lower efficiency, that is, 425 mg/g. The removal percentage decreases from 99% to 25.8% (orthorhombic phase) and 99.4% to 67.8% (mixed phase) with increasing dye concentrations.

Keywords: MoO₃; Structural phase; Mixed-phase; Adsorption; Methylene blue; Kinetics; Isotherm; Adsorption efficiency

1. Introduction

Organic dyes are complex chemicals that can be dangerous if dumped into water bodies without sufficient treatment. Large-scale industrialization has raised the use of dye-laden chemicals in manufacturing [1,2]. Following their use, these dye-infused substances are directly disposed into the environment, affecting flora and animals. These effluents in water increase chemical oxygen demand, impair visibility, and limit photosynthesis, impacting both people and aquatic life [3,4]. Here are some common types of dyes and their potential effects on human health. Synthetic organic dyes: These dyes are widely used in the textile, food, and cosmetic industries. Azo dyes are part of synthetic dye. Some synthetic dyes leads to cancer, skin irritation, and allergic reactions on direct exposure. For example, the dye Sudan red has been found to cause cancer in laboratory animals, and the dye para-phenylenediamine is a common cause of allergic reactions.

- **Natural dyes:** Natural dyes are derived from minerals, plants, and animals. Although they are generally considered safe, some of them can cause skin irritation and allergic reactions in sensitive individuals.
- **Food dyes:** Food dyes are used to color a wide range of processed foods. Some food dyes like dye tartrazine has been associated with asthma and hives in sensitive individuals. Few commonly used food dyes are Quinoline Yellow, Carmoisine, Pontreau 4R and Patent blue V etc.
- **Hair dyes:** Hair dyes are used to color hair and are often made with synthetic dyes which can trigger increased risk of cancer, particularly bladder cancer and leukaemia.
- **Medical dyes:** Medical dyes are used to help diagnose and treat medical conditions. For example, contrast dyes are used in medical imaging to highlight blood vessels and organs. While medical dyes are generally considered safe, some people may have an allergic reaction to them [5–10].

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Synthesis and dye adsorption studies of WO₃/MoO₃ nanocomposites

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ABSTRACT

Tungsten oxide/molybdenum oxide nanocomposites have been synthesized using a cost-effective internal combustion method by incorporating two different phases of tungsten oxide into hexagonal and orthorhombic molybdenum oxide nanostructures. The synthesized materials were subjected to different analytical techniques including X-ray diffraction, Fourier transform infrared spectroscopy, field emission scanning electron microscopy, and energy-dispersive X-ray spectroscopy, to investigate their structural and morphological properties. The synthesized materials were employed for the adsorption of methylene blue by varying different parameters, such as the initial dye concentration, contact time, adsorbent dose, pH, and temperature of the solution. The thermodynamical parameters were calculated to validate the adsorption phenomenon in terms of its spontaneity and feasibility. Various kinetic studies, such as pseudo-first-order, pseudo-second-order, and intra-particle diffusion models, were used to determine kinetic parameters and understand the adsorbate-adsorbent interactions. The detailed characteristics of adsorbent surface and adsorption behavior were studied using the Langmuir, Freundlich, and Temkin isotherms. Among these, monoclinic tungsten oxide/orthorhombic molybdenum oxide exhibits the best adsorption efficiency and higher kinetic rate constant, followed by the orthorhombic tungsten oxide/orthorhombic molybdenum oxide nanocomposite. Dye adsorption over the adsorbent surface was confirmed by investigating the materials characteristics before and after the process using Fourier transform infrared spectroscopy. The enhanced adsorption efficiency and higher rate constant can be attributed to the improved surface properties of these materials.



1. Introduction

The large-scale use of organic compounds containing dyes and pigments in various industries has tremendous effects on drinking water required for the survival of the entire biosphere [1]. Even a small amount of dye lowers the visibility in water and thus, interrupts photosynthetic activity, harming aqueous biota [2]. Among the class of organic dyes, methylene blue (MB) is used on a large-scale in various industries, such as paper, leather, cosmetics, cotton, and medicine, for coloring their products and consuming large volumes of water [3]. It has been approximated that annually, over 7×10^5 tonnes of dyestuff are produced from these industries. Untreated sludge from industry is disposed into the biosphere, resulting in an ecological imbalance because of the contamination of water bodies [4]. It can induce eye irritation, which can result in lasting damage to both human and animals. When inhaled, it can provoke short periods of fast or difficult breathing, whereas ingestion can cause nausea, vomiting, mental

disorientation, excessive perspiration, and methemoglobinemia [5]. This is why the remediation of wastewater is urgently required. Scientists have been working for the last few decades on different pathways for the purification of water using different techniques, such as filtration, flocculation, membrane-separation, adsorption, ion exchange, and photodegradation [6,7]. Adsorption is widely used among all of these methods because of its flexible design and simplicity, cost-effective adsorbents, easy separation, and low toxicity [8].

A large variety of adsorbent materials such as activated carbon-based nanomaterials, polymers nanocomposites, agriculture waste-based sludge, and bio-induced materials have been synthesized and employed for dye adsorption across the world over the last few years [9,10]. Each class of materials has its own set of advantages and disadvantages, such as the fact that some are extremely hazardous and their use may have catastrophic implications, whilst others are quite expensive and require complicated system design [11]. Therefore, the attention of researchers has recently turned towards the use of transition

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PAPER

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Study of the methylene blue adsorption mechanism using ZrO_2 /Polyaniline nanocompositeRECEIVED
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E-mail: rajeshbaboria@gmail.comKeywords: ZrO_2 , surfactant, MB, adsorption, ZrO_2 /PANI, IPD, elovich

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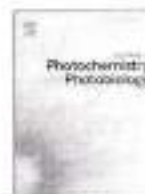
Abstract

ZrO_2 (Zirconia) nanoparticles (NPs), PANI (polyaniline), and ZrO_2 /PANI nanocomposites (NCs) were successfully synthesized using CTAB (Hexadecyltrimethylammonium bromide) and SDS (Sodium dodecyl sulfate) surfactants by following the co-precipitation method. The structural phase analysis of as-prepared, annealed nanoparticles, and nanocomposites was done using the XRD (x-ray diffraction) technique. The crystallite size of pure SDS and CTAB assisted ZrO_2 NPs comes out to be 19 and 17 nm, respectively. After the formation of NCs, the size has been reduced to 15.7 and 15.9 nm, respectively for the same samples. The effect of surfactants on the dye adsorption mechanism was studied using XRD and UV-vis spectroscopy. The prepared NPs and NCs were utilized as an adsorbent for the removal of organic dye methylene blue (MB) which is used as a model compound. UV-vis spectra of the supernatant solution were taken and studied to detect the relative decrease in the dye concentration with time. The as-prepared CTAB assisted ZrO_2 /PANI NCs show higher adsorption activity than annealed CTAB assisted ZrO_2 /PANI whereas a reversal trend in the adsorption activity was observed for SDS-assisted ZrO_2 /PANI NCs. Various kinetic models were implemented and correlated to the experimental data to elucidate the working mechanism for dye adsorption and to set up, a relation in the adsorption activity of surfactant modified NPs and NCs.

1. Introduction

The growing population of the world is posing lots of serious consequences of environmental pollution because of the drastically increasing industries for the fulfillment of the needs of such a huge population. Among these issues, water pollution is a serious concern. Due to the limited resources of drinking water, peoples are consuming polluted water which has serious consequences on their life [1–3]. The large-scale development of industries uses toxic chemicals which after use have been flooded into the rivers thereby affecting aquatic life and creates an imbalance in the environment [4]. Among these chemicals, organic dyes are used on a large scale. These organic dyes have a harmful effect on humans as well as on aquatic life. Among organic dyes, methylene blue (MB) is used enormously in medical, paper, leather, plastics, and paints, etc industries on a large scale [5]. There is a huge amount of the dye affected untreated water which is directly mixed in pure water destroying the original structure of water thereby polluting the environment [6].

Since the past few decades, a lot of research has been done on the wastewater treatment for the removal of such organic dyes using various techniques such as sedimentation, sludge treatment, membrane separation, ion-exchange, coagulation, photocatalysis, and adsorption [7–9]. Among these methods, an adsorption study has been done on a vast scale because of its easiness, low cost, effectiveness, and reusability of adsorbent [9, 10]. A large number of organic, inorganic, and bio-adsorbent have been used for the effective removal of dyes from wastewater [6–10]. For example, Pereira *et al* have studied the adsorption of a range of dyes by using activated carbon as an adsorbent and showed the effect of surface chemistry on the adsorption [11]. Machado and coworker fabricated carbon nanotubes and have gained large efficiency against the removal of alizarin red S dye [4]. Similarly, various metal oxide such as ZnO, TiO_2 , MoO_3 , WO_3 , Fe_3O_4 , ZrO_2 , etc was employed for the



Superpulsed 904 nm laser photobiomodulation combined with coenzyme Q10 synergistically augment burn wound healing

