



## RESEARCH PAPER PUBLICATIONS IN 2020-21

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**Prof. Dr. Benny Joseph**  
**(PRINCIPAL)**





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# Smart Stick for Blinds with advanced Face Recognition and Vehicle Detection using Machine Learning

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**Abstract:** Some infrastructure can be provided for the blind people so that they can feel safe while travelling. A smart stick can be proposed as an additional aid for the blind to improve mobility. The stick helps to sense obstacles and provide assistance to return to home safely. The stick helps to detect the vehicle coming towards the user by means of strong sensors employed in it. This enables the blinds user to cross roads without assistance. The Assistor works based on the technology of object recognition, image processing and human recognition and a navigation system. This model implements a camera on the hand of the stick. It captures the images of person approaching the user. Using convolutional neural network algorithm(CNN), the stick recognize the image and it returns the identity of that person. Ultrasonic sensors are used for obstacle detection. Three of them together helps to detect the vehicles passing by. Atmega328 microcontroller controls the activities taking place in the system. Feedback is given to the user through an audio earpiece using Bluetooth technology. The system employs GPS module for location tracking and navigation. GSM module installed in the stick sends emergency messages to the stored mobile numbers (Usually the numbers of people closer to the user) along with his current location.

**Index Terms:** GPS, GSM, CNN, image recognition, vehicle de- tecton, ultrasonic sensors, bluetooth module, emergency button.



2(2020-21)

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## Effect of Nano B<sub>4</sub>C on the Tribological Behaviour of Magnesium Alloy Prepared Through Powder Metallurgy

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In this present study, the particle size of as received magnesium alloy (AZ91) and B<sub>4</sub>C powders was reduced through high energy ball mills. The combination of AZ91 (both 10 μm and 60 μm) reinforced with nano B<sub>4</sub>C particles were fabricated by powder metallurgy technique. The incorporation of nano B<sub>4</sub>C particles to the Mg matrix was done at various weight % such as 5, 10, 15 and 20. The AZ91 composites were fabricated in a suitable die set assembly and the green compacts were sintered in an electric muffle furnace at 500 °C with argon atmosphere for a dwell time of 1 h. The density of the composites was estimated using Archimedes principle. Micro hardness test was carried out for the prepared specimens and dry sliding wear test was conducted by using pin-on-disc apparatus at room temperature with varying loads and sliding velocities by keeping a constant Sliding Distance (SD). Among the various specimens, the composite with 10 μm size attained a higher Vickers hardness value as well as better wear resistant property. Worn surface analysis of the prepared composites was studied using Scanning Electron Microscope (SEM).

**Keywords:** AZ91, B<sub>4</sub>C, coefficient of friction, sliding wear, hardness.

### 1. INTRODUCTION

There is much attention in scientific research because of the increase in demand on lightweight materials for aerospace and automotive applications. Metal matrix composites are used as effective reinforcements to enhance the mechanical properties and also reduction in fuel consumption [1,2]. Many researchers found that magnesium alloys process good strengthening affects and are used in aerospace applications due to its low density. Magnesium composites result in better wear resistance and lower Coefficient of Friction (CoF) [3]. Recent works focused on AZ91 magnesium alloy, which has good mechanical properties, Specific Wear Rate (SWR) and hardness [4]. Powder metallurgy method utilizes reduced manufacturing temperature and gains uniform reinforcement distribution. So, metal matrix composites (MMC's) were prepared by this method which favours nucleation at the reinforcement-matrix interface [5].

Magnesium alone has reduced lifetime, poor corrosion resistance and wear property but it's lightweight and low density makes the material demand and applicable for automobile and aerospace.

It can be reinforced with matrix composites like aluminium, boron carbide, silicon carbide, titanium carbide, etc. [6]. Also, the mechanical properties of pure

magnesium and its alloys were improved by high strength and high modulus materials like titanium, zinc, copper and nickel etc., Researchers found compressive responses when Mg is incorporated with ZnO<sub>2</sub> and Cu led to enhanced hardness, compressive and tensile strength [7, 8]. Also, silicon carbide reinforced Mg composites processed by powder metallurgy technique enhances the compressive behaviour with reduced grain size and uniform reinforcement distribution [9]. The microstructures of Mg sample changes with average grain size and weight percentage of the reinforcements added [10]. The reinforcement of nanoparticles to the magnesium composites exhibits superior mechanical properties such as hardness, corrosion resistance and tribological behaviour [11].

In this research, AZ91 magnesium alloy is reinforced with Boron carbide in different weight percent to reduce the wear rate and CoF. B<sub>4</sub>C is a one of the carbide particles, which is used to increase the strength and tribological properties [12]. Specially, the interfacial microstructure was focused on many studies such as aluminium composites reinforced with boron carbide, which results in high strength, low density, high hardness and Young's modulus [13]. Ball milling was carried out for homogeneous mixing of nano B<sub>4</sub>C particles with AZ91 alloy for 1h before taken to compaction. The AZ91 alloy reinforced with B<sub>4</sub>C particles were prepared through powder metallurgy method [14]. The compacted specimen

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## Tensile and compression behaviour, microstructural characterization on Mg-3Zn-3Sn-0.7Mn alloy reinforced with SiCp prepared through powder metallurgy method

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**Keywords:** Mg-3Zn-3Sn-0.7Mn, silicon carbide, hardness, strength, SEM, powder metallurgy

### Abstract

In this research paper, Mg-3Zn-3Sn-0.7Mn/SiC composite is developed by reinforcing various weight fractions of SiC<sub>p</sub> in Mg-3Zn-3Sn-0.7Mn alloy through powder metallurgy route. The weight fraction of SiC<sub>p</sub> usage is varied from 3% to 15% in Mg-3Zn-3Sn-0.7Mn alloy (i.e., in Mg-3Zn-3Sn-0.7Mn/xSiC; the sample values are varies for x is 3, 6, 9, 12 and 15%). The effect of SiC<sub>p</sub> addition got tested against its tensile strength, compression behavior, hardness, microstructure, alloying nature and porosity. This study shows better grain refinement with improved properties while reinforcing Mg-3Zn-3Sn-0.7Mn alloy with 6 wt% SiC composites. It was observed that the grain refinement occurred while adding up to 6 wt% of SiC particles in the composite and thereafter increase in SiC caused little grain refinement effect. Hardness is getting increased with the increase of SiC weight fraction and reached maximum to 133 HV at 12SiC/ Mg-3Zn-3Sn-0.7Mn. Higher UTS of 293 MPa obtained from the sample prepared with 12%SiC for 0.0533 s<sup>-1</sup> strain rate. The highest UCS of 341 MPa is obtained from the sample made with 15%SiC inclusion for 0.0533 s<sup>-1</sup> strain rate. From the SEM fracture analysis, the Mg-3Zn-3Sn-0.7Mn alloy and Mg-3Zn-3Sn-0.7Mn/SiC composite exhibit the almost same type of fracture called quasi-cleavage regardless of the % addition of SiC reinforcement. It was observed that the increase of SiC weight fraction increases the UCS because of its increased load-bearing capacity and reduction in cleavage facets.

