

A Survey on Autism Spectrum Disorder Recognition Techniques

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Abstract

Human beings can express their emotions through various ways, such as facial expression, bodily expressions, or language. Autism Spectrum Disorder (ASD) is a kind of neurological developmental disorder characterized by its reduced ability that affects the social interaction, language (or) behavioral skills of children. This tends to engage in repetitive and stereotypic behaviors. The underlying causes of ASD are still not well understood but an alarming number of children are diagnosed and suffered from this disorder in the world today. Early Intervention of the disorder is the most important factor which plays a key role in treating the kids with ASD. Various techniques which include Image Processing, Speech Recognition, Behavioral Analysis are used in identifying the children with ASD at early stages. Image Processing is used to Identify the presence of Autism through facial images by providing extensive training to the machine learning models. Speech recognition, questionnaires and behavioral therapies are used for diagnosing the disorder and its severity at various levels.

This paper describes the survey of various Autism recognition techniques and their major contributions in identifying and analyzing the severity of the disorder in children, their performance, and the scope of improvement for further research.

Machine Learning Approach for Stress Detection using BioSignals

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Abstract

Psychological Stress and Depression have been pinpointed repeatedly as significant issues contributing to the weakening of physical and mental health. Nowadays stress is considered as the biggest threat to individual's well-being. However, stress can be a positive aspect in our daily life, but too much stress can rather be harmful to physical and emotional healthiness where as managing it, is a major concern for populations around the world. Hence, there is significant importance to detect stress in its early stages, before it turns into severe problem. Automatic stress detection can be executed along the four main modalities, viz., Psychological, Physiological, Behavioural and Social Media Interaction modalities, along with appropriate measurements, in order to give hints about the most appropriate ways and means to be used for Psychological Stress Detection.

In Existing system it has proved that stress level can be detected and validated through Heart Rate, Humidity response, Temperature response. These parameters were measured through Fuzzy Logic algorithm. Stress detection in voice gives a great alternative for obtaining a non- invasive way to extract information about a possible deception from a person declaration. Lippold microtremor can be detected through FFT signal processing when a person is under psychological pressure.

This paper speaks about the psychological, physiological, and behavioural modalities for stress detection. The idea is to create a system that accounts these points to add more independency, value and aim to improve the lives of the common people. Proposed system classifies the person as 'stressed' 'not stressed' by taking into account the pupil diameter size and speech of the participant. Threshold calculations are used on the pupil diameter size to detect whether the person is stressed or not and CNN for speech classification.

Index terms

Stress Detection, Pupil Diameter Size, Speech, CNN, Threshold Calculations

Performance Analysis on Wisconsin Breast Cancer Dataset Using Ensemble Model

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Abstract

Breast cancer is an invasive cancer that develops from breast tissue. It is one of the most dangerous diseases that are very effective for women in the world. Detecting the cancer through various automatic diagnostic techniques is very necessary. Many machine learning algorithms are available for prediction and diagnosis of breast cancer. Some of the machine learning algorithms are K-Nearest Neighbor (KNN), it suffers from curse of dimensionality, Naïve Bayes, which has disadvantage assumption of independent predictors, Support Vector Machine (SVM), its disadvantage is Extensive memory requirement and Multilayer Perceptron which gives best result for unstructured data but in study structured data is used. Wisconsin Breast Cancer Dataset is used which contains 569 rows and 30 features. Construction of hybrid classifier for Support Vector Machines and decision trees in WEKA gives accuracy of 91%. In this paper Ensemble method is used to compute best method for diagnosing breast cancer disease. Ensemble methods work well to speed up prediction accuracy. The performance parameters like precision, recall, f1 score were analyzed to identify the best classification method. The primary objective behind using Ensemble learning is to reduce the variables and diagnose the disease effectively. In this approach the features were reduced to sixteen variables. It is ascertained that the classification accuracy has been improved by ensemble method of random forest and gradient boosting algorithm before and after attribute removal. Before the accuracy is 96.07 percent and these selected sixteen variables gave good accuracy of about 97.23% than other set of variables..

A Complete Monitor to Shishu

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Abstract

It is very important for a parent or guardian to monitor a new born / infant every moment. Monitoring includes the checking if the infant is safe in the placed environment, actions that infants do etc. But it is difficult and also regarded as impossible in the real world, but the requirement of constant monitoring of the infant is never down. Sudden Infant Death Syndrome, also known as SIDS, is the leading cause of mortality in infants from one month to one year of age. Rural as well as urban areas high probably lack the capabilities to help shorten the response time of SIDS cases. In worldwide there are four million babies die in the first month of their birth, one million die on their first day. Now-a-days at least 25% of neonatal deaths happen because of preterm birth also.