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ABSTRACT

The management of multifaceted burn wound imparts a huge health care burden. Innumerable complexities associated with non-healing burn wounds led to the search for new therapeutic healing modalities. Earlier, our studies have shown that photobiomodulation (PBM) with superpulsed 904 nm laser increased cellular proliferation, bioenergetics activation, reduced inflammation and nitrooxidative stress during burn wound healing. Coenzyme Q10 (CoQ10), a mitochondrial electron carrier acts as a potent antioxidant, maintains redox balance and mitochondrial dysfunction. Multi-target therapy aims to accelerate healing of intractable impaired wounds, which could exhibit a synergistic effect to potentially affecting different phases of the repair process. The present study investigates the efficacy of 904 nm superpulsed laser-mediated PBM (200 ns pulse-width, 100 Hz frequency, 0.24 J/cm² total energy density, 0.40 mW/cm² average power density and 19.77 W/cm² peak power density for 10 min once daily for 7 days post-wounding) and CoQ10 (0.6%, w/v) topical treatments individually and in combination on full-thickness burn wound healing in rats and further explore the underlying mechanisms of action. The dual treatment showed significant ($p < 0.05$) synergism in enhancing pro-reparative healing markers: wound closure, mitogenesis (DNA, protein), angiogenesis (HIF-1 α , VEGF), re-epithelialization, collagen deposition and bioenergetics activation (mitochondrial activity, cytochrome c oxidase and ATP), redox homeostasis (increased Nrf2, HO1, TXNRD2, catalase, SOD and decreased reactive oxygen species, lipid peroxidation levels) as compared to the standalone treatment and burn control groups. The PBM-CoQ10 combination treatment demonstrated significantly ($p < 0.05$) increased cellular proliferation (TGF- β 2), light-sensitive ion channel regulation (TRPV3) and cytoprotection (HSP90, GRP78) during burn wound repair. Collectively, the combined therapy of PBM and CoQ10 is highly effective than either treatment alone in augmenting burn wound healing by efficiently attenuating oxidative stress and enhancing cellular proliferation, collagen deposition and bioenergetics activation. The study shows that combined treatment distinctly augments full-thickness burn repair in rats, which could pave the path for multi-target therapy approaches for non-healing impaired wounds in clinical care.



1. Introduction

Burn wounds are usually associated with countless impediments primarily involving lengthened, dysregulated inflammatory phase, constricted blood supply, increased risk of sepsis, lesser tissue oxygenation and higher protease activities. The compromised availability of oxygen and other vital nutrients in the burn wound bed incurring the overproduction of reactive oxygen species (ROS), that leads to ROS-induced oxidative damage, lesser energy generation and cellular reducing-potential (ATP, NADPH), which cumulatively impede the healing process. Despite continuous rigorous efforts across the globe, the management of non-healing burn wound care is still challenging. Therefore, the search for new advanced effective therapeutic modalities is essentially necessitated for wound care of chronic non-healing thermal injuries.

In the last few decades, visible and near-infrared (NIR) light mediated photobiomodulation (PBM) has evolved as a drugless and non-invasive healing modality, which could act as a promising therapeutic healing intervention for impaired wounds. The PBM is a non-thermal process that uses low-power photons causing stimulation of endogenous mitochondrial or non-mitochondrial photoacceptors/ chromophores, which further regulate photophysical, photochemical events at various molecular levels and biological scales [1,2]. Moreover, it has been reported that cytochrome c oxidase (CCO, complex IV of mitochondria) acts as the chief photoacceptor for PBM, which subsequently regulates various transcription factors and triggers downstream cellular signaling pathways [3–5]. NIR light has minimal scattering and deep tissue penetration properties [6]. There is ample evidence substantiating the positive outcomes of NIR light-mediated PBM in the treatment of chronic wounds [2–4,7–10].

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ANALYSING A STEPPED CONICAL ANTENNA

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ABSTRACT: Cone-shaped antennas are helpful for several applications as a result of their broadband characteristics and relative simplicity. This instance includes an analysis of the antenna electric resistance and also the graphical record as functions of the frequency for a monoconical antenna with a finite ground plane and a fifty Ω concentrically feed. A double stepped conical is designed and analysed. The electric field in the proposed antenna is nearly same that is 22 and 25 respectively Reflection losses and S parameter of the proposed antenna is also less, which is 28 w.r.t 34. The bandwidth of the proposed antenna much more (5GHZ) than the basic conical antenna (0.2GHZ-6GHZ). The reflection parameter of the proposed antenna is better than the basic antenna. The gain is almost double than the proposed antenna. Far field amplitude is nearly comparative at the last point

KEYWORDS: Conical, Antenna, S-parameter, Gain.

I. INTRODUCTION

Conical antennas are useful for many applications due to their broadband characteristics and relative simplicity. This example includes an analysis of the antenna impedance and the radiation pattern as functions of the frequency for a monoconical antenna with a finite ground plane and a 50 Ω coaxial feed. The rotational symmetry makes it possible to model this in axially symmetric 2D. When modeling in 2D, you can use a dense mesh, giving an excellent accuracy for a wide range of frequencies.

II. MODEL DEFINITION

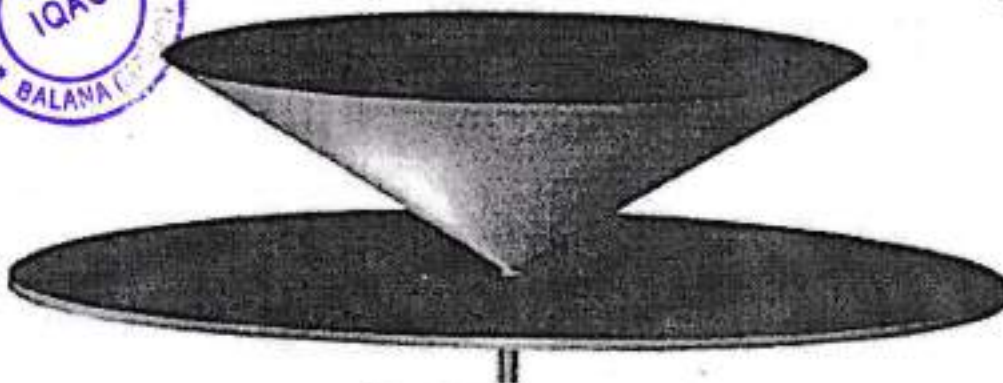


Figure 1: The pure mathematics of the antenna.



Comparison between Integration of Wind Plant and Pump-Hydro Power Plant Optimized by BFO and by Interior-Point Algorithm

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Generation scheduling (GS), Bacterial foraging optimization (BFO), Day-ahead strategy, Operational management strategy (OS).

ABSTRACT

This paper presents two new approaches to solve the generation scheduling (GS) problem of a wind-hydro power plant by BFO and by interior-point algorithm. The production of an optimal day-ahead generating schedule is considered. A bidding strategy by combining stochastic day ahead strategy and operational management strategy is used a comparison is shown with revenue generated by only day ahead strategy. In day ahead strategy we make a strategy for an advance day that we generate power from wind and store the power in pump storage unit when the price is low and generate power from wind and hydro plant when price is high. On other hand in operational management strategy we reduce the imbalance between contracted and generated power in the operating day. So we maximize the profit by minimizing the imbalance of power. For this we have used a more advanced bio optimized optimization - Bacterial foraging optimization and by interior-point algorithm and compare these result.

1. Notations Used in the paper

- $P_{H,i}$ Hydroelectric power at hour i
- $P_{D,i}$ Wind Power directly delivered to the grid at hour i
- $P_{P,i}$ Pumping Power in scenario s at hour i
- E_i Energy stored in the reservoir at hour i
- T_i Regulation costs in scenario s at hour i
- d_i Power imbalances in scenario s at hour i
- PDL, Dumping power loads in scenario s at hour i

2. Introduction

Wind energy have many positive benefits to the utility system, such as low-cost energy, long-term price stability, and spare system capacity, but it also has different generation characteristics than non-renewable energy resources. Unlike non-renewable power generation sources, wind power generators supply intermittent power because of uncertainty in the wind resource. In a large-scale wind power penetration scenario, wind operator require the greater reserve power, in order to balance possible errors between predicted power generated and actually wind power generated output.[1]

A most important strategy for increasing profits of utility is to integrate the wind power plant with pumped storage plants. A pumped storage unit can be used to provide added value to a wind plant that is taking part in the market in comparison with individual participation of them. The possibility of storing energy in pumped storage plants can significantly reduce the risk of wind power producers self-scheduling in the market. In another strategy for decrease the deviation between contracted power and generated power is also used. In this strategy the power imbalance between predicted power generated and actually wind power generated can be reduced by pumped storage unit.

The wind power predicted and actually measured at Illinois State for a day as shown in figure 1.

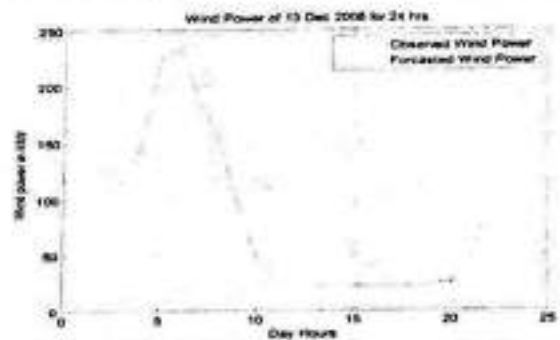


Figure 1: Forecasted and observed wind power of a day

The figure shows the 24 hrs wind power profile. In night hours wind speed is high so energy generation is also high but in day hours it decreases because of decrease in wind speed. The difference between predicted and observed power is also high. This figure shows the stochastic forecasting of wind power.

This large deviation in wind speed and difference with forecasted data will change the spot price as shown in figure 2.



Figure 2: spot price fluctuation due to variation in wind speed

It shows that when wind generation was high, prices were low but with decrease in generation, prices also rise per hrs.