### 1. Introduction

Magnesium (Mg) alloys and composites have various applications in an automobile field and in making of human implants because of its high strength to weight ratio and biocompatibility of magnesium [1, 2]. The success of these applications depends on the superior mechanical and physical properties shown from the studies carried out by many researchers; it is evident that the addition of Zn, Sn and Mn is come to improve the mechanical properties of magnesium alloy. Reinforcing of SiC<sub>p</sub> also drastically influence the mechanical properties. Some researches were extended with various magnesium alloys with composite nature developed through different processing [3–12]. The Mg-1.0Mn alloy by casting followed by hot extrusion obtained superior mechanical properties [13]. The high strength TAZ1031 Mg alloy at a ram speed of 0.1 mm/s and an extrusion temperature of 250 °C the same values were used for this study too [14]. The addition of Sn to the Mg-6Zn-1Mn alloy improved mechanical properties [15]. The effect of SiC particle reinforcement in AZ91 alloy and attained improved tensile and yield strength in AZ91/3SiC composite. SiCp reinforced in AZ31B alloy improves the mechanical properties and refined the grain size of AZ31B/SiCp composite [16, 17]. Taguchi based grey analysis



4(2020-21)



## Dry Sliding Friction of Al-Si-B<sub>4</sub>C Composites Prepared Through Powder Metallurgy using Taguchi Design



Abraham Subaraj. M, Bensam Raj. J, Naveenchandran. P, Christopher Ezhil Singh. S, G.Glan Devadhas

**Abstract:** This research paper discuss about the friction behavior of Al-12Si-xB<sub>4</sub>C composites prepared through powder metallurgy method by varying the weight percentage of reinforcement (x = 2, 4, 6, 8, and 10) content. The samples were prepared by using die and punch assembly and the lubricant used to eject the sample from the die was molybdenum disulfide. The compaction was done by using compression testing machine by applying a pressure of 800MPa. The dry sliding friction behavior of the sample was conducted on Pin-on-Disc machine and the experimental values of friction were calibrated. Taguchi design experiment was done by applying L25 orthogonal array for 3 factors at 5 levels for the response parameter coefficient of friction. Analysis of Variance demonstrated by Mean and S/N ratio table for coefficient of friction was discussed and from the table it can be seen that the reinforcement plays a main role, when the compared with load and sliding distance. The normal probability plot shows that the residuals falls near to the red line, it indicate that the error values were less in the model.

**Keywords:** Al-Si-B<sub>4</sub>C, ANOVA, P/M, Taguchi design, CoF.

### I. INTRODUCTION

Aluminium based composites is commonly utilized in manufacturing to variety appropriates variations to improve the tribological in addition to mechanical properties. Al based composites is strengthened to afford extra strength to metal [1]. The light weight metal Al alloy is strengthened by some of carbide or oxide materials. Among Al alloy is the best utilized matrix metal for the planning of light weight commercial products [2]. The CoF have been conceded out in this effort. Taguchi technique is utilized for optimization of factors and ANOVA is conceded out [4]. The friction

behaviour on Al based composites utilizing Taguchi technique with load, reinforcement, sliding distance as input and output as CoF. ANOVA demonstrates the significant factors for controlling the friction. This research work the friction behavior of Al-12Si-xB<sub>4</sub>C composites prepared through powder metallurgy method by varying the weight percentage of reinforcement (x = 2, 4, 6, 8, and 10) content. Taguchi design experiment was done by applying L25 orthogonal array for 3 factors at 5 levels for the response parameter coefficient of friction. Analysis of Variance demonstrated by Mean and S/N ratio table for coefficient of friction was discussed and from the table it can be seen that the reinforcement plays a main role, when the compared with load and sliding distance. The normal probability plot shows that the residuals falls near to the red line, it indicate that the error values were less in the model.

### II. EXPERIMENTAL PROCEDURE

The aluminium and silicon powder was purchased from metal powder company, Thirumagalum, Madurai, Tamilnadu, India. The particle sizes of the two powders were 40µm with purity 99.5%. The powders were mixed in high energy ball mill for 30min for homogenous mixing. The mixed powder were compacted in die and punch assembly with a pressure of 800MPa in compression testing machine. The samples with 10mm diameter and 30mm height were used for the dry sliding friction and wear on pin-on-disc machine.

### III. TAGUCHI DESIGN

The influence of input parameters on the friction parameters was deliberate utilizing the Taguchi's method. Next leading the trial test, it was obvious to select the levels of experiments. For the current circumstance, process parameters deliberated are reinforcement, load, and SD changing at 5 levels. Friction trials were showed in agreement to say trial plan and response was measured as specified in Table 1. The input parameters such as reinforcement (A), load (B) and SD (C) at 5 levels were deliberated for this current work. With the design plan of L25 orthogonal array, the trial levels were obvious and revealed in Table 2.

Table 1 trials and levels

Factors	Levels				
	1	2	3	4	5
wt.% B <sub>4</sub> C	2	4	6	8	10

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5(2020-21)

## Analysis of Sneak Path Issues in Memristor Based 4x4 And 8x8 Crossbar Nonvolatile Random Access Memory Array

Dr. V. Saminathan, Dr. V. Sampathkumar, Dr. P. Sridharan

PDF

### Abstract

Numerous memory vendors are pursuing different categories of memory cells that can deal with more density, nonvolatility, extreme performance and long endurance. There are a number of on-going determinations to architect main memory systems with these novel NVRAMs that can contest with traditional DRAM and SRAM systems. Every NVRAM has individualities that entail novel micro architectures and procedures for memory access. Resistive memories have commonly been premeditated as substitutes for level two and secondary level caches because of their low leakage energies. In this paper, we examine a memristor-CMOS based nonvolatile random access 4x4 and 8x8 memory array and also investigate the sneak path problem. It can be evaluated by introducing three types of array structure such as grounded array, floating array and gated array structure. Furthermore, the sneak current, noise margin and power consumption of the proposed array structures related to these solutions can be evaluated during different memory operations.