An incubator is the one which is used in the hospitals to protect the premature babies, who are extra vulnerable and are at increased risk of complications from infection, noise and light. It may even provide humidified air to help very premature babies to maintain skin integrity. The hospitals in rural areas can't have such facilities to protect the preemies. And, the sad part is many tender lives are lost due to lack of this facility.

This project is for video – based baby monitoring system with Internet of Things (IoT).In the event that abnormal movement is detected from the baby an alarm will be generated to notify the parents or guardians. Monitoring the baby health parameters like temperature, pulse rate and moisture and also for storing the measured values in cloud with appropriate security. The major critical parameters are measured in real time. If any variation from the threshold level, it automatically sends an alert message to the caretaker and do the necessary action immediately to safeguard the children. Advantages are increased response time of the guardian in emergencies, monitoring the environment in which the infant is placed, keeping track of the actions infants do, notifying when an abnormal action detected to respond, low cost baby health monitoring system helps to overcome the inhibitive cost of existing baby incubator.



Smart Computing Techniques and Applications pp 59–71

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[Shireesha Gundeti](#) & [Bhageshwari Ratkal](#)

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Abstract

No matter how well people set up to-do lists and calendars, they usually can't get things done unless they have a reliable way of reminding themselves to do them. However hard they try to remember them all, it is very common for people to forget an appointment with a doctor, or to wish a friend on birthday. And moreover, as people grow older, their brains change and they may have problems related to memory, every once in a while. These details may include simple things like not remembering when

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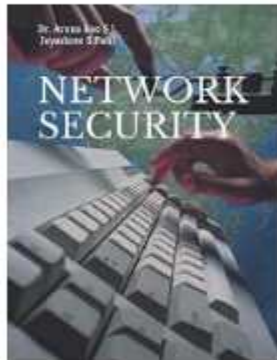
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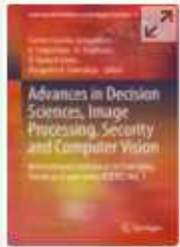
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Advances in Decision Sciences, Image Processing, Security and Computer Vision pp 719–727

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Detection and Tracking of Text from Video Using MSER and SIFT

[M. Manasa Devi](#) , [M. Seetha](#), [S. Viswanada Raju](#) & [D. Srinivasa Rao](#)

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Abstract

Text that looks in a scene or is explicitly added to video can offer an imperative additional basis of directory evidence as well as evidences for interpreting the video's arrangement and for classification. Computerized text mining from a number of stationary resources quickness up the progression in workplaces, libraries, banks and an assortment of further places. Text extraction can be



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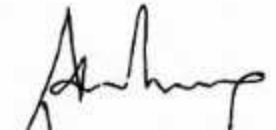
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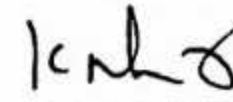



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Dehaze Model to Improve Object Visibility Under Atmospheric Degradation

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Abstract—Optically captured images from the outdoor scenes will be humiliated by natural occurrences of Fog, Mist and Haze. This is due to atmospheric absorption and scattering of visible information, resulting in poor object visibility. It is necessary to estimate the quantifiable parameters of this atmospheric degradation to improve the visibility. Dehazing models attempt to estimate scattering parameters. Single image dehazing models are observed to possess estimation of inaccurate textures, thereby leading to blocking artifacts. The imbalances in the concentration of atmospheric particles and air-light are crucial, that should be mitigated. The available models have to be improved in terms of image parameters such as contrast, saturation and color information. The work reported in this paper emphasized the model that estimates intensified transmission map from the hazy images with color distortions and thereby exploiting scattering parameters for dehazing.

Index Terms—Semi-inverse image, Hue Disparity, Contrast, Depth map.

I. INTRODUCTION

Visibility is a measure of clarity of the atmosphere. A clear scene is obvious for low-level image analysis as well as for high-level object recognition. Outdoor image captured by the satellite or drone has large structured objects relatively represented by less number of pixels. The visibility degradation in aerially captured images is because of the terrible medium which consists of the particles and water droplets in the atmosphere.