LUNG CANCER DETECTION USING DIGITAL IMAGE PROCESSING AND ARTIFICIAL NEURAL NETWORKS

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Abstract: Detection of lung cancer is the most interesting research area of researcher's in early stages. The proposed system is designed to detect lung cancer in premature stage in two stages. The proposed system consists of many steps such as image acquisition, preprocessing, binarization, thresholding, segmentation, feature extraction, and neural network detection. Lung cancer keeps on changing on various medical factors depending on topographic areas. The identification of Lung cancer at initial stages is of extreme importance if it is intended to degrade high mortality rate. The worldwide lung screening program focuses to imagine PET/CT examinations amongst most matured gatherings at danger to upgrade the early location rate. In spite of the fact that utilization of obtrusive procedures, the side effects will scarcely show up until infection is propelled, this will make it troublesome for radiologist to recognize sores. Every year, the American Cancer Society appraises the quantities of new growth cases and passing that will happen in the world in the present year and aggregates the latest information on tumor frequency, mortality, and survival. Genuine and precise information is the basis of disease control initiatives. More than 3/4th of the illness is identified with tobacco utilization. Furthermore, hereditary components, presentation to ecological poisons, second hand smoking expand illness quickly. Cures including chemotherapy, radiotherapy, surgery, epidermal open medications raise survival rate and personal satisfaction. Location of CT pictures received from cancer research organizations is investigated utilizing MATLAB.

Keywords: Lung Cancer; MATLAB; American Cancer society; Noise Removal; Segmentation; Mortality Rate.

1. Introduction:

Lung cancer is one of the major cancer deaths worldwide. It is the most dangerous cancer as compared to any other like Breast Cancer, Skin Cancer and many more. It is really tough to detect lung cancer in its beginning because its symptoms appear at the advanced stage where the chance of survival is very low. Every year many people die suffering from lung cancer than other cancer. There is a significant reason which shows that early detection of this cancer will increase the chance of survival. According to world health organization 7.6 million deaths are only because of lung cancer that is obtained from the latest statistics. Furthermore, the death rate from cancer is expected to rise continuously up to 17 million worldwide till 2030 [1]. There are many techniques to diagnosis lung cancer, such as Chest Radiograph (x-ray), Computed Tomography (CT), Magnetic Resonance Imaging (MRI scan) and Sputum Cytology [2]. However, most of these techniques are expensive and time consuming. In other words, most of these techniques are detecting the lung cancer in its advanced stages, where the patient's chance of survival is very low. Therefore, there is a great need for a new technology to detect the lung cancer in its early stages. Image processing techniques provide a good quality tool for improving the manual analysis. A number of medical researchers utilized the analysis of sputum cells for early detection of lung cancer [3], most recent research relay on quantitative information, such as the size, shape and the ratio of the affected cells [4]. For this reason we attempt to use automatic diagnostic system for detecting lung cancer in its early stages based on the analysis images of lung cancer of the gray level. In order to formulate a rule which is based on the threshold technique through which we apply segmentation pre-processing technique which divide image into several steps and many steps are being applied on it by which we obtain fully diagnosis image by the help of which detection of lung cancer in early stage become easy. In image segmentation we used as the first step is image enhancement by the help of histogram Equalization we get frequency level of a image. There are many algorithms which are used in image segmentation in medical field, such as histogram analysis, regional growth, edge detection and Adaptive thresholding [5]. A review of such image segmentation techniques can be found in [6]. For lung cancer diagnosis many authors have used color information as the key discriminating factor for cell segmentation [7]. The analysis of sputum images have been used in [8] for detecting lung cancer; it consists of images for detecting gray level. They used analysis techniques and feature extraction for the enhancement of the images, such as edge detection, heuristic knowledge, region labeling and removing. This research approached the segmentation of lung cancer problem by using thresholding techniques: For segmentation it has used thresholding OSTU method and 2D histogram analysis. The images are obtained from hospitals [9]. However, the images are described by a noisy and cluttered background patterns that make the segmentation and automatic detection of the cancerous cells very difficult. In addition to that there are many gray levels in the background of the images. Aim was to design a system that maximizes the true positive and minimizes the false negative to their best level. These make me to think about a pre-processing technique which can cover all these gray levels and keep the nuclei and cytoplasm.

ANALYSIS OF BIOMASS ENERGY POTENTIAL IN PUNJAB

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Abstract : Biomass energy is one of the renewable energy which not only a green energy but also solve out the waste disposal problem which is among the major concern issues of today's world. The biogas obtained from the biomass is rich in methane which has higher calorific value than LPG, thus a better fuel for household and even transportation purposes. This biomass energy can be converted into electricity also. This paper presents the analysis of the potential Punjab has as biomass energy producer. Punjab is among the leading producers of wheat, paddy etc. which are the good biomass sources for biomass energy. This paper presents the district wise biomass availability in Punjab and further presents a report on how much the coal and cost can be saved after installing the biomass energy harnessing system to produce electricity in Punjab.

IndexTerms – Biomass Energy, Coal Consumption, Crop Straw, Livestock Manure.

I. INTRODUCTION

With the advancement of technology in order to improve the livelihood, the demand of electric power is rising at a good pace. The electric power generation is one of the concern areas. Still the thermal power generation shares the largest portion of total electricity generation the sources not only degrade the environment but also have imposed a question of meeting the current energy demand once they get consumed up all. The renewable sources have shown the potential to replace these non-renewable sources but a lot of research is needed in this regard to achieve satisfactory results. This paper estimates the potential of biomass energy in Punjab, state of India. Figure 1 shows the electric power generation in Punjab by different sources. In total power generation of 12866.30 MW in Punjab, there is still 64.55% power is being generated from coal, Renewable Energy Sources (RES) share a small percentage of 6.12% of total power generation [1].

Lybaek *et al.* focused on the deriving the environmental benefits from the use of biomass residues. Energy-and-business models had been developed for screening of relevant biomass residues for energy production [2]. Septyadi *et al.* discussed the potential of biomass energy in Indonesia for rural electrification [3]. Gao analyzed the crop straw, livestock manure and forest resources to produce the biomass energy in Heilongjiang province of China [4]. Namuli and Pillay maximized the revenue obtained from the selling of energy obtained from the biomass [5]. Wattananoi *et al.* studied the effects of torrefaction and densification on the combustion behaviors of biomass [6]. It was demonstrated that torrefaction increases the volumetric energy density of the biomass. Wahlroos *et al.* demonstrated the potential of combined heat and power scheme in increasing the efficiency of biomass energy in electricity generation [7]. Lamula *et al.* presented a study of a biomass based energy generation plant for a South African farm making it cost-effective and reliable [8].

The total biomass energy capacity of Punjab is being estimated in this paper for a complete year. The major crops straw and livestock manure available in different districts of Punjab are analyzed separately for their share in biomass energy. The potential of biomass energy in different districts of Punjab is being presented here. Further the amount of coal power generation reduction has been computed along with the reduction in cost of energy production after employing the biogas to electricity converting plant.

The paper is organized as follows: Section I presents the Introduction, Biomass Reserves and Distribution in Punjab is being discussed in Section II, Section III depicts the Results and Conclusion is being given in Section IV.

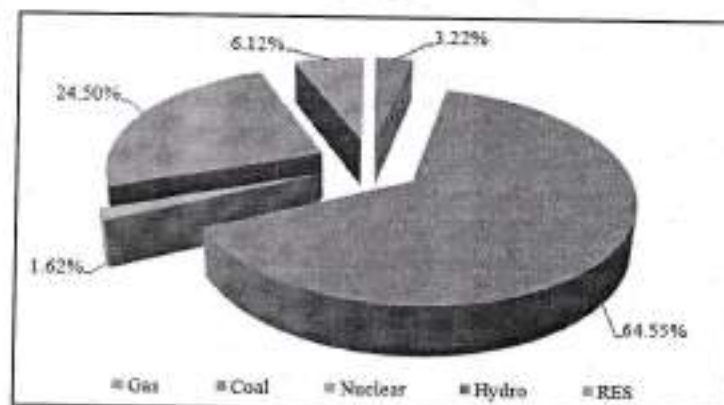


Fig. 1: Share of different sources of electricity generation in Punjab

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II. BIOMASS RESERVES AND DISTRIBUTION IN PUNJAB

2.1 Crops Straw Reserves

Punjab produces many crops. The major crops along with their average yield in a year produced in different districts of Punjab are being given in Table 1 [9]. Table 2 presents the coefficient of waste content in the crops given in Table 1 [4], [10]-[12]. It can be seen from Table 1 and 2 that wheat is being produced largely in Punjab and also it has highest waste content

Design and Comparison of Hydrogen Fuel Cell and Solar Photovoltaic powered Base Transceiver Stations and ATMs

Vishal K. Mittal, Shivam Saxena, Shivani Abrol and Shweta Soam

Abstract – Energy being the very crucial issue in today's world is transforming its shape from the non-renewable sources to various renewable sources because of the two major repercussions using non-renewable sources – one is the deterioration of the environment due to combustion of the fossil fuels causing threats not only to abiotic components but to biotic components also of the ecosystem and the second is that these non-renewable resources are going to be consumed up soon. So, it demands to look for the clean and perennial energy source. There are many renewable sources such as solar, wind, tidal, wave etc., this paper discusses the application of hydrogen fuel cell and solar photovoltaic (PV) in powering the base transceiver stations (BTS) and ATMs. The paper presents the design analysis of the fuel cell and solar PV system in powering BTS and ATM. Finally the paper compares these two renewable methods of power generation in terms of cost, reliability and effectiveness.

Index terms – Automated Teller Machine (ATM), Base Transceiver Station (BTS), On-field generation, Polymer Electrolyte Membrane Fuel Cell (PEMFC), Solar photovoltaic (PV).