Issue

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Section

Articles



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# INTERCIENCIA

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## ARCHIVE

Title	PREDICTION OF PERFORMANCE EMISSION CHARACTERISTICS OF DI ENGINE WITH BIOFUEL USING ARTIFICIAL NEURAL NETWORKS
Paper ID	hSPzt
Keywords	ANN, Alternate Fuel, BTE, Radial Basis Function Network, Treated Bio gas.
	<p><a href="#">Read More...</a></p> <div style="border: 1px solid black; padding: 10px;"> <p>Energy is one of the most significant products to power the global economy as stated by the World Trade Organization (WTO). The world's population is expected to upsurge from 7.1 billion in 2013 to 9 billion in 2040, with the growth-focused in Africa, India, Southeast Asia, and the Middle East. The massive growth of world population, advanced technical developments, and a higher standard of living in the industrially developed nations has led to a complicated situation in the field of energy supply and demand. The Scenario of New Policies include platforms to backing non-conventional</p> </div>







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MATERIAL SCIENCE AND NANOTECHNOLOGY

## Optimization on friction and wear behaviour of Al-Si alloy reinforced with B<sub>4</sub>C particles by Powder Metallurgy using Taguchi design

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**Abstract.** This research paper discusses the friction and wear behaviour of Al-12Si alloy reinforced with B<sub>4</sub>C prepared through Powder Metallurgy (P/M) method by varying the weight percentage of reinforcement ( $x = 2, 4, 6, 8,$  and  $10$ ) content. The samples were prepared by using die and punch assembly and the lubricant used to eject the sample from the die was molybdenum disulfide. The compaction was done by using a compression testing machine by applying a pressure of 800 MPa. The dry sliding friction and wear behaviour of the sample was conducted on a Pin-on-Disc machine and the experimental values of friction and wear were calibrated. The Taguchi design experiment was done by applying an L25 orthogonal array for 3 factors at 5 levels for the response parameter Coefficient of Friction (CoF) and wear loss. The SEM images show the shape, size and EDX confirm the existence of Al, Si, B<sub>4</sub>C particles in the composites. Analysis of Variance (ANOVA) for CoF of S/N ratio, shows that the reinforcement having 34.92% influence towards the S/N ratio of CoF, ANOVA for wear loss of S/N ratio shows that the sliding distance having 46.76% influence towards the S/N ratio of wear loss, when compared to that of the other two input parameters. The interaction line plot and the 2D surface plot for CoF and wear loss show that the increase in B<sub>4</sub>C content decreases the wear loss and CoF. The worn surface shows that the B<sub>4</sub>C addition will increase the wear resistance.

**Key words:** Al-Si, B<sub>4</sub>C, ANOVA, Taguchi design, CoF and wear loss.

### 1. INTRODUCTION

Aluminium based composites are commonly utilized in manufacturing to change variations in the improvement of the tribological in addition to mechanical properties. The Al based composites are strengthened to afford extra strength to metal [1–3]. The lightweight metal Al alloy is strengthened by some of the carbide or oxide materials. Among Al alloy is the best utilized matrix metal for the planning of light weight commercial products [4–5]. Optimization of process parameters analysed by performing the milling machining of hardened steel by varying each parameter for L16 orthogonal array and output Parameter as surface finish. The result shows that radial cutting depth and the interaction between the radial and axial depth of cut are the most relevant parameters [6–7]. The face milling operation on Al6061 material according to Taguchi Orthogonal Array (OA) and Artificial Neural Network (ANN) model for various combinations of control parameter, concluded that both the experimental approaches got almost the

same for surface roughness value [8–10]. The effect of cutting parameters on machine tool vibration and surface roughness was carried out in high precision CNC milling machines. Comparing the ANOVA results for full factorial and Taguchi design of experiments techniques it was found that Taguchi design of experiments is better and reliable to obtain optimal number of experiments [11–13]. Optimization of cutting process parameters increases the efficiency and improves the quality of the component [14]. The second order equation developed, and it has shown good correlation between the predicted and experimental values [15]. The Taguchi method has been successfully employed for optimizing the process parameter of milling of mild steel; it provides a systematic and efficient methodology for optimal milling parameters [16]. The CoF have been conceded out in this effort. Taguchi technique is utilized for optimization of factors and ANOVA is conceded out [17]. The friction behaviour on Al based composites utilizing Taguchi technique with load, reinforcement, sliding distance as input and output as CoF. ANOVA demonstrates the significant factors for controlling the friction.

In this research work, we discuss the Taguchi technique on dry sliding wear and friction behaviour of Al-12Si alloy reinforced with B<sub>4</sub>C particles prepared through P/M method by varying the weight percentage of reinforcement ( $x = 2, 4, 6, 8,$

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# EARLY DETECTION AND CLASSIFICATION OF BREAST TUMOR FROM MAMMOGRAM IMAGES

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**ABSTRACT** – A low dose X-ray technique of the breast known as mammography is popular due to its advantages over other imaging techniques. Even though only 2 percentage chance of being malignant radiologist usually recommend for a biopsy test. The unwanted biopsy test not only increase the anxiety among patient but also enhance the health care cost. The existing CAD system may misinterpret the suspicious lesion as false positive or false negative. To avoid such misinterpretation it is necessary to improve the existing CAD system such that it will accurately **predict** the suspicious lesion. This paper presents a novel approach which compares several hybrid image processing techniques to enhance the accuracy. Hybrid technique is defined as the technique which combine two or more techniques together. The accuracy of the proposed system is obtained as 95 percentages.

**Key words-** CAD; Mammogram; Median filter; Preprocessing; FCM; PSO; GLCM; Genetic Algorithm

## I. INTRODUCTION

Breast Tumor is considered as a main cause of mortality in women. According to national cancer institute,



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## [A tumour segmentation approach from FLAIR MRI brain images using SVM and genetic algorithm](#)

by S.U. Aswathy; G. Glan Devadhas; S.S. Kumar

*International Journal of Biomedical Engineering and Technology (IJBT), Vol. 33, No. 4, 2020*

**Abstract:** This paper puts forth a framework of a medical image analysis system for brain tumour segmentation. Image segmentation helps to segregate objects right from the background, thus proving to be a powerful tool in medical image processing. This paper presents an improved segmentation algorithm rooted in support vector machine and genetic algorithm. SVM is the basis technique used for segmentation and classification of medical images. The MRI database used consists of FLAIR images. The proposed system consists of two stages. The first stage performs preprocessing the MRI image, followed by block division. The second stage includes - feature extraction, feature selection and finally, the SVM-based training and testing. The feature extraction is done by first order histogram and co-occurrence matrix and GA using KNN is used to select subset features. The performance of the proposed system is evaluated in terms of specificity, sensitivity, accuracy, time elapsed and figure of merit.