The international definitions of visibility range for different weather conditions is depicted in Figure 1 [1]. Due to atmospheric absorption and scattering of the light from source to observer due to haze, fog, smoke, mist, etc., effects the information in the outdoor images. As a result, the contrast and color fidelity is lost in the outdoor images acquired under various weather conditions. The presence of different sources of interference in imaging makes its modeling very challenging. Therefore, recovering from degraded image is always a challenging task and it is ongoing interest in the image processing and computer vision fields.

Developing image dehazing techniques helps many real world applications like intelligent vehicles, remote sensing, under water imaging, etc. In security systems, detecting suspicious objects like aerial/balloon bombs, airdropping of

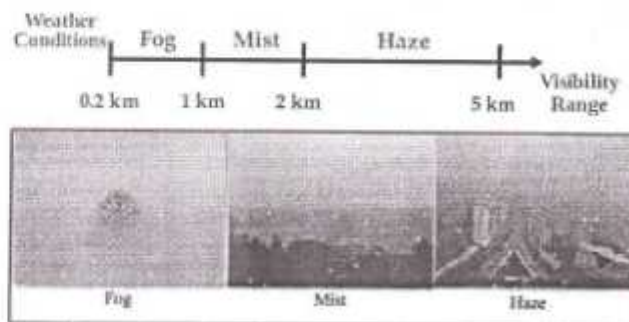


Figure 1: International definitions of visibility range [1]

weapons, small explosive devices lying on the ground, landmines, etc., is a cumbersome issue, when the scene radiance is degraded due to the atmospheric conditions. Apart from this, when the color of these objects is similar to the atmospheric background then it is a cumbersome task to identify them.

Scattering effects pose new challenges in the form of degradation on the computational aspects of image analysis [2]. The path radiance is the main contribution for hazy image and the haze transmission can be estimated using the dark pixels. Searching the dark objects locally in the whole scene can be used to construct haze thickness map [2]. Upon subtracting the haze thickness map from the hazy image, allows one to recover the haze-free image at the sensor. Therefore, there is a need to model a framework for enhancement of images which is insensitive to environmental conditions. The overview of dehazing models is discussed in the next section.

II. OVERVIEW OF DEHAZING MODELS

The dehazing models are of two kinds- non-model based and model based. The restoration performance of non-model based approaches such as Gamma-correction and Histogram equalization is not that effective when compared to model-based approaches to address all types of haze levels. The model-based restoration algorithms are classified based on the number of input images used for restoration. In multi-image haze models, images captured at different degrees of polarization using a polarizer [3], [4], [5] or a special imaging

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Beamformed Sensing using Dominant DoA in Cognitive mmWave Network

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Abstract—In this paper, we propose spectrum sensing schemes for a secondary user (SU) with multiple antennas to detect a primary user (PU) transmission in a cognitive mmWave network. The channel model considered at mmWave carrier frequencies is the clustered Rician fading channel, which has few multipaths. For the considered scenario, we propose three beamformed energy detection (BFED) schemes where beamforming is done in the dominant direction of arrival (DoA) at the SU and then energy detection (ED) is applied. The three schemes differ in the amount of information assumed about the DoAs at the SU. The performance of these schemes has been compared with the traditional ED and maximal ratio combining (MRC) schemes for multiantenna systems. It is shown through simulations that the proposed BFED approaches provide significant performance gains over the ED and negligible loss as compared to the MRC, which makes an impractical assumption of the channel between the PU and the SU to be exactly known.

Index Terms—Antenna array, beamforming, cognitive radio, direction of arrival, dominant path, energy detection, mmWave.

I. INTRODUCTION

The tremendous increase in the number of devices with the advent of the internet of things (IoT) and the demand for higher data rate applications like augmented reality (AR) and virtual reality (VR), is increasing the requirement for larger bandwidths. This requirement can be easily met at the millimeter wave (mmWave) frequencies [1], which has made them crucial for the 5G and beyond technologies.

Even though the mmWave bands support larger bandwidths, spectral resources are still used in a static manner. Cognitive radio (CR) can be used to address this issue. Also, the mmWave cellular systems can have multiple networks managed by different operators simultaneously operating in the same frequency without compromising on the individual achieved rates. Licensed spectrum sharing (LSA) helps different operators to share the resource and cost. CR is a potential technology that can achieve this without any coordination between the users [2].

Spectrum sensing is a vital component in cognitive radio as it tells us about the spectrum occupancy. Out of the several spectrum sensing techniques proposed in the literature, energy detection was widely adopted due to its simplicity. Also, ED is an optimal scheme for detecting a random signal in AWGN when the noise floor is exactly known [3]. In this paper, we are interested in sensing in the mmWave channel.