NOMENCLATURE

T	Temperature (K)
R	Universal Gas constant (8.314 J/mol K)
P	Pressure of hydrogen gas (bar)
d_p	Density of hydrogen gas at pressure P (g/L)
n	No. of moles of hydrogen gas
M	Molar mass of hydrogen gas (g)
V	Volume of hydrogen gas (m^3)
Γ_p	Volume Flow rate of hydrogen gas at pressure P (L/min)
q	Mass flow rate of hydrogen gas (g/h)
Q	Total consumption of hydrogen gas in a day (g)
m	Mass of hydrogen gas contained in a $7Nm^3$ hydrogen cylinder (g)
E	Electrical energy supplied by a $7Nm^3$ hydrogen cylinder (kWh)
N_f	Number of fuel cells in a stack

t_H^x	Time for which $7Nm^3$ hydrogen cylinder will power load x (h)
P_L^x	Load of x i.e. either BTS or ATM (kW)
E^x	Electrical Energy consumed by BTS or ATM in one day (kWh)
V	Operating voltage of PEMFC stack or battery
h	Cost of one $7Nm^3$ hydrogen gas cylinder (Rs)
\mathcal{R}	Running cost of power generated by PEMFC (Rs/kWh)
N_B	Number of batteries required in the battery bank
c	Capacity of a battery (Ah)
C	Total capacity of battery bank (Ah)
DoD	Depth of discharge of battery (%)
t_b	Time the battery bank should give backup (h)
E_b	Backup energy provided by the battery (kWh)
t_c	Charging time of the battery bank using solar power (h)
S	Size of the extra solar panel required to charge the battery bank (kW)

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1 INTRODUCTION

ENERGY generation in today's electricity hungry world is a major issue to look upon as nearly 68.23% electricity is still generated from fossil fuels [1]. Fig.1 shows the percentage participation of various sources in generation of electric power in the world [1]. As the electric power demand is increasing very rapidly in this electric power conscious world, hence the more electric power is required to be generated. For this, in case of fossil fuels operated plants, the fuel intake will

Role of Solar Power Technology for Generation Electricity

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ABSTRACT

India is undergoing a massive development in all spheres be it real estate, transport, power, industry, education, agriculture, urban and rural lifestyle etc. everything needs energy and power. At present India has installed capacity of power generation from all the resources of about 1.59 GW with a declared shortage of about 13.3% in peak load supply. Further there are regular power cuts in the most of the cities and a very erratic, low quality and inadequate power supply in rural areas. The capacity addition every year taking place is not commensurate with the ever increasing demand in the country. Hence, there is utmost need to harness power from all resources. Further due to environment concerns, spiraling fuel prices, fuel security concerns and support for green power, it has become imperative to look forward for renewable energy i.e. from wind, biomass, small hydro and solar energy etc. as a source for energy independence.

Keywords: Peak Load, Green Power, Energy Independence etc.

INTRODUCTION

Energy plays a vital role in the economic growth of developing country like India. Due to rapid depletion of fossil fuels, alternative renewable energy sources should be developed and implemented in order to cope with such humming energy requirements. Solar energy seems to be one of the most promising alternative energy resources. Solar radiation

consists of both light and heat energy. This article focuses on harnessing heat energy from solar radiation to generate electricity. The technology used for this purpose is known as concentrated solar thermal power (CST).

Solar thermal technology: Solar thermal energy systems use the sun to supply heat, such as for solar water heating, and in higher temperature systems that produce sufficient energy to drive machines for power generation. The latter is the subject of this study. There are a number of solar thermal technologies that are considered for power generation. These are:

- Lower temperature applications such as solar ponds and solar chimneys; and
- Concentrating solar thermal power(CST)

Lower temperature solar thermal systems

Solar ponds

a solar pond is a reservoir of salty water that stores solar heat and uses this heat for power generation or other applications. Solar ponds up to 5 MW (e) have been developed and operated in Israel, but are not currently developed for large scale commercial power generation.



Performance Analysis of Different Filters using Digital Image Restoration

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ABSTRACT: In this paper, a method to restore the image degraded by white noise has been introduced. This method uses different filters to regain restore the quality of degraded image. The median filter is one of the well-established linear filtering methods and is well known for its excellent performance in denoising the white noise. However the estimation of the original image from the degraded image characterization is very difficult task as in most of time only a degraded version of image is available in many image processing application. Performance comparison of the denoising methods as Average filter, Gaussian filter, Median filter, Wiener filter in frequency domain, Wiener filter in frequency domain have the lowest value of PSNR with the Gaussian noise and average filter have the highest PSNR value. Again performance comparison of the denoising methods as Average filter, Gaussian filter, Median filter, Wiener filter in frequency domain (in PSNR). Median filter have the highest value of PSNR with the salt & pepper noise.

It has been observed that the median filter is having overall performance for images corrupted by white noise better compared to other nonlinear filters. Thus, the median filter is a solution to the restoration problem based upon the use of linear filter.

1 Introduction

We may define noise to be any degradation in the image signals, caused by external disturbance. If an image signal is being sent electronically from one place to another place, via satellite or wireless transmission, or through the networked cable, we may expect errors to occur in the image signals. These errors will appear on the image output in different ways depending on the type of disturbance in the signal. We know what types of error to expect, and hence the type of noise, echo on the image; hence we can choose the most appropriate method for reducing the effects. Cleaning an images corrupted by noise to signal is thus an important area of image restoration. [2]

The main applications are : Medicine, Agriculture, Industry, Law enforcement and Digital camera images.

Mean/ Average Filter

If the Gaussian noise has mean 0, then we would expect that an average filter would average the noise to 0. The larger size of the filter mask, the closer to zero. Unfortunately, averaging tends to blur an image. However, if we are preparing to trade off blurring for

noise reduction, then we can reduce noise significantly by this method,



Fig.1 original image



Fig.2 noised image



Fig.3 Filtering mask 3x3

Comparative Study between Hydrogen Fuel Cell and D.G. Set Operated During Peak Hours in an Industry

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Abstract—According to today's scenario, there are many large scale industries which share more than 80kW load and are continuously using the DG Set during peak hours. As in India, the cost of diesel is quite high due to which the per unit electricity generation cost is high. In this paper we present a remedial method to overcome the above problem using Hydrogen Fuel Cell. The higher calorific value of hydrogen and higher efficiency of Hydrogen Fuel Cell has made the above statement to come into existence. This paper compares the D.G. Set and Fuel Cell operation during peak hours in terms of cost along with discussing the environmental impacts of these two methods. This paper shows how the hydrogen fuel cell plays a vital role in sustainable development.

Key words — Hydrogen fuel cell; DG set; peak hours; calorific value; sustainable development.



I. INTRODUCTION

The rising consumer demands have imparted more burden on manufacturing sector. There are many small power (SP), medium power (MP) and large power (LP) industries in India. The power consumption in case of SP and MP is not too high but for the case of LP it is a matter of concern. Even with the total installed capacity of 12,688.68 MW contributing in the total installed capacity in India of 302.087 GW⁽¹⁾ Punjab is not able to completely fulfill the energy demand. It is the consequence of above that during the large power demands which is known as peak hours, the LP industries are charged more than the off peak hours for per unit electricity consumption. There is also probability of cascade tripping if the demand exceeds the limit which causes the shutdown of whole plant resulting in the huge loss to industry. Hence, to avoid the above ill issues the industries go for the DG Set. Industries expend a huge amount on the maintenance of these DG Set along with the rising prices of diesel in India the running cost (fuel cost) of DG Set is increasing. More important is that at this today's consumption rate the diesel will last for only around 40 more years. Also the combustion

of diesel causes air pollution which is also a major issue of current.

The hydrogen fuel cell provides an efficient, cost effective, renewable and green solution to the above problem. The calorific value of hydrogen is 141 MJ/kg which is nearly three times greater than that of diesel 44.8 MJ/kg⁽²⁾ i.e. more energy to mass ratio. The maximum efficiency with DG set has been achieved up to 45% whereas hydrogen fuel cells work with efficiency of nearly about 50%⁽³⁾. The fuel for the hydrogen fuel cells is hydrogen gas i.e. no carbon content, hence there is zero carbon emission which is a boon for the depleting environment.

II. SELECTION OF STUDY DOMAIN

Analysis of 150kW spinning mill industry during the peak hours and comparison of operation of DG Set and hydrogen fuel cell during peak hours.

III. METHODOLOGY

- Analysis of Electricity charges of PSPCL during the peak hours for SP, MP and LP industries.
- Analysis of per unit cost of electrical energy obtained using DG set.
- Analysis of per unit cost of electrical energy obtained using hydrogen fuel cell.
- Environmental effects of DG set and hydrogen fuel cell operation.

A. Analysis of Electricity charges of PSPCL during the peak hours:-

Time of Day (ToD) tariff structure has been introduced in the system for LP industries. In ToD different rates are applied at different times of a day on electricity units. The charged rates are higher during the peak hours to that of during normal

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SAP S/4HANA Database – Segmentation Approach for Modern Business Applications

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Abstract:

In Today's World it become difficult to handle a large business due to huge amount of data. SAP Has become one of the largest Data warehousing tools to manage data for every kind of businesses. It will take couple of time in fetching data, when there become huge amount of data in database, through SAP also because SAP uses third party Database like Oracle / MYSQL Etc (computation of complicated reports become difficult). *In this Research Paper, proposed a Segmentation approach for fast access of the (computation of complicated reports) count of records using HANA Database. This makes the better performance of system for accessing data.*

The basic Idea of the SAP HANA information is that the integration of the transactional and analytical work among constant direction system. The main feature of SAP-HANA is In-Memory database server is used which helps to store and retrieve data much faster. Beside this, it can perform advanced analytics (predictive analytics, spatial data processing, text analytics, text search, streaming analytics, graph data processing etc) and includes ETL capabilities as well as an application server.

Keywords — Analytical application, SAP HANA, Reporting, HANA Deployment, Segmentation.