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RESEARCH ARTICLE

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# Detection and classification of breast cancer from digital mammograms using hybrid extreme learning machine classifier

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## Abstract

Breast imaging technique called mammography has gained bigger attention among the researchers for the diagnosis of breast malignancy in the woman. Mammogram screening is the most effective procedure to visualize various potential problems in the breast. The two most common features connected with breast tumors are mass lesions and microcalcification. The collection of suitable image preprocessing, segmentation, feature extraction, selection and prediction algorithms play an essential role in the accurate detection and classification of cancer on mammograms. Classification techniques estimate unlabeled datasets class labeling depending on its similarity to the pattern learned. The Glowworm Swarm Optimization(GSO) algorithm is ideal for finding several solutions, and dissimilar or equivalent objective function values at the same time. This feature of GSO is useful for optimizing the feature set obtained from multiscale feature extraction procedures. Poor performance in generalization is the issue that arises due to the unconditioned output matrix



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NAAC Cycle 2

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11(2020-21)

## Driver Exhaustion Detection Systems

6 Pages · Posted: 7 Apr 2020

[sharija ajeer](#)

Vimal Jyothi Engineering College

[Akhila Mathew](#)

Vimal Jyothi Engineering College

Date Written: March 12, 2020

### Abstract

Driver exhaustion throughout travel square measure comic main causes for expressive pathway mishap. Accordingly, exhaustion correspondent transportation mishap possess a better dumps furthermore beginning additional harm toward effective climate in comparison among collision wherever farcical automobilist square measure vigilant. A system which will facilitate to extend observance of the motorist and build him alert from fatigue state by supply timely warning may facilitate to forestall several collision, as well as therefore emancipate coinage as well as scale back secluded misfortune. During this paper, various method to notice





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## Approaching Bus Driver Collapse Exposure Entity Situating upon Rumbustious Observable Inquiry as Concerns Eye Eventuality

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**Abstract:** Drivers exhaustion is one in ensemble effective ultimate considerable causation away from service collision, decidedly considering operator based on immense transport. Recommend a perceiving situated exhaustion exposure entity considering indigene monitoring, whatever endure straightforward including versatile considering organization trendy integrate including enormous automobile. Effective entity repose based on section containing head-shoulder exposure, face exposure, eye pair exposure, eye observance appraisal, indolence frequency percent based on eyelift desistance appraisal, mouth exposure, as a consequence exhaustion level apportionment. A study measure of Eye Closure's Percentage on effective continual surface of eye observance endure specify, and therefore the operator states are classified on that. In venture, complete evaluations moreover investigation connected with contemplated algorithms, similarly as measuring with ground truth on Eye Closure's Percentage computation endure achieve. Impressive experimental repercussion show effective benefits of the entity on accuracy along with stableness as long as expressive investigate latitude immediately upon a camera of an sloping observe angle to





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# Kidney Transplantation System for Matching and Donor Recipient Verification using BlockChain

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**Abstract:** Kidney failure or end-stage renal disease (ESRD) is the last stage of chronic kidney disease. Kidney transplantation is the only one solution for this problem. Individuals suffering from kidney failure today face significant challenges in order to obtain a Donor. The use of Blockchain promises to provide an avenue of decentralized system for kidney transplantation. In kidney transplantation, time is a critical factor so by using the Kidney transplantation system with BlockChain can give a transparent and time effective Kidney match. Originally devised for the digital currency, Bitcoin, but there are other potential uses for the technology such as security and transparency. Hence we propose a system using Blockchain that can verify and validate which matches a potential donor and recipient. Our system is based on Blockchain that can match a recipient with a potential donor. Various parameters are evaluated and a suitable match for the recipient is found. The involvement of third parties will not be there in the transplantation procedure. The patient gets the kidney in a time effective manner. And we have more reliable and secure procedures for kidney matching. The willing donor can easily register in the system and make transparent transplantation.

**Keywords:** Kidney; Transplantation; BlockChain; Donor; Recipient; Doctor;



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## SCRIPT IDENTIFICATION: A REVIEW

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**Abstract:** In a multilingual, robust learning environment, identifying a script in the field is very important. Textual identification is an important task, especially in India, where there are 13 different texts for 22 languages. Text filtering, automatic translation, OCR (Optical Character Recognition) and text location identification are the main applications for script identification. In recent years, with the widespread use of the Internet and automated text processing around the world, scripting techniques have become increasingly important in the field of pattern recognition. Script Identification refers to techniques for distinguishing different texts into multilingual and graphic texts.

### I.INTRODUCTION

Every human core of the population has a collection of languages which belong to that country and are considered to be its inherent characteristic. The root of human languages has been the topic of intellectual discussion for many decades. Even after so much study, there was no agreement on definite origin. Similarly, no agreement was reached at the age of the human language. This problem is made more complex by the fact that there is a deficit in direct undeviating facts. As a result, researchers seeking to discover and investigate the origin and genesis of languages must draw inferences from other forms of data and information such as archaeological evidence, language learning hypotheses, fossil records, current linguistic diversity, and by similarities and analogies between the human communication system and the communication systems used by animals. For communication of messages in a language, a writing method is popularly defined as a systematic, structured, and routine process for storing and transmitting text. This is achieved by using a series of symbols widely referred to

as characters, for visual encoding (writing) and decoding (reading). Collectively, the list of these characters is referred to a script. Collections of these characters typically contain numbers and letters. The attributes of writing systems can be broadly categorized into:

1. Alphabets: includes a standard set of letters consisting of vowels and consonants which encode, on the basis of the general law, that the letters reflect simple, significant sounds which are the phonemes of the spoken language.
2. Syllabaries: Generally, the syllabaries here correlate a syllable to a sign (these are usually a pair or group of phonemes and these are used as units for building words).
3. Logography: Here the character represents each unit of sentences, phrase or morpheme. They can be in groups or two groups of characters.