The mmWave channels suffer from higher penetration losses and poor diffraction leading to sparsity in the angular domain. Beamforming can be used to overcome these losses, as at mmWave more number of antennas can be accommodated in a given form factor [4]. This motivates us to use directional sensing considering both sparsity and losses. Directional sensing involves applying weights to the receive antenna array such that the beamforming pattern is in the direction of the received signal.

DoA based spectrum sensing for AWGN channel was addressed in [5]–[7]. In these papers, multiple antennas at SU were used for DoA estimation. In [7], receive beamforming followed by ED (BFED) in the estimated DoA was addressed for improved beamforming gains and detection performance in the AWGN channel. In this paper, the work on the BFED is extended to the mmWave Rician channels. Here, the term *BFED* refers to receive beamforming in the dominant angle followed by the ED, which has received very little attention in the spectrum sensing literature.

In this paper, we propose three BFED schemes for spectrum sensing in clustered Rician fading channel based on different assumptions on the channel parameters. For the case of known LOS, the first spectrum sensing scheme does beamforming in the LOS direction. Note that for a Rician channel with sufficiently strong LOS, it is the dominant ray most of the time. For the case of all DoAs known but the LOS unknown, the second spectrum sensing scheme algorithms estimate the dominant DoA among the known DoAs and beamforms in the direction of the dominant DoA.

For the case where no DoAs are known, the third spectrum sensing scheme first estimates the DoAs and then finds the dominant ray. For this scenario, DoAs are estimated using multiple signal classification algorithm (MUSIC), while the dominant DoA is picked using two methods: maximum energy and PEak TRacking Algorithm (PETRA) [8]. Before applying these schemes, spatial smoothing is used to decorrelate the correlated signals received from multiple paths [9].

In all three cases, there is no need for channel fading coefficients, which might be difficult to obtain for a SU in practical systems. The performance of these proposed schemes is studied for both LOS ($K > 0$) and NLOS ($K = 0$) conditions for the different number of antennas as well as for the different number



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Detection of Plasma Bubbles using Ground Based GNSS Receiver Data Network

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Abstract

The most significant contributor of error in Global Navigation Satellite System (GNSS) positioning is the ionosphere. The ionospheric layer induces errors in trans-ionospheric GNSS signal resulting in signal delay, signal distortion and loss of data. Low latitudes are the most affected regions owing to the fact that the ionosphere in this part of earth experiences excessive perturbations. GNSS signal errors need to be detected and corrected to improve positional and navigational accuracy. Most of these errors occur during the post-sunset hours due to Equatorial Plasma Bubbles (EPBs). EPBs occur during higher level of solar activity which results in greater Total Electron Content (TEC) disturbances. This paper proposes an efficient EPB detector based on Rate of TEC Index (ROTI) using global continuous data. In this work, GNSS data is downloaded from Scripps Orbit and Permanent Array Center (SOPAC) archives. The data in Receiver Independent Exchange (RINEX) format has been collected from the IISC station, Bangalore, Karnataka (latitude- 13.0219°N, longitude-77.5671°E) in the southern part of India for half of the 24th solar cycle from the year 2014-2019. The results indicate an increased ionospheric activity during the equinoxes and the occurrence of winter anomaly.

Design and Implementation of Smart Car Parking System using LabView

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Abstract

Due to rapid proliferation in the number of vehicles on the road, finding a vacant car parking space is becoming challenging and ubiquitous in every major city, resulting traffic problems are bound to exist. Increase in traffic causes the number of accidents that cause serious bodily harm to the road users, the pollution caused by the large amount of CO₂ released by the vehicles, and the continuous stress of drivers who must drive in often narrow and very busy roads and who must look for a long time to find a space to park. Thus, to solve the parking problem, lot of research is being done on smart parking management system mechanisms. The existing system gives us the information about the empty slots availability but does not give information about the exact location of parking slot available in such a big area. This paper proposes an efficient, cost effective smart car Parking System on wireless Sensor Networks (WSN) technology using LabView that can easily locate and secure a vacant parking space at any car park deemed convenient to them. The parking slots are continuously monitored, and data is continuously updated in the display board.