I. INTRODUCTION

Today's Businesses users always want to react very fast to the ever-changing clients and to the marketing environment. They want Dynamic accessing to the data in real time world.

SAP S/4HANA is an SAP's ERP Platform for large businesses. It is an ERP Software Package with the goal to cover all Day-To-Day Processes of an Enterprise (For Instance, Order-To-Cash, Procure-To-Pay, Plan-To-Product, and Request-To-Service) with Core Capabilities.

SAP S/4HANA is called as the SAP's Biggest Update to its ERP strategy and platform in over two decades. SAP ECC based Businesses are using Third Party Database Platforms Like – ORACLE, Microsoft and IBM. But SAP HANA Based Businesses have its own HANA database which is implemented through In-Memory Strategy.

SAP HANA replaces the traditional relational databases through SAP applications. The SAP Net Weaver Business Warehouse (SAP Net Weaver BW) component, which is a proven enterprise data warehouse solution, is the very first application where SAP customers can migrate from their existing database to an SAP HANA database.[1]

II. WHAT IS SAP?

SAP has become one of the largest data warehousing and business Processes software in today's marketplace. SAP provides the best ERP (enterprise resource and planning) solutions and services. It provides the modern QuickStart approach to implement small, medium or large businesses. It helps to make business easy, cost-effective and fast accessible. If any Business is looking to grow and transform in today's competitive market, SAP provides the best solution for it. SAP Management Software provides most powerful tool that helps you



DEFECT DETECTION IN FABRIC USING DEEP LEARNING

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Abstract

A prevalent issue that affects many manufacturing industries and causes significant monetary loss as well as customer loss is the distribution of items to users that have defects or anomalies. These problems are typical in industries that produce components made of fabric, metal, wood, glass, plastic, and paper. These defects are numerous surface defects that vary in size, shape, and color. The best strategies for this task now are deep learning techniques. To locate faults on an object's surface, a vision-based model can be created and trained using standardized defects. It would improve production efficiency and eventually result in added costs for the manufacturing company by making it easier to identify defective items and separate them before selling to the consumer. Deep learning has recently received a lot of attention as a potential tool for automating defect detection.

Keywords : Deep Learning, Defect Detection, Machine Learning, Convolutional Neural Networks.

I. INTRODUCTION

One of the most important tasks in industrial processes for ensuring the proper quality of the finished product is surface inspection. The visual quality impression of a product has a strong influence on whether or not it is purchased. The purpose of this paper is to investigate the use of visual analytics solutions to track surface quality defects or anomalies of products on the industrial shop floor.

The generalized framework can handle defects or anomalies of various shapes, sizes, object colors, and surface defects. Depending on the application, the object with defects or anomalies may be stationary or moving.

In these cases, it is common practice to manually or automatically inspect each fabricated part for visible defects. Manual inspection is a tedious task that frequently results in overlooked errors and subjective assessments. For these and other reasons, the industry has lofty goals for automating any type of surface inspection.

Convolutional Neural Networks (CNNs) are now the preferred method for many image-related machine learning tasks. CNN is one of the fundamental deep learning architectures that can be used to solve visual analytics problems. We can use it for analysis based on the number of layers we chose for our architecture, and by changing some parameters, we can find better hyperparameters for a specific architecture. Other techniques, such as domain adaptation and transfer learning, can provide better results on a given problem statement, where we are attempting to generalize a given knowledge to any of the problem statements based on classes, similarity in dataset instances, and so on.


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SAP S/4HANA Database – Segmentation Approach for Modern Business Applications

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SWITCH TRANSFORMERS: SCALING TO TRILLION PARAMETER MODELS WITH SIMPLE AND EFFICIENT SPARSITY USING DEEP LEARNING

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Abstract

deep learning fashions generally reuse the same parameters for all inputs aggregate of specialists (MoE) fashions defy this and as a substitute pick distinct parameters for every incoming instance. The end result is a sparsely-activated model—with an outrageous range of parameters—however a consistent computational value. However, notwithstanding numerous extremely good successes of MoE, extensive adoption has been hindered through complexity, verbal exchange costs, and education instability. We cope with these with the introduction of the transfer Transformer. We simplify the MoE routing algorithm and layout intuitive advanced fashions with reduced communication and computational fees. Our proposed education techniques mitigate the instabilities, and we display big sparse fashions may be educated, for the primary time, with lower precision (bfloat16) formats. We design models used totally off T5-Base and T5-huge (Raffalet al., 2019) to obtain up to 7x will increase in pre-training speed with the equal computational sources. these upgrades expand into multilingual settings where we degree profit over the mT5-Base model throughout all a hundred and one languages. finally, we develop the modern scale of language fashions by using pre-schooling up a trillion parameter models on the "significant clean Crawled Corpus", and acquire a 4x speedup over the T5-XXL version. Key issues: aggregate-of-specialists, herbal language processing, sparsity, big-scale gadget mastering, allotted computing.

Index Terms – DEEP LEARNING, SPARSITY MATRIX.

1 INTRODUCTION

large scale training has been an powerful path towards bendy and powerful neural language models (Radford et al., 2018; Kaplan et al., 2020; Brown et al., 2020). simple architectures—subsidized via a beneficent computational price range, facts set length and parameter remember—surpass extra complex algorithms (Sutton, 2019). As technique observed in Radford et al. (2018), Raffael et al. (2019); Brown et al. (2020) expands the model size of a densely-activated Transformer (Vaswani et al., 2017). While effective, it's also extraordinarily computationally in depth (Strubell et al., 2019).



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IMAGE DESCRIPTION WITH LSB/MSE ENCODING IN STEGANOGRAPHY METHODOLOGY

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Abstract:

Steganography is the most mighty process in which cover the data into life records. the principle aim of steganography is provide higher safety from an unknown or anonymous get entry to. Its essence is to embed secret message within harmless service in such way that unknown or anonymous events are not aware about verbal exchange and the message. a number of the techniques utilized in steganography are least tremendous bit (LSB) insertion and noise operate, and rework area that contain operate algorithms and photo transformation on this paper, there's approach wherein Least sizeable Bit is modified to cover the name of the game message or any facts from unauthorised celebration. Least great Bit(LSB) encryption is-used for hiding facts in multimedia files for example text, image, Audio, Video. on this technique each man or woman of secret embedding message which includes more special individual which become in ASCII(American Standard Code for data Interchange) code then each price is turned in eight bit binary quantity. each bit of every character is inserted in closing LSB (Least extensive bit) of every pixel of image, text, audio and video. most effective final bits of photograph might be altered soon, this technique having an potential of giving a mystery-embedded photograph that is completely identical from the original photograph through the human eyes.

Index Terms - : Steganography, LSB, Encryption, Decryption, Cryptography, PSNR, MSB

1. INTRODUCTION

The word steganography is made of Greek phrases steganos and graphia which means "hid writing". it is a most effective approach in which cover the information into existence statistics. steganography technique can be applied to pics, a video report or an audio report. In wide experience, the term steganography is used for hiding message inside an image. inside the enhancement of Cryptography techniques in which the enemy is authorized to perceive, detection and modification of message. Cryptography is capable of violate certain security premises guaranteed with the aid of a cryptosystem, the intention of steganography is to hide message in manner that does not qualify any violator to even detect that there may be a 2nd mystery message present. Steganography is within the (mainly military) literature additionally known as transmission security of quick

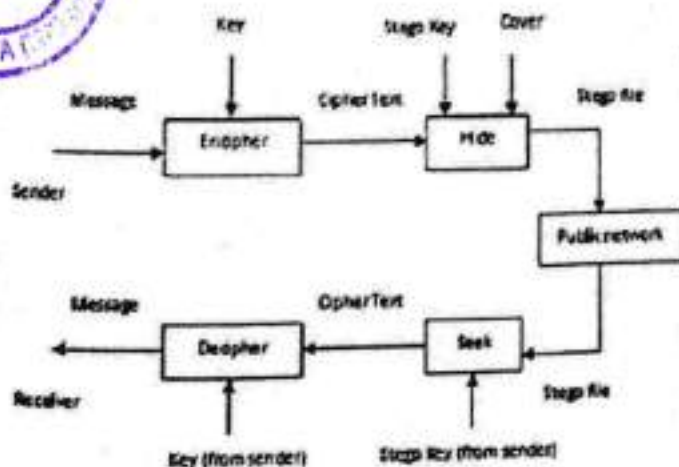


Fig. 1: Block Diagram and functionality of Steganography



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Sensor Authentication in Sensor Networks That Collaborate