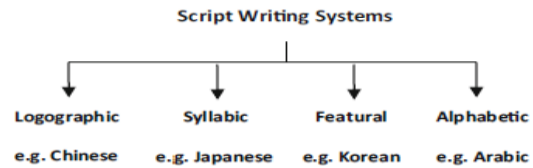


Fig. 1 Common script writing systems

Script Identification is intended to predict the script of a given text, which has a very important role in multilingual programming. Under several areas, it is necessary to determine which language model should be used for further identification or textual recognition. Pre-paper work, handwriting and video overlay, in which texts have a clear layout and clear context, have achieved great efficiency. But in the case of identifying Scene Text Script, which extends the application to many fields such as image Comprehension, other problems arise, such as complex content, different text types and different sounds, and so on. Our work focuses







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## IDENTIFICATION OF PLANT DISEASE: A REVIEW

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**Abstract—** Agriculture has become something quite just a way of feeding ever-increasing populations. It's necessary to believe agriculture wherever there's a further 70th population of an Asian country. meaning it feeds an honest sort of people. Less crop quality thanks to disease is taken into account to be the foremost necessary. By the identification of disease we can avoid loss of production. Disease detection is that the step of inputting a picture preprocessing, segmenting, feature extracting and classify the images. The images of the leaves are given to identify plant diseases. It's also useful to classify illnesses of plants for farmers.

the process steps of pictures followed by Unit 3, a literature survey is given. In fourth section, table offers fast details on the strategies and techniques of varied articles by each writers and ends with section five, paper offers conclusions.

### I. INTRODUCTION

In the world, invariably been within the field of agriculture. The number of damaged plants is increased very fast. If the leaf of the plant is plagued by the unwellness, it'll cause a decline in crop production. If the detection and classification of leaf disease as early as possible is vital for farmers. Leaves of the plant are accustomed acknowledge and classify the leaf disease by early detection victimisation the image process system. Some diseases that have the potential to have an effect on plants will cause overwhelming money, social and ecological losses. Digital image process early detection of unwellness is extremely vital in accuracy.

In the field of agriculture, watching the well-being and illness of crops is very imperative for the roaring production of crops within the cultivation sector. This wants glorious time interval and employment package. The image handling technique are often used at the location of leaf disease. within the field of agriculture, watching the well-being and illness of crops is very imperative for the roaring production of crops within the cultivation sector. This wants glorious time interval and employment package. The image handling technique are often used at the location of leaf disease. image preprocessing will update the standard of the image. Image process analytics will manufacture fantastic results. It integrates shift of color area, improvement of pictures, and segmentation of pictures. The infection facet effects on the leaves, stem, and fruits will largely be seen. associate sign of infection could seem on the leaf of the plant. Image process is that the improvement of the image that an image manages to form some uses. After taking a picture involves sharp a picture from the center, light edges, differentiating image progression, or brightening a picture, evacuating noise. The preparation of the image has the potential to tell apart a number of varieties of leaf diseases, like to detect the sides of the unhealthy leaf and stem (ii) to search out the shape of the diseased space (iii) to make a decision the colour of the diseased space (iv) to differentiate the image parts (v) to section the picture.

This will facilitate farmers assess and create early choices concerning the kind of unwellness. This analysis addresses many varieties of image process techniques for the identification of diseases within the plant. Unit one provides associate degree introduction to the identification of plant disease. Unit 2 describes





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# Machine Learning and Internet of Things based Fruit Quality Monitoring System: A Proof of Concept Implementation and Analysis

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**Abstract:** Food safety is imperative to avoid food borne diseases and to ensure the public health. Monitoring of perishable food products and early detection of degradation will avoid loss due to food wastage and ensures the freshness of food. In this scenario, remote monitoring of fruits during transportation from field to shelf can ensure the quality of fruit. Recent technological advancements like Internet of Things and Machine Learning (ML) has significant methodologies which can improve the fruit quality monitory process's cost and time efficiency. This paper describes the concepts, architecture, proof of concept implementation and results analysis of such a Fruit Quality Monitoring System (FQMS).

**Keywords:** Fruit quality, Bioinformatics, Internet of Things, Machine Learning, Deep Learning

## I. INTRODUCTION

Food is the main energy source for the living being, intrinsically food quality and safety has been within the highest demand throughout the human history. The standard of food must be monitored, and it must be prevented from rotting and decaying because of atmospheric factors like temperature, humidity, and darkness. Therefore, it is necessary to put quality monitoring devices at food



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## Automatic Form Filler

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**Abstract:** In the present world, the elderly and illiterate people find it difficult to fill a deposit or withdrawal form in a bank. They often require the help of literate people to fill the form. To solve this problem, we introduce an automatic for filler that would take the customer speech in Malayalam as input and produces the required form. The system is implemented using python modules that involves text-to-speech conversion, language translation, speech-to-text conversion, pdf generation, etc. The system uses googletrans module for translating Malayalam to English and vice-versa. It also uses gTTS module for text-to-speech conversion. The system uses speech-recognition module for converting speech to text format and reportlab module for producing the required form in PDF format. The input speech is converted to text using Speech-recognition module and the generated text is then used for language translation by googletrans module. The questions to be asked is converted from text to speech gTTS module. The system takes both account number and amount from the customer and generate the form with correct entries in PDF format. The generated form is sent to the counter for further processes.

**Keyword:** Speech recognition, Speech-to-Text, Text-to-Speech, Translation, Malayalam.





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### Weight optimized neural network for heart disease prediction using hybrid lion plus particle swarm algorithm

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#### ARTICLE INFO

##### Keywords:

Heart disease  
Feature extraction  
Neural network  
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#### ABSTRACT

Heart disease remains one of the significant causes of mortality and morbidity amongst the world's population. Predicting heart disease is considered as one of the vital issues in clinical data analysis. Since the number of data is rising gradually, it is much complicated for analyzing and processing, and especially, it becomes difficult to maintain the e-healthcare data. Moreover, the prediction model under machine learning seems to be an essential facet in this research area. In this scenario, this paper aims to propose a new heart disease prediction model with the inclusion of specific processes like Feature Extraction, Record, Attribute minimization, and Classification. Initially, both statistical and higher-order statistical features are extracted under feature extraction. Subsequently, the record and attribute minimization carried out, where Component Analysis PCA plays its major role in solving the "curse of dimensionality." Finally, the prediction process takes place by the Neural Network (NN) model that intake the dimensionally reduced features. Moreover, the major intention of this paper deals with the accurate prediction. Hence, it is planned to influence the utility of meta-heuristic algorithms for the weight optimization of NN. This paper introduces a new hybrid algorithm termed Particle Swarm Optimization (PSO) merged LA update (PM-LU) algorithm that solves the above-mentioned optimization crisis, which hybrids the concept of Lion Algorithm (LA) and PSO algorithm. Finally, the efficiency of proposed work is compared over other conventional approaches and its superiority is proven with respect to certain performance measures. From the analysis, the presented PM-LU-NN scheme with regards to accuracy is 3.85%, 12.5%, 12.5%, 3.85%, and 7.41% better than LM-NN, WOA-NN, FF-NN, PSO-NN and LA-NN algorithms.