Index terms

parking system, smart parking, IR sensor

An IOT Based Air and Noise Pollution Monitoring System

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Abstract

Despite the growing trends in the science and technology, India is facing the wrath of poor air quality and particulate matter such as pollen; smoke and dust have only made it worse. Studies show a steep rise in the number of people suffering from asthma and rhinitis from 1964 to 2018. Urban planting makes the people more vulnerable due to the interaction of pollen with industrial and urban motor vehicular gaseous emissions. Noise, on the other hand is an underestimated form of pollution. It has various adverse effects on the body such as cardiovascular effects, sleep disturbance, poorer work environment and hearing impairment. Our objective is to measure the air quality i.e. pollen count along with the hazardous gases and to monitor the noise levels of a particular area. We also aspire to alert people about hazardous gases and noise levels in the surrounding environment. The proposed system uses an Arduino Uno, a PM2.5 GP2Y1010AU0F Dust Smoke Particle Sensor along with MQ-135, MQ-9 sensors. Ada fruit electret microphone is used to measure the sound level in decibels which can be displayed on a 1.3 inch SPI OLED for reference. Whenever the particle count and the concentration of the gases (in PPM) reaches a dangerous level, a buzzer gets activated. On the other hand, when the sound levels go beyond a certain point an LED is turned on. A Wi-Fi module is used to push the data onto the cloud which can be later used for live tracking on a mobile phone.

Index terms

Arduino Uno, PM2.5 GP2Y1010AU0F Dust Smoke Particle Sensor, MQ-135, MQ-9, Node MCU, Sound Sensor

28.1

20-21

An Efficient Gradient Boosting Approach for PVT Aware Estimation of Leakage Power and Propagation delay in CMOS/FinFET Digital Cells

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Abstract—In this paper, we propose an accurate and computationally efficient Gradient Boosting approach for the estimation of statistical variations aware leakage power and propagation delay in the CMOS/FinFET standard digital cells. The proposed model estimates the leakage power and propagation delay w.r.t variations in process, temperature (-55°C to 125°C) and supply voltage ($\pm 10\%$ variations). The distinguishing feature of the proposed approach is its compatibility with both CMOS and FinFET technologies. Moreover, the performance of the proposed model is consistent with various technology nodes. Exhaustive tests report an average error of $<1\%$ in 16nm CMOS and FinFET standard digital cells w.r.t analog HSPICE simulations with several orders increase in computational speed. Further, the complex cell estimation can be carried out through pre-characterized standard cells abstaining longer simulations.

Index Terms—Machine learning (ML), Gradient Boosting Model (GBM), Leakage power, Propagation delay, CMOS, FinFET, VLSI

I. INTRODUCTION

The challenges in accurate estimation of power and delay in digital VLSI circuits are increasing in the nanometer regime. The aggressive scaling down of CMOS/FinFETs devices has led to a profound increase in process variability in turn, an enormous increase in leakage power. The existence of process variations in both devices and interconnect networks increases the randomness in the behavior of the digital circuits and affect their performance. This phenomenon is building difficulties in the device characterization of VLSI circuits and in turn, could result in the parametric degradation of manufacturing yield. The process variations together with the environmental variation sources affect the electrical behavior of the circuit leading to circuit deviation and deterioration of the overall performance of the chip [1]. Although, FinFETs are more tolerant to leakage than CMOS devices, the performance degradation due to the process variation is inevitable [2].

Therefore, the accurate and efficient estimation of leakage and delay of CMOS/FinFET devices under the influence of random variations in process, temperature and supply voltage is emphasized in the nanometer regime prior to fabrications of ICs. A common approach for the estimation of leakage and delay is through Monte-Carlo simulations from HSPICE [3]. The HSPICE Monte-Carlo simulations guarantee accurate results at the cost of a huge simulation time [4]. That makes

them unfeasible for the estimation of complex devices. One solution for avoiding long simulation runs is to develop surrogate models that approximate the performance of a circuit as a function of statistical parameters. The surrogate models can then replace the simulator in large Monte-Carlo simulations thus, reducing the computational time.

We propose a computationally efficient surrogate model for PVT variations aware leakage and delay estimation in digital CMOS/FinFETs of standard digital logic cells using the Gradient Boosting algorithm. To our knowledge, this is the first paper developing a statistical black-box model based on gradient boosting for the estimation of leakage and delays in CMOS/FinFET circuits. We also presented a comparative analysis of results from other machine learning techniques reported in literature; linear, polynomial regression [5] and support vector machine (SVM) [6].