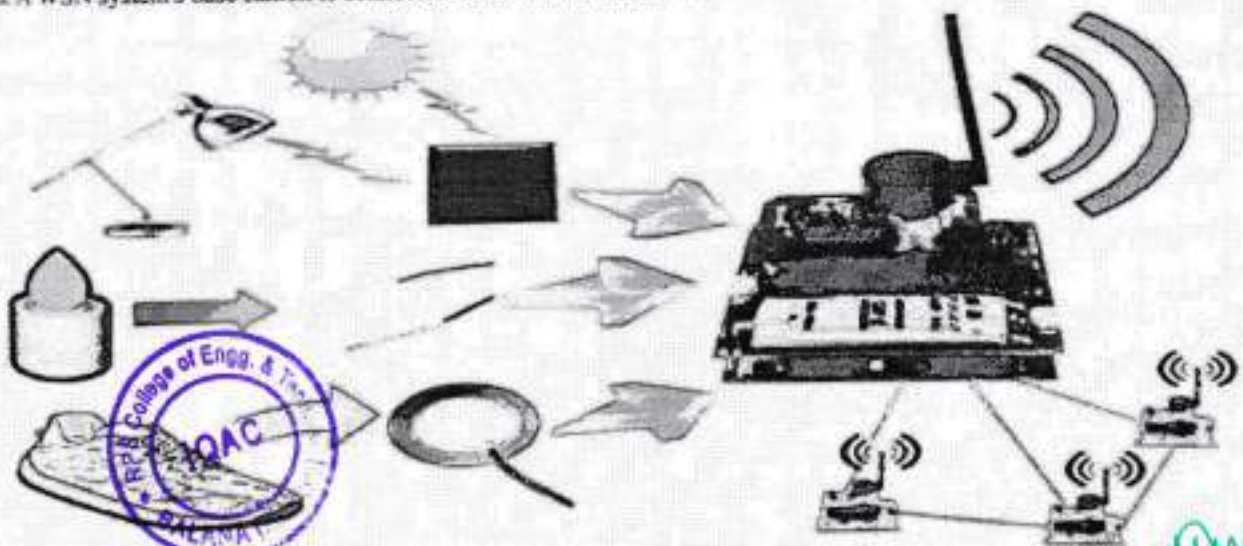
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Abstract: In this thesis, we have a tendency to address a brand new security drawback within the realm of collaborating device networks. By collaborating device networks, we have a tendency to discuss with the networks of device networks collaborating on a mission, with every device network is severally closely-held and operated by separate entities. Such networks square measure wherever variety of freelance entities will deploy their own device networks in multi-national, commercial, and environmental situations, and a few of those networks can integrate complementary functionalities for a mission. Within the state of affairs, we have a tendency to address associate degree authentication drawback whereby the goal is for the Operator O_i of device Network S_i to properly confirm the quantity of active sensors in Network S_i. Such a retardant is difficult in collaborating device networks wherever different device networks, despite showing associate degree intent to collaborate, might not be fully trustworthy and will compromise the authentication method. We have a tendency to propose 2 authentication protocols to deal with this drawback. Our protocols place confidence in Physically Unclonable Functions, that square measure a hardware based mostly authentication primitive exploiting inherent randomness in circuit fabrication. Our protocols square measure light-weight, energy economical, and extremely secure against variety of attacks. To the simplest of our information, ours is that the 1st to addresses a sensible security drawback in collaborating device networks.

Keywords: Sensor, Path, Routing, Algorithms

Introduction

The Wireless Sensor Network (WSN) is an infrastructure-free wireless network that uses an ad-hoc deployment of a large number of wireless sensors to monitor system, physical, and environmental factors. WSN uses sensor nodes with an inbuilt processor to manage and monitor the environment in a specific area. As WSN system's base station is connected to the Internet to share data. They are linked to the Base Station, which serves as the WSN System's processing unit. A WSN system's base station is connected to the Internet to share data.



Wireless Sensor Network



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Wireless Sensor Networks Used To Verify Vehicle Paths

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Abstract: Path Verification could be a drawback wherever a voucher would really like to work out however closely a vehicle really traversed a path that it claims to own traversed. This problem has vital significances in terms of auto quality. Mobilenodes is patrols officers or cab drivers, whereas individual verifiers is police dispatchers or cab operators. During this paper, we have a tendency to style a sensing element network motor-assisted technique for vehicle path verification. In our style, variety of static wireless sensors placed in road segments can function witnesses and certify vehicles as they move. Post movement, these witness certificates are used by the voucher to derive the particular path of a suspect vehicle. The challenge now could be a way to compare a Claimed Path as reportable by the vehicle and therefore the Actual Path derived from witness certificates. During this paper, we style an easy, however effective technique for scrutiny similarity between 2 vehicle ways. Our technique extends from Continuous Dynamic Time distortion, which involves constructing a universal manifold from the 2 ways and so finding the geodesic on the ensuing plane figure surface (shortest path on the surface) that is a diagonal from the origin of the surface to the limit. This distance is analogous to the Freshet distance and yields a decent live of the similarity between twopaths. Exploitation simulations and real experiments, we have a tendency to demonstrate the performance of our technique from theangle of police work false ways claims from correct ones. We additionally style light-weight scientific discipline techniques tostop vehicle masquerading and certificate formation attacks. A proof of thought experiment was conducted on the streets of Rolla, Missouri. A sensing element grid was established on tiny low section of Rolla and a vehicle with a transmitter was driven through the grid repeatedly. The analysis of the info yielded results in line with the expected ones

Keywords: Sensor, Path, Routing, Algorithms

INTRODUCTION

The government, industry, and academia are all paying attention to the topic of vehicular networking. Several organizations are investing in Vehicular Ad Hoc Networks (VANETs) to improve the state-of-the-art in road transportation by using wireless networking support. The Federal Communications Commission (FCC) of the United States has set aside 75MHz in the 5.9GHz band for Dedicated Short Range Communications, a collection of protocols and standards for short to medium-range wireless communication for automobile application. The USDOT's Vehicle Infrastructure Integration (VII) initiative, which is a collaborative endeavor between the USDOT and automotive manufacturers, focuses on the possibility of installing communications systems for road transportation safety and efficiency [28]. The ERTICO cooperation is a multi-sector collaboration aimed at developing and deploying Intelligent Transportation Systems across Europe [26]. A variety of VANET test-beds have been established in academia, including DRIVE-IN at Carnegie Mellon [24], CarTel at MIT [25], C-VET and Car Torrent at UCLA [7, 19], and the DOME tested at UMASS-Amherst [27]. With the development of vehicular networking, a lot of previously impossible uses are now possible. Content sharing between vehicles, real-time congestion detection, traffic re-routing to optimize efficiency, and emergency vehicle preemption are just a few examples.

PROBLEM ADDRESSED AND IMPORTANCE

We examine a novel challenge in the field of vehicular networking in this thesis:

How can a Verifier S assess whether or not a Vehicle V truly followed the path it claims to have travelled given a path it claims to have taken?



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Modified AODV Based ISEP to Improve Lifetime of Heterogeneous WSN for IOT Based Application

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Abstract: The creation of an energy-efficient WSN routing system is a monumental challenge. Clustering is a novel technique for increasing the quality of a sensor network. In heterogeneous protocols, two or three node energy levels are commonly created; however, in heterogeneous WSNs, a wide variety of energy levels is now available. Energy management and energy efficiency have been tremendously hot and hard study topics for WSNs for many years. Because there are so many sensor nodes in such a hostile environment, the sensor batteries cannot be replaced. It is proposed to employ the AODV-ISEP protocol that is based on clustering. The fundamental aim of this study is to create the I-SEP protocol on the basis of a low-energy WSN protocol. The study suggests energy-efficient ways for selecting cluster heads with high energy efficiency. The final findings are reached by differentiating network efficiency based on average remaining energy, no. of alive or dead nodes as well as network throughput. As per the simulation findings, the chosen method surpasses the prior technique. On the basis of packet loss rate, the results reveal that the suggested AODV-ISEP beats the existing approach.

Keywords: AODV, Sensor Networks, Internet of Things, Clustering, Energy Efficiency, SEP.

I. INTRODUCTION

Since WSNs are a backbone to IoT networks, improving their lifetime is of utmost importance. Authors in the existing work [1] used the concept of clustering to improve the energy consumption of the sensor nodes. They have worked upon a heterogeneous network where the nodes have different energy levels and they have given preference to the nodes having higher energy to become cluster heads. However, these nodes have may be located far away from the base station and it may cost remarkable amount of energy by them when they transfer data to the base station over a longer distance.

The main issue with the WSN is the energy inefficiency in its network [2] and the shorter life of the network because the sensors are not efficient. Small sensors and power generating systems, which are typically utilised in inaccessible settings, provide tiny batteries. Battery replacement is not an option. Based on the battery, it does not only restrict the life of the sensor but also poses a real challenge to the successful design and management of WSNs. However, there are substantial research on all layers of the WSN due to the limitations in energy supply. The uniformity of its service parameters, like latency, throughput, jitter, availability, reliability and even safety, are also measured in a network in terms of energy consumption (EC), however, it's often hard to evaluate and optimise a system using an energy model that incorporates the EC.

Another thing to be noted in the research work was the use of single hop communication from cluster head to BS. Direct data transfer is another cause of more power consumption. If energy in WSN is not conserved then the

cost of IOT network would also go up since the IOT devices will no longer be receiving any data from the sensors. This will lead to failure of entire application for which the IOT network has been deployed.

In order to address sensory network scalability, energy and life problems, the research community has widely advocated clustering in sensor nodes [3]. Cluster algorithms govern local domain communications, which are only disseminated to the rest of the internet via transmission nodes. CH and local interaction between cluster nodes establish a community of cluster nodes. Cluster members often engage with the cluster's leader, and the information obtained is consolidated and combined with energy conservation by the cluster's leader [4].

Cluster-based routing is a method for selecting high-energy nodes that saves energy. A cluster-based routing protocol function plays an important role in achieving these application objectives. Energy performance, scalability, defect resistance, node distribution and quality of service are the main limitations of WSN. There is various energy-efficient clustering protocol used in the field of wireless sensors that focus on optimal cluster head selection.

Several clustering techniques are presented for maximising energy usage of system. Two hierarchical clustering-based routing protocols [5] are primarily used to broaden the life of the network, which are efficient clustering algorithms. One suggested energy efficiency algorithm is SEP. SEP is an extension of LEACH protocol, a heterogeneous protocol that extends the interval of time before the first node dies, which is essential for a variety of applications. The SEP provides a longer stability time and higher average output. The grouping of EP is identical to the grouping of LEACH.