#### 1. Introduction

Disease prediction systems have been playing a significant role in the life of people, and it has been considered as an important topic, as a prediction of the diseases is essential for people to lead a well-settled life [1-3]. Disease prediction [4-6] thus remains much important for health care groups for arranging better medical care for patients. The recent development of data mining techniques has caused numerous disease

LR, NN approaches, and it also deploys more clustering techniques [14,15,40,44] for effective prediction.

Heart failure, also known as congestive heart malfunction, it happens when the heart could not be able to pump sufficient blood to meet with the needs of the body [16]. The threat factors for heart disease comprises heart attack, high blood pressure, obesity, a smoking, alcohol addict, vitamin deficit, heavy metal toxicity, sleep apnea, being inactive, and an improper diet (together with salt and animal fats) [17,18,47]. Therefore, the medical specialists recognize the damages that had occurred in a patient's heart and test out how well the blood is pumped in the heart of





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## *Bitcoin: An Overview of the Innovative Decentralised Digital Currency*

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### *Abstract*

*The Internet has become so popular that most of the activities like communication, exchange of messages and commercial and non-commercial*





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## Frame-Angle Controlled Wavelet Modulated Inverter and Self-Recurrent Wavelet Neural Network-Based Maximum Power Point Tracking for Wind Energy Conversion System

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**ABSTRACT** In this work, a new control methodology is proposed for Type -IV wind energy conversion system (WECS) using a self-recurrent wavelet neural network (SRWNN) control with a Vienna rectifier as the machine side converter (MSC). A SRWNN combines excellent dynamic properties of recurrent neural networks and the fast convergence speed of wavelet neural network. Hidden neurons of SRWNN contains local self-feedback loops, which provide the memory feature and the necessary information of past values of the signals, allowing it to track maximum power from WECS under varying wind speeds. The Vienna rectifier allows unity power factor operation to increase electrical efficiency. Frame angle-controlled wavelet modulation is proposed for the grid side converter (GSC). Wavelet modulated inverter produces output voltage fundamental components with higher magnitudes than those obtained from the pulse width modulated inverters. The non-linear load compensation and power quality enhancement are achieved by



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## MODELING AND CONFIGURATIONS OF AN ELECTRIC VEHICLE

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### ABSTRACT

*The vehicle modelling and configurations of an EV power-train is analyzed here. Electric Vehicle means, the propulsion power is solely produced by electrical means. Electric Vehicle are enjoying more widespread customer acceptance as personal vehicle because of their performance and economy in running cost. All electric vehicles use a battery pack to store electrical energy that powers the motor. Electric Vehicles are also known as battery electric vehicle. The charging of the battery of an EV can be done by plugging it. Since there is no tail pipe emission, EV's are considered as the zero emissions vehicles. The modeling of a vehicle and various configurations of EV based on the power train and power source is presented here.*

**Key words:** EV-Electric Vehicle, HEV-Hybrid Electric Vehicle, BLDC-Brushless DC, LMV-Light Motor Vehicle, FG- Fixed Gear, D- Differentials, EM – Electrical





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## A Bibliometric Review of Stock Market Prediction: Perspective of Emerging Markets

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**Abstract** – The objective of the paper is to identify predictive models in stock market prediction focusing on a scenario of the emerging markets. An exploratory analysis and conceptual modelling based on the extant literature during 1933 to 2020 have been used in the study. The databases of Web of Science, Scopus, and JSTOR ensure the reliability of the literature. Bibliometrics and scientometric techniques have been applied to the retrieved articles to create a conceptual framework by mapping interlinks and limitations in past studies. Focus of research is hybrid models that integrate big data, social media, and real-time streaming data. Key finding is that actual phenomena affecting stock market sectors are diverse and, hence, limited in generalization. The future research must focus on models empirically validated within the emerging markets. Such an approach will offer an insight to analysts and researchers, policymakers or regulators.

**Keywords** – Bibliometrics, emerging markets, stock market prediction, systematic review.

### I. INTRODUCTION

Research in the field of stock market goes back to the early 1930s. Apart from concrete theories, most studies have contributed to merging and sub-diverging of academic disciplines and varied findings. The earliest real stock market recorded in human history was Amsterdam stock exchange in 1602. Securities or shares/stocks that are comprised of different companies or firms can be grouped and tracked under a common notion called a stock index. Before the turn of the 21st century, this very definition has paved the way to different notions with the rise of electronic financial markets [1]. It is human psychology that investors and other stakeholders in this market wish to get profit regardless of actual economics involved in the transaction environment. From the perspective of academic disciplines of Statistics and Finance, researchers started looking into how the stock market behaves or prices can be predicted [2]. Three key theories have been developed from the earliest studies: random walk hypothesis (RWH), efficient market hypothesis (EMH), and noisy market hypothesis. In the current study, some major contributions are as follows.

1. The research growth of stock market prediction models documented from 1933 to 2020 are extracted from Web of Science and Scopus.

2. The authors analyse the major factors, such as most productive and influential researchers, highly cited journals.
3. Detailed synthesis of top papers on the basis of the total citations received till date from both databases.
4. The visualization of the highly influential works and inter-referencing in this field are displayed using citation data.
5. In addition to bibliometric methods, theoretical implications are discussed from the influential papers on the practice of emerging markets to provide the areas for future studies.

Bibliometrics or scientometric analysis is the research field to analyse current trends in the literature of a specific research field and delivers procedures and impetus for future research. Earlier, [3] have provided precise explanation of a bibliometric study. Similarly, one study by [4] has given the motivation to work in this area. Rest of the paper is organised as follows. Section 2 provides a review of literature. Section 3 introduces the research methodology. The framework is proposed in Section 4. Finally, conclusions are drawn in Section 5.