II. RELATED WORKS

Several surrogate techniques are proposed in the literature for the estimation of leakage and delay in digital circuits. Kim *et al.* [4] presented a calculation model for estimating propagation delay in digital circuits converting an arbitrary logic gate into an equivalent inverter. The model does not require any pre-simulation step but it shows 5% error w.r.t HSPICE. D.Helms *et al.* [7] introduced RT level leakage macro models for the gate level leakage estimation which reported an error of 2.1% (for 16nm LP) 6.8% (for 65-nm bulk) w.r.t HSPICE simulations. The paper considers 90000 training samples and limited the process variations to 10 due to complexity reasons. Garg *et al.* [6] presented a stack-based macro model for statistical aware gate-level leakage power estimation (CMOS) using support vector machines (SVM) with a 17x improvement in speed. In [8], Xingsheng Wang *et al.* discussed the statistical variability and reliability of FinFETs taking into consideration the impact of different design and process parameters. But the paper does not address the effect of these variations on the leakage and delay.

A more accurate estimation through the proposed surrogate models is crucial for the realistic estimation of the fabrication yield. A model that does estimations on par with HSPICE is entailed. Our paper reports a negligible average error rate of $<1\%$ with 15000 PVT variations. Moreover, the model is an

HEARTY CONGRATS!

ATM: Approximate Toom-Cook Multiplication for Speech Processing Applications

20-21

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Abstract— Approximate Computing has paved way for elaborate savings in design area and latency of modern system architectures processing images or signals, by a deliberate yet tolerable loss of functional accuracy. This paper thus proposes a design of an approximate multiplier based on the efficient Toom-Cook algorithm, that has a lower complexity of $O(N^{log_d(2d-1)})$ than $O(N^2)$, for order d . Inherent integer divisions in the algorithm has restricted its feasibility in hardware, unless without suitable approximation. On an average, the proposed multiplier achieves 53%, 18% and 57% improvements in area, delay and power only with less than 1% mean error. Owing to these benefits due to lower computational complexity, the multiplier can be configured to achieve significant savings with a high quality output and that suits well to the nature of the speech processing systems, hence the design works well for the epoch extraction system in speech.

Keywords— Approximate Computing, Toom-Cook Multiplication, Epoch Extraction, Speech

I. INTRODUCTION

Biased human perceptions and redundancy in data can be translated into design simplifications, with controlled errors in the output, but achieve many-fold savings in chip design. The challenge arises in optimization of the design while maintaining this quality constraint, which is best addressed through approximate circuit design [1].

With exponential growth of data-intensive approaches and slowing down of the Moore's law [2], [3], approximate computing provides an attractive option by exploiting the error resilience of such applications. Over the recent years, a number of techniques have been proposed for approximate addition and multiplication. A few of them are as follows. In [4], RoBA multiplier achieves simplification by rounding the input operands to nearest powers of 2 and as a result the multiplication requires only simple shifts and addition operations. However, the maximum error of 11% is quite high and remains the same with upscaling of the multiplier, as large operands differ significantly from their rounded counterparts. In [5], the approximations are adopted in the partial product addition tree of the multiplier. However, the multiplier is more suited for shorter bit lengths. The proposed multiplier not only outperforms due to its lower complexity, but also shares similarities with the DRUM multiplier [6] in advantages of scalability, flexibility in the choice of the base multiplier, etc.

The paper is organized as follows: In Section II, the Toom-Cook algorithm is explained and the scope and motivation of the approximation that is achieved, is discussed. Section III deals with the design implementation details and Section IV presents the trade-offs and results. Section V discusses the application of the proposed multiplier in epoch extraction. Section VI summarizes and concludes.

II. PROPOSED APPROXIMATE TOOM-COOK MULTIPLICATION

Toom-Cook multiplication algorithm is proven to be faster than conventional multiplication. as it has reduced number of sub-multiplications. From the hardware implementation point, the problem of divisions though by small numbers, offset the savings in the multiplications. The issue has been solved recently for modular multiplication [7], [8], however, normal integer multiplication is required in several processing cores, and for the algorithm to be realizable in this respect, must incorporate some approximations.