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DEFECT DETECTION IN FABRIC USING DEEP LEARNING

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Abstract

A prevalent issue that affects many manufacturing industries and causes significant monetary loss as well as customer loss is the distribution of items to users that have defects or anomalies. These problems are typical in industries that produce components made of fabric, metal, wood, glass, plastic, and paper. These defects are numerous surface defects that vary in size, shape, and color. The best strategies for this task now are deep learning techniques. To locate faults on an object's surface, a vision-based model can be created and trained using standardized defects. It would improve production efficiency and eventually result in added costs for the manufacturing company by making it easier to identify defective items and separate them before selling to the consumer. Deep learning has recently received a lot of attention as a potential tool for automating defect detection.

Keywords : Deep Learning, Defect Detection, Machine Learning, Convolutional Neural Networks.

1. INTRODUCTION

One of the most important tasks in industrial processes for ensuring the proper quality of the finished product is surface inspection. The visual quality impression of a product has a strong influence on whether or not it is purchased. The purpose of this paper is to investigate the use of visual analytics solutions to track surface quality defects or anomalies of products on the industrial shop floor

The generalized framework can handle defects or anomalies of various shapes, sizes, object colors, and surface defects. Depending on the application, the object with defects or anomalies may be stationary or moving.

In these cases, it is common practice to manually or automatically inspect each fabricated part for visible defects. Manual inspection is a tedious task that frequently results in overlooked errors and subjective assessments. For these and other reasons, the industry has lofty goals for automating any type of surface inspection.

Convolutional Neural Networks (CNNs) are now the preferred method for many image-related machine learning tasks. CNN is one of the fundamental deep learning architectures that can be used to solve visual analytics problems. We can use it for analysis based on the number of layers we chose for our architecture, and by changing some parameters, we can find better hyperparameters for a specific architecture. Other techniques, such as domain adaptation and transfer learning, can provide better results on a given problem statement, where we are attempting to generalize a given knowledge to any of the problem statements based on classes, similarity in dataset instances, and so on.

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Wireless Sensor Networks, Cross Layer Design Achieved Using Cooperative Routing and Link Allocation

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Abstract:

Both energy and information measure are scarce resources in detector networks. Within the past, the energy economical routing drawback has been extensively studied in efforts to maximise sensor network lifetimes, however the link information measure has been optimistically assumed to be abundant. As a result of energy constraint affects however knowledge ought to be routed, link information measure affects not solely the routing topology, however additionally the allowed rate on every link, which in turn affects the time period. Previous analysis that concentrate on energy economical operations in sensor networks with [the sole the solely the only real] objective of increasing network time period only think about the energy constraint ignoring the information measure constraint. This thesis shows how ever impracticable these solutions are often once information measure will gift a constraint. It provides a brand new mathematical model that address each energy and information measure constraints and proposes two economical heuristics for routing and rate allocation. Simulation results show that these heuristics offer additional possible routing solutions than previous work, and considerably improve output. A technique of distribution the slot supported the given link rates is presented. The cross layer style approach improves channel utility considerably and completely solves the hidden terminal and exposed terminal issues.

Keywords: Sensor, Vibration, Energy

INTRODUCTION

The sensing element may be a inexpensive low-power device that responds to a physical information (such as heat, light, sound, pressure, magnetic, or a particular motion), communicates a corresponding impulse (for measure or control), then encodes these during a human-readable formatting. This can be advantageous in terms of movability and readying, however it additionally limits the process speed and storage capability of the sensors. A wireless sensing element network (WSN) may be a network of autonomous sensors that square measure physically distributed. Sensing element nodes square measure chargeable for self-organizing, associate adequate spec when the primary readying (which is commonly ad hoc), that ordinarily includes multi-hop connections between sensing element nodes. The aboard sensors then begin assembling acoustic, seismic, infrared, or magnetic information from the environment in either continuous or event-driven modes. The information flow involves a halt at special nodes (sometimes they're additionally brought up as sinks) to distribute the information determined for additional processing. A gateway connects the sensing element network to a different network (such as a gateway). As a result of base stations should perform sophisticated processing, they need additional capabilities than straightforward sensing element nodes; this justifies the utilization of workstation/laptop category processors, similarly as enough memory, energy, storage, and procedure capability to complete their tasks. Although processor style and computation have advanced considerably, breakthroughs in battery technology

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Enhancement In Data Mining Using Fuzzy Associative Rule-Based Strategy

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Abstract:

The latest new approach for data mining implementation of Associative Rule Mining with Fuzzy Logic. The Combination is announced through Fuzzy Associative Rule Mining (Fuzzy ARM). This helps in decision-making for the given Complex problems. Associative Rule mining is one of the widely used technique for data mining.

In this research paper, Fuzzy approach used with Associative rule mining technique which increase the power of Decision making. Using Fuzzy logic predictions are made more reliable than conventional methods. Improved Associative Rule based Fuzzy Algorithm to predict the risk involved in identifying disease which is through fuzzy based C-Means clustering concept adopted to discover inference knowledge from frequent patterns.[1]

Keywords — Fuzzy Logic, Data Mining, Association Rule Mining.



II. WHAT IS ASSOCIATIVE RULE MINING?

I. INTRODUCTION

Data mining is an approach to extract data with efficient and reliable way from huge amount of data in database. It become difficult to analyze patterns for extract if volume is high. The mining means sorting the large dataset to identify the patterns and relationships in it. It can also help in problem-solving in the data analysis process. There are four stages in data mining. They are data sources, data exploration, Modeling, and deploying models. This technique is used in many fields such as mathematics, cybernetics, genetics, education, sports, medicine, marketing, etc.; web mining is a type of data mining used in customer relationship management. It also consist of parameters like association rule mining, sequence or path analysis, classification, clustering, and data forecasting.[2]

Fuzzy logic in data mining involves computation of data based on predictive models and its categories. In the traditional method this was done with "TRUE" or "FALSE". Algorithms using Fuzzy logic have increased the power of decision making.[3]

Association Rule Mining :

Definition 1: Let PT be a set of patients, which contains different patients $PT_1, PT_2, PT_3, \dots, PT_n$ which may occur in different transactions, $PT = \{PT_1, PT_2, PT_3, \dots, PT_n\}$.

Definition 2: Let ST sets of symptoms contains different symptoms $ST_1, ST_2, ST_3, \dots, ST_m$: $ST = \{ST_1, ST_2, ST_3, \dots, ST_m\}$ where $ST \subseteq PT$ in transactional data base DB.

Definition 3: An association rule represented in the form of an implication of $ST_1 \rightarrow ST_2$ where $ST_1, ST_2 \subseteq ST, ST_1 \cap ST_2 = \phi$, ST_1 is called the antecedent and ST_2 is called consequent. Support (ST) of an association rule is defined as the percentage of records that contain the total number of records in the database.[4]

$Support, ST(ST_1 \rightarrow ST_2) = Supp (ST_1 \cup ST_2)$

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Enhancing Database Performance Using SAP S/4HANA

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Abstract:

In today's world, managing large businesses can be very difficult due to the large amount of information. SAP has become one of the largest Data management tools used to manage data for all kind of businesses. When there is big data for any organization, to manage it through third party databases – Oracle or MYSQL, becomes very difficult. It will decrease the performance of system for fetching data from database. In this research paper, implemented a segmentation approach using HANA database for fast access to get the count of records matching a particular pattern (Computation of Complex Reports). This process will make the system more efficient while processing data and performance of system will be increased.

The core idea of SAP HANA database is to integrate business and analytical work in a continuous direction. The main feature of SAP HANA is to use of an in – memory database server, which increases the speed and storage of data. Among other things, it can perform advanced analysis (prediction prediction, spatial data processing, paper analysis, paper search, flow analytics, and graphical data processing, etc.) and includes ETL features with application server.

Keywords — Database Management System (DBMS), SAP High Performance Analytics Appliance, HANA Deployment, Segmentation, Structured Query Language (SQL).

I. INTRODUCTION

Today's Business always want to get very fast access of data and fast growth in market. Dynamic access of data makes system fast in real time world.

SAP S/4HANA one of the SAP's ERP Platform for every kind of businesses like small business or large business. HANA is an ERP Software Package with the main aim to cover all Day-To-Day Processes of an Enterprise (For Instance, Order-To-Cash, Procure-To-Pay, Plan-To-Product, and Request-To-Service) with Core Capabilities.

SAP S/4HANA is one of the SAP's Biggest Update to its ERP strategy and platform in over two decades. SAP ECC based Businesses are using Third-Party Database systems Like – ORACLE, Microsoft and IBM. But SAP HANA implemented

systems have its own HANA database which is implemented through **In-Memory** build Strategy.

SAP HANA implementation would replaces the traditional relational databases through SAP applications. The SAP Net Weaver Business Warehouse (SAP Net Weaver BW) component, which is a proven enterprise data warehouse solution, is the very first application where SAP customers can migrate from their existing database to an SAP HANA database.[1]

II. SAP

SAP become one of the largest data warehousing tool as well as business Processing software in today's marketplace. SAP provides the best ERP (enterprise resource and planning) solutions and services. It provides the modern QuickStart approach to implement small, medium or large



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Secure Data Transmission Using CRYPTO- STEGO Approach

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Abstract:

Cryptography is a process to secure data transmission using Encryption and decryption over the internet. This paper proposed concept to enhance the data encryption and decryption security by using combination of both Cryptography and Steganography techniques. In Cryptography there is used Rivest-Shamir-Adleman (RSA) Algorithm. In Steganography there is used Image Steganography for hiding the data. Through using combination of both cryptography and steganography security of data is increased which is also known as CRYPTO-STEGO Approach. This satisfies all services in Cryptography i.e., Access Control, Confidentiality, Integrity, Authentication. And data can be maintained more securely. There can used RSA for encryption of data and Steganography approach to hide the data in an image so that data can not be accessed by anybody in network and only sender and receiver can retrieve the data from message file. [1]

Keywords — RSA Algorithm, Cryptography, Steganography.