### II. LITERATURE REVIEW

In the current study, two research questions are addressed. Research Question 1: Which are major predictive models for stock market prediction in emerging markets? This leads to the investigative question IQ1: Why is there a dearth of research in stock market forecasting models focused on sector/industrial categories in emerging markets? Research Question 2: What are emerging research themes of stock index forecasting in this scenario? The investigative question is IQ2: How can different theoretical frameworks of prediction models be validated in the Indian context?

In effort to answer these questions, a systematic but not exhaustive review is first carried out. Only scientific manuscripts are considered in the literature review. Any tertiary sources or industry reports etc. are not considered. Then Indian context works are compared on the basis of methodological variations, findings and contributions towards an overall research theme, and field of interest. Beginning with the theoretical perspectives, a random walk hypothesis (RWH) proposes that changes in stock prices have the same distribution

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## Comparison Method of PSO and DE Optimization for MPPT in PV Systems under Partial Shading Conditions

**Abstract** – Solar power is the conversion of energy from sunlight into electricity by using photovoltaic cell. The output power of the PV array decreases due to partial shading conditions such as clouds, trees, buildings, etc. There are a variety of traditional methods available for tracking maximum power point. But these all techniques perform well only in uniform irradiation conditions, however during partial shaded conditions; these are not capable to search the global maximum power point. Therefore, there is a proper optimization technique is essential for maximum power point tracking in PV system under partial shading condition. In this paper we will evaluate the performance of PSO and DE algorithms for maximum power point tracking in partially shaded condition with a PV panel connected to load via CUK converter is verified on MATLAB/Simulink environment. The simulation results shows that the two techniques defeat the partial shading problems extremely well with a maximum output power and the DE method has advantages compare to PSO method. From this comparison it is observed that faster convergence is achieved in DE algorithm when compared to PSO algorithm.

**Keywords** – differential evolution algorithm, maximum power point tracking, partial shading condition, particle swarm optimization, photovoltaic.

### 1. INTRODUCTION

The need for non-conventional and clean sources of energy is increasing throughout the world. With increasing popularity of solar systems, there is always an eminent need in making an efficient the PV system. The efficiency of the energy conversion in the solar energy system will be high only at certain voltage and current conditions at which the power will be maximum. Hence the operating point is called maximum power point. It is found non-linear for power-voltage curve of a PV panel and thereby it also depends sunlight irradiance and temperature of the atmosphere. The variation in voltage and power due to temperature is less significant when compared to sunlight irradiance [1]. Since the sunlight irradiance is not constant throughout the day, the power output of a PV panel will also not constant. Besides, the MPP will also shift with change in sunlight irradiance and atmospheric temperature [2]. MPPT technique is to be used for achieve maximum power under different temperature and irradiance [3].

Another major problem associated with solar power generation is handling partial shading condition (PSC) due to passing clouds. During partial shading conditions the sunlight irradiance will not be uniform over the entire panel [4]. In a photovoltaic system, for obtaining a required power rating the PV panels are arranged in series and parallel connections. Under partial shading condition, the PV panels are subjected to

non-uniform irradiance and in this situation the power-voltage characteristics exhibits multiple power peaks. The maximum of this power peak is called global power peak (GPP). The power output of a PV system under partial shading condition will be a maximum only when it is operated at GPP has been presented in [5]. Therefore, under partial shading condition the operating point should be maintained at GPP in order to take out maximum amount of power from partially shaded PV system [6]. In order to solve the stated problems is not practical; since they create the case of LMPP, hence partial shading algorithm is stated. Hence we use artificial intelligence method instead of traditional methods like perturb and observe, incremental conductance method etc. Thus from this work, we have simulated of PSO and DE (differential evolution) to determine the DC-DC converter switching process specially CUK converter [7].

### 2. PROPOSED SYSTEM

The block diagram of the partially shaded PV system selected for analysis of particle swarm optimization (PSO) technique is shown in Figure 1. The proposed PV system consists of four PV panels in series under shading condition, CUK boost converter, MPPT controller and load. In this project PSO and DE technique is used to determine the best PWM duty for the CUK converter to track MPP under PSC [8]. The PSO and DE algorithms are simulated using MATLAB / SIMULINK and the obtained results are presented in next section partially shaded condition (PSC) PV panel connected to load via CUK converter. PSO and DE algorithm is utilized to decide the optimum PWM duty for CUK boost converter to accomplish most extreme power from the PV panel under PSC. Searching the best

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## A Unified Tensor Framework for Clustering and Simultaneous Reconstruction of Incomplete Imaging Data

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Incomplete observations in the data are always troublesome to data clustering algorithms. In fact, most of the well-received techniques are not designed to encounter such imperative scenarios. Hence, clustering of images under incomplete samples is an inquisitive yet unaddressed area of research. Therefore, the aim of this article is to design a single-stage optimization procedure for clustering as well as simultaneous reconstruction of images without breaking the intrinsic spatial structure. The method employs the self-expressiveness property of submodules, and images are stacked as the lateral slices of a three-dimensional tensor. The proposed optimization method is designed to extract a sparse  $t$ -linear combination tensor with low multirank constraint, consisting of a unique set of linear coefficients in the form of mode-3 fibers and the spectral clustering is performed on these fibers. Simultaneously, the recovery of lost samples is accomplished by twisting the entire lateral slices of the data tensor and applying a low-rank approximation on each slice. The prominence of the proposed method lies in the simultaneous execution of data clustering and reconstruction of incomplete observations in a single step. Experimental results reveal the excellence of the proposed method over state-of-the-art clustering algorithms in the context of incomplete imaging data.

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CCS Concepts: • Computing methodologies → Optimization algorithms; Unsupervised learning; Cluster analysis; Reconstruction;

Additional Key Words and Phrases: Image clustering, subspace clustering, union of free submodules, low-rank approximation, image completion

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### 1 INTRODUCTION

In recent decades, there have been a massive volume of high-dimensional data generated from multiple sources all around the world. This high-dimensional data have actually originated from a wide variety sources such as images or videos from millions of cameras, surveillance systems, satellites,

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## A Two-Way Optimization Framework for Clustering of Images using Weighted Tensor Nuclear Norm Approximation

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**Abstract**—Clustering of multidimensional data has found applications in different fields. Among the existing methods, spectral clustering techniques have gained great attention due to its superior performance and low computational complexity. The clustering accuracy in spectral clustering methods depends on the affinity matrix learned from the data. Traditional clustering techniques fail to capture the spatial aspects of the images since they vectorize the images. In the proposed approach, the images are stacked as lateral slices of a three-way tensor. Further, a two-way optimization problem is formulated to extract a sparse t-linear combination tensor. Weighted Tensor Nuclear Norm (WTNN) is introduced in the optimization problem for enhancing tensor sparsity, and thereby improving the clustering accuracy. The performance of the proposed method is evaluated on three popular datasets. The evaluation shows that the proposed method has superior performance over the state-of-the-art methods.