The algorithm assumes polynomial representation of the input operands, around some base $x = 2^B$, selected based on the size of the input operands and the order d . The polynomial $P(x)$ with coefficients p_i evaluates the multiplicand.

$$P(x) = p_{k-1}x^{k-1} + \dots + p_2x^2 + p_1x^1 + p_0$$

Similarly, $Q(x)$ with q_i evaluates the multiplier. The final product is evaluated simply as $R(x) = P(x) \cdot Q(x)$.

$$\begin{bmatrix} R(x_0) \\ R(x_1) \\ \vdots \\ R(x_{2k-2}) \end{bmatrix} = \begin{bmatrix} x_0^0 & x_0^1 & \dots & x_0^{2k-2} \\ x_1^0 & x_1^1 & \dots & x_1^{2k-2} \\ \vdots & \vdots & \dots & \vdots \\ x_{2k-2}^0 & x_{2k-2}^1 & \dots & x_{2k-2}^{2k-2} \end{bmatrix} \begin{bmatrix} r_0 \\ r_1 \\ \vdots \\ r_{2k-2} \end{bmatrix}$$

$$R = X_E r \Rightarrow r = X_E^{-1} R$$

The above equations show the evaluation of the product polynomial at different evaluation points. The evaluation matrix inverse (X_E^{-1}) can thus provide the product polynomial coefficients r , given the evaluated product at different points. The product $R(x)$ is of degree $2k - 2$, requiring $2k - 1$ points to solve for its coefficients. Since X_E is a Vandermonde matrix, its inverse in the form of upper and lower triangular matrices ($U^{-1}L^{-1}$), is given by the following equation [9].

$$l_{i,j} = 0 \ (i < j), l_{0,0} = 1, l_{i,j} = \prod_{m=0, m \neq j}^i \frac{1}{x_j - x_m}$$

$$u_{i,i} = 1, u_{i,0} = 0, u_{i,j} = u_{i-1,j-1} - u_{i,j-1}x_{j-1}$$

The divisions arise due to the term $\frac{1}{x_j - x_m}$, and are directly dictated by the choice of the evaluation points. Another constraint on this choice is based on the ease of evaluation of the input polynomials, i.e. $P(x)$ and $Q(x)$. The second constraint demands the points either be $0, \pm 1, \infty$ (∞ is a valid option, as explained in [10]) or be chosen in powers of 2 so that operation be represented as a shift in hardware. However, this choice will disregard the first one as for some values of a, b , let the term $\frac{1}{x_j - x_m} = \frac{1}{2^a - 2^b}$, this cannot be in powers

HEARTY CONGRATS!

Detection of similar objects and localizing on each using Depth Camera

20-21

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Abstract— This paper introduces the problem of detection of similar color multiple objects and localizing on each object. The similar color multiple objects in an image are segmented using CIELAB color space. The reason for the use of CIELAB space is that the nonlinear relations of L^* , a^* , and b^* mimic the nonlinear response of the human eye. This results in increased accuracy in color segmentation. Further localization on each of these objects is done from the information of depth image. In this work, the 3D sensor is used, Intel® RealSense™ depth camera D435i which captures depth & RGB images. The novelty in this work is in use of depth image from Intel 3D sensor in localization of each object. The advantage of this 3D sensor is, this does not require computation in image alignment of RGB image and depth image. The results of segmenting similar objects and localizing on each are presented, in three different scenes of laboratory/indoor environment.

Keywords—3D Sensors, image alignment, CIELAB space, Depth image, Point cloud data.

I. INTRODUCTION

Real-world perception and analysis for robots are very complex and this is possible using RGBD sensors. Current 3D cameras include Microsoft Kinect camera, Intel® RealSense™ depth camera, and 3D laser range sensors. These imaging and sensing systems are used in solving many real-world autonomous navigation tasks like 3D Simultaneous Mapping and Localization [1], object recognition [2], visual odometry [3], 3D modeling using Iterative close point algorithm [4], Gait Analysis [5] which are few among the 3D processing and visualization tasks.

With the fast growth in the technology of computational devices and Sensors, 3D or point cloud processing of images is gaining vital importance due to its wide applications in robotics. This is possible due to the availability of Open source supporting libraries like Point Cloud library [6], Open3D [7], Robotic Operating system [8], OpenCV library [9]. Various RGBD Sensors [10] are available due to the use of depth images in computer vision applications [11, 12]. Further Deep Learning [13] and Machine learning algorithms [14] are used to find significant solutions to many vision-based problems. Usually, in warehouses, robots need to be trained to pick

each object from multiple similar objects. This task can be accomplished by segmenting similar objects and then localizing on each object.

This work relates to the difficulty of segmenting multiple similar objects and localizing on each, using Intel® RealSense™ depth camera D435i [11, 13]. This camera captures images at various resolutions of both depth and color at a frame rate of 30Hz. Since depth and color image are provided by distinct camera sensors, the alignment of these two images is required. This is possible by Intel RealSense OpenCV supporting libraries and Librealsense wrappers. After the RGB and depth images are captured, the CIELAB space image is obtained from an RGB image. Next, the similarity is computed among the selected region of interest to the rest of the pixels to obtain Euclidean distance or deltaE image. This on threshold gives a mask image, which indicates objects similar to the region of interest. Later the depth image is used to access each of the objects of ROI.