I. INTRODUCTION

In Today's world, Data security has become basic issue. Steganography and cryptography are two popular ways of sending the information in a secret way. One method used to hide the existence of the message, and the other will distort the message itself. Through this research paper mainly focus to develop a new system with extra security features where a meaningful piece of text message can be hidden by combining security techniques like cryptography and steganography.

Currently, most of the departments in government, military communication, financial institution, medical imaging, and private business greatly deal with data that are in the form of images. So, security of digital images has become most important. [2]

II. CRYPTOGRAPHY

The basic idea of cryptography is to encrypt the information or data in such a way that an unauthorised person cannot access it. Cryptography is mainly used to send data via an unsecured channel,

such as internet, or used to ensure that unauthorised persons do not comprehend what they are looking at in a case where they have accessed the information.[3]

In Cryptography, the original message is known as plaintext. And the process to convert the original message into another form which can not be understood by third person is known as encryption. The encrypted message is known as ciphertext. This all done through some encryption algorithm using some encryption key.

Its reverse process is known as decryption which will convert the cipher text into plain text (Original message) through some decryption algorithm using decryption key.



Fig. 1. Cryptography concept



VEHICLE DETECTION AND TRACKING USING MACHINE LEARNING TECHNIQUES

Chirag
Student

Indira Gandhi University, Rewari

with



Saroj Kumar Gupta
Guide, Asst. Professor

Indira Gandhi University, Rewari

ABSTRACT

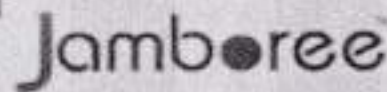
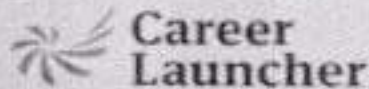
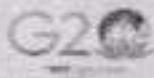
This master's thesis focuses on vehicle detection and tracking. The research tries to detect vehicles in images and videos. It deploys a dataset from Udacity in order to train the algorithms. Two machine learning algorithms; Support Vector Machine (SVM) and Decision Tree have been developed for the detection and tracking tasks. Python programming language have been utilized as the development language for the creation and training of both models. These two algorithms have been developed, trained, tested, and compared to each other to specify the weaknesses and strengths of each of them, although to present and suggest the best model among these two. For the evaluation purpose multiple techniques are used in order to compare and identify the more accurate model. The primary goal and target of the thesis is to develop a system in which the system should be able to detect and track the vehicles automatically whether they are static or moving in images and videos.

Vehicle detection also called computer vision object recognition, basically the scientific methods and ways of how machines see rather than human eyes. The main duty of a vehicle detection system is to localize one or more vehicles in input images.

CHAPTER 1 INTRODUCTION

1.1 Background

Since the population and transport system increase day by day, the demand for managing them increase at including vehicles increased at the same time. That being said, new topics like traffic, accidents and many more issues are needed to be managed. It is hard to manage them with the old methods, new trends and



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Classification of brain tumour based on texture and deep features of magnetic resonance images

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Abstract

According to the world health organization report, brain cancer has the highest death rate. magnetic resonance imaging (MRI) for detecting brain tumours is adopted these days due to several advantages over other detection techniques. This paper presents a novel methodology to classify MR images based on texture and deep features, z-score normalization, and Comprehensive learning elephant herding optimization (CLEHO) based feature optimization and classification. Deep features of brain MR images have been extracted through DenseNet121 convolutional neural network and texture features have been extracted by using the Gabor 2D filter, Haralick texture feature, edge continuity texture feature, first order statistical texture feature, local binary pattern feature, difference theoretic texture feature, and spectral texture feature techniques. Normalization has been done using three normalization techniques that is, z score, mean median absolute deviation (MMAD), and Tanh-based after aggregating the features extracted from the previous step. z-score normalization has been suggested for feature normalization after comparing the results attained from the three techniques. Lastly, binary CLEHO has been proposed for selecting an optimal feature set and also optimizing the 'k' value of the k-NN classifier. The outcome of this proposed work is compared with other state-of-the-art methods for a publicly available magnetic resonance image Fishshare dataset of 3064 slices from 233 patients. The proposed work has a brain tumour average classification accuracy of 98.97%, which is better than the other state-of-the-art methods. The proposed work can be used to assist the radiologist in the screening of multi-class brain tumours.

KEYWORDS

brain tumours, classification, feature extraction, feature normalization, feature selection, magnetic resonance imaging

1 | INTRODUCTION

A brain tumour problem is a major health concern worldwide. Therefore, accurate brain tumour classification plays an important role in reducing death rates. Brain tumours are classified as primary or secondary. Primary brain tumours develop and grow within the brain, and secondary brain tumours develop through the cancerous cell spreading within the brain from other body organs such as kidneys, breast, skin, lungs, and thyroid gland (Dimillier & Ilhan, 2016). Secondary brain tumours are mostly cancerous and patients have a low survival rate (Franchino et al., 2018). Primary tumours are initially non-cancerous and patients have a high survival rate if detected and classified well in time (Selingerová et al., 2016).


Principal

R.P.S. College of Engg. & Tech
Balana, Mohindergarh (HR.)

Papers Published

- 3.2.2.
1. Ritu Mohan. "Macbeth and Shakespeare in Love: A Rejoinder to the "Tragedy"." *Literaria* (An International Journal of New Literature across the World). (ISSN: 2229-4600). Vol. 11, No. 1-2. Jan-Dec 2022. pp45-56. (Peer Reviewed International Journal)
 2. Ritu Mohan. "Two Film Adaptations of Hamlet in Perspective: A Comparative Scrutiny." *Literary Miscellany* (An International Journal of Literary Studies). (ISSN: 2230-7451). Vol. 10, No. 1-2. Jan-Dec 2022. pp 23-39. (Peer Reviewed International Journal)
 3. Ritu Mohan. "Three British Film-Adaptations of Macbeth: A Comparative Study." *Language Forum*. (ISSN: 0253-9071). Vol. 48, No. 1-2. Jan-Dec 2022. pp149-56. (Peer Reviewed International Journal)
 4. Ritu Mohan. "Depiction of Gender-based Abuse in *Lap Players* and *Wetlands*: An Analysis." *International Journal of Communication* (An International Journal of Literary Studies). (ISSN: 0975-640X). Vol. 32, No. 1-2. Jan-Dec 2022. pp72-79. (Peer Reviewed International Journal)




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R.P.S. College of Engg. & T. n
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Resource Person / Invited Lecture



**CHANAKYA
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(Ministry of Education, Govt. of India)



**CENTRE FOR
HUMAN SCIENCES**

Two-Day Training Workshop

“Translation and Culture”

This is to certify that

✓
Dr./Prof./Mr. Ms. *Ritu Mohan*

of *R.P.S.C.E.T. Mahendergarh*

has attended as ~~Participant~~ ✓ **Resource Person/Paper Presenter** in the two-day training workshop on “**Translation & Culture**” on 21st & 22nd of January 2023, sponsored by Bharatiya Bhasha Samiti, jointly organised by Chanakya University, Bengaluru & Centre for Human Sciences, Rishihood University, Sonipat.

Dr. Chandan Shrivastava

Dr. Chandan Shrivastava
Academic Coordinator
Bharatiya Bhasha Samiti,
Ministry of Education, Govt.



M. S. Chaitra

Prof. M.S. Chaitra
Program Coordinator &
Associate Professor,
Chanakya University

Ujjwala
Principal
R.P.S. College of Engg. & Tech.
Balana Mohindergarh (HR)

Prof. Sampadananda Mishra
Director, Centre for Human Sciences,
Rishihood University, Sonipat

[Signature]

Paper presentation



Certificate



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INSTITUTION OF EMINENCE

This is to certify that

Dr. Ritu Mohan

participated/presented a paper titled

"Global Aesthetics of Regional Haryanvi Saang (S) Based Folk Literature"

at the 3-day International Conference organized on "Globalizing South Asian 'Regional' Literature: Social and Cultural Perspectives" during 14th -16th September, 2022 at the Centre for Comparative Literature, University of Hyderabad, Telangana, India.

Dr. J. BHEEMAIAH
Professor

Centre for Comparative Literature
School of Humanities
University of Hyderabad
Campus, 500 045, T.S.

Conference Coordinator



Kuyyada
Principal

R.P.S. College of Engg. & Tech
Balana Mohindergarh (HR.)

Head, Centre for Comparative Literature

Sany

Paper presentation


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District-Bilaspur (H.P.) 174033, India

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Dr. Jaswant S. Saini
Associate Professor
Organising Secretary




Sh. Rajesh Kumar
Associate Professor
Convener


Principal
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Balana Mahendergarh (H.P.)

Sh. Sudama Ram
Principal-cum-Patron
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Dr. Jaswant S. Saini
Associate Professor
Organising Secretary

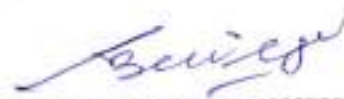



Sh. Rajesh Kumar
Associate Professor
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Certificate of Participation

THIS IS TO CERTIFY THAT

Ravi Kumar

has participated and presented with a paper entitled
**Genetic Algorithm Based Load Shifting Technique for Demand Side
Management on Distribution System**

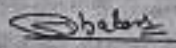
Co-author by : **Dr. Anil Kumar**


At the International Conference on Sustainable Energy and Clean Technologies (ICSECT-22) on
2-4 September, 2022, jointly organized by Department of Chemical & Electrical Engineering, School of
Technology,

Pandit Deendayal Energy University, Gandhinagar, Gujarat, India


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Convener


Dr. Vima Mali
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