**Index Terms**—Image Clustering, Low Rank Approximation, Subspace Clustering, Spectral Clustering

### I. INTRODUCTION

Aggregation of unorganised data has enormous applications in different domains such as engineering, medical science, market research and many more [1], [5]. Classification and clustering are the methods to characterize any object into groups. The term classification is used in the context of unsupervised learning technique where the class labels are already available [1]- [2]. The term clustering is used in the context of unsupervised learning where unlabelled datapoints are grouped based on the inherent similarity [1].

Clustering has attained remarkable attention in recent years due to massive data generation and to date, several clustering techniques has been proposed in various fields [7]. Clustering techniques can be broadly classified as Hierarchical Clustering, Partitioning Clustering, Mixture Resolve Clustering and Fuzzy Clustering techniques [2]. The main objective of a clustering problem is to obtain high accurate clustering with minimum execution time. All the conventional techniques mentioned above do not give satisfactory results when dealing with high dimensional data due to the curse of dimensionality [3]. As the number of dimension increases, the data becomes more sparse and the performance can be affected by the noise [7]. Hence, all the techniques need dimensionality reduction beforehand. But, most of the times dimensionality reduction techniques fail to give satisfactory results for high dimensional data [8]- [9]. Hence, subspace clustering is adopted for high dimensional data [5].

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Even if the data is high dimensional, they can be well represented in low dimensional space [6]. In practical scenario, the high dimensional data will be lying in multiple subspaces. The goal of subspace clustering is to find these subspaces and segment the data according to the dissimilarity between the subspaces [3]. Subspace clustering techniques are generally divided into algebraic methods, matrix factorization methods, statistical methods and spectral clustering methods [5].

Algebraic methods perform better on intrinsic data, but are sensitive to noise and outliers [11]. Statistical methods assumes that the datapoints are fetched from a Gaussian distribution and the clustering problem is equivalent to find out the suitable parameters of the probability distribution model. However, these methods need the prior information about the number of subspaces.

Spectral clustering methods achieve the segmentation by spectral decomposition of the affinity matrix learned from the data. Spectral clustering is the most popular one in the literature since it is easy to implement and can outperform many of the existing traditional methods [12]. Different spectral clustering algorithms are available based on the type of affinity matrices learned. Andrew *et al.* proposed another method using Laplacian matrix with additional row normalization [13]. Elhamifar *et al.* proposed Sparse Subspace Clustering (SSC) [14] where each data point is expressed as a linear combination of other data points. This is called self expressiveness property. The SSC algorithm tries to obtain the sparsest solution which corresponds to find out the points belonging to the same subspace. The SSC is more robust to noise compared to the previously mentioned methods [14]. But, the method is proved more appropriate for disjoint and independent subspaces [5]. Liu *et al.* [15] proposed a method similar to SSC except that instead of sparsest solution, it aims to find out the low rank representation. However, this method works well only for noiseless data samples drawn from independent subspaces.

All the aforementioned methods vectorize each image prior to the clustering. Hence, these methods do not take the spatial aspects of the image into consideration. To overcome this issue, instead of vectorizing the imaging data, another method was proposed which conserves its matrix structure and this approach is called Union of Free Submodule (UoFS) model [16]. Using this concept and extending the idea of self expressiveness property in SSC algorithm, Kernfeld *et al.* proposed



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ORIGINAL RESEARCH



## Automated breast cancer detection using hybrid extreme learning machine classifier

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### Abstract

Breast cancer has been identified as one of the major diseases that have led to the death of women in recent decades. Mammograms are extensively used by physicians to diagnose breast cancer. The selection of appropriate image enhancement, segmentation, feature extraction, feature selection and prediction algorithm plays an essential role in precise cancer diagnosis on mammograms and remains as a major task in the research field. Classification methods predict the class label for unlabeled dataset based on its proximity to the learnt pattern. The selected features obtained after feature selection are classified using an extreme learning machines (ELM) to three classes with the classes being normal, benign and malignant. Low generalisation performance is the problem which happens due to the ill-conditioned output matrix of the hidden layer of the classifier. The optimisation algorithms would resolve these issues because of their global searching ability. This paper proposes ELM with Fruitfly Optimisation Algorithm (ELM-FOA) to tune the input weight to obtain optimum output at the ELM's hidden node to obtain the solution analytically. The testing sensitivity and precision of ELM-FOA are 97.5% and 100% respectively. The developed method can detect the calcifications and tumours with 99.04% accuracy. The optimal selection of preprocessing and segmentation algorithms, features from multiple feature filters and the efficient classifier algorithm meliorate the performance of the approach.

**Keywords** Mammogram · Classification · ELM · Fruit fly · Optimization · Accuracy · CAD

### 1 Introduction

Over the last few years, signal and image processing algorithms hold key position in the field of research. These algorithms have been used to analyze various images which are useful in the field of remote sensing, medicine, aerospace, control system etc. (Tavakoli et al. 2019). In the area of medical imaging, breast imaging technique called mammography has gained bigger attention among the researchers for the diagnosis of breast malignancy in woman. Mammography is popular as it utilises low energy X-rays to imaging the breast of women (Bray et al. 2018; Melekoodappattu and

Subbian 2019). It is safe and painless procedure to diagnose the breast. Mammography is used for the early identification of breast malignancy, commonly through the identification of masses and small scale calcifications (Akselrod-Ballin et al. 2019).

In the image processing application, enhancement of the image is vital to procure the features and make classification steps easier (Sankar and Melekoodappattu, 2019; Adam Kelder et al. 2018). Hence, perfect pre-processing approaches are an essential requirement in biomedical image processing application. To attain high performance, a suitable denoising filter is absolutely necessary (Ahmed et al. 2020). The abnormal areas in the mammogram images can be obtained by proper segmentation approaches (Melekoodappattu and Subbian 2019). Feature extraction is the very next stage after preprocessing and area of interest exaction which is trailed by feature selection. Features are selected based on some predetermined criteria (Elftoukhy et al. 2018). Once feature selection is completed, these features are subjected to the classification process. A hybrid classification system has been designed to enhance classification

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