J J Hernandez et al [11] worked on the similar problem of detection of objects using Microsoft Kinect sensor. But the process, involved was too computational with the use of Homography. In this paper, a method is proposed which detects multiple similar objects of interest by CIELAB color processing and localizing on each object using depth image. Our contribution is in the use of Intel® RealSense™ depth camera D435i[16] for localizing on each object without any intricacy of using Homography.

This paper is organized as follows. Section 2 describes the proposed methodology, the CIELAB model, and the process of obtaining the deltaE image. Section 3, details on Intel RealSense Camera specifications. Finally, section 5 focuses on the results using three cases of laboratory/indoor scene and section 6 presents the conclusions.

II. PROPOSED SYSTEM

A. Methodology

The process flow of the system involving segmentation and localizing on each object is shown in figure 1. Intel®

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An Efficient ROTI based Equatorial Plasma Bubble Detector for Low Latitude Reg

IN THE 3RD INTERNATIONAL CONFERENCE ON SOFT COMPUTING AND SIGNAL
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Acoustic Scene Classification using Single Frequency Filtering Cepstral Coefficients and DNN

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Abstract—Various representations have been developed for acoustic scene classifications (ASC) task using spectral information. However, there is a wide gap in dealing with acoustic scene representations. In this paper, we propose to use a single frequency filtering (SFF) approach, which provides good temporal and spectral resolution at each instant. Single-frequency filtering cepstral coefficients (SFFCC) with deep neural network (DNN) model as the classifier is used for the experimentation on DCASE 2019 and DCASE 2018 Task 1, development data of subtasks A and B. From the conducted experiments on the development datasets, the usage of the SFFCC features significantly improved ASC performance. This approach has got 35th team rank out of 46 submissions to the corresponding DCASE 2019 Task 1A challenge with a 52.6% classification accuracy on the evaluation dataset. Also, the effect of raw waveforms taken as features for ASC using DNNs was observed.

Index Terms—Log Mel band energies, Single Frequency Filtering Cepstral Coefficients (SFFCC), Acoustic Scene Classification (ASC), Deep Neural Network (DNN).

I. INTRODUCTION

Classification of predefined acoustic scenes from the test audio recordings is known as acoustic scene classification (ASC) (eg., Park, Metro, etc.). ASC is a very interesting research field nowadays as it has various applications like monitoring sound by smartphones and robots, sound monitoring by artificial intelligence (AI), etc [1], [2]. Detection and Classification of Acoustic Scenes and Events (DCASE) challenge organizers have motivated this field by providing public datasets and baseline systems from the past few years. Due to that, this field has good scientific submissions towards scene representations. In DCASE 2013 baseline, a bag of frames was used for ASC representations and the Gaussian mixture model (GMM) model for classification [1]. In DCASE 2016 baseline, Mel frequency cepstral coefficients (MFCC)s were used for acoustic scene representations and GMM model for classification [3], [4]. Acoustic event detection in real-life recordings using MFCC and hidden Markov model (HMM) were proposed for ASC [5]. In DCASE 2017, log-Mel band energies and multilayer perceptron models were proposed for ASC in [6]. In DCASE 2018, log-Mel band energies and convolutional neural network (CNN) models were proposed for ASC in [7]. Generative Adversarial Network (GAN) based acoustic scene training set augmentation and selection using support vector machine (SVM) hyper-plane were proposed for ASC in [8]. Double image features and the CNN model were proposed for ASC in [9]. An ensemble of spectrograms

based on adaptive temporal divisions based ASC was done in [10]. Wavelet transform-based Mel-scaled features for ASC is presented in [11]. DNN based multi-level feature ensemble for ASC was presented in [12]. Audio feature space analysis for ASC was presented in [13]. CNNs for ASC were investigated in [14], [15]. A multi-level attention model for weakly supervised audio classification was proposed in [16]. The significance of phase in single frequency filtering outputs of speech signals was described in [17]. In our approach, SFFCCs were used to represent the acoustic scenes and DNN model is used for classifying the acoustic scenes. The main motivation behind SFFCC handicraft representation of an acoustic scene is that these features capture spectro-temporal information at each instant in mismatched conditions robustly. Acoustic scene detection is possible as it can capture instantaneous spectral variations with high temporal and spectral resolution in the low-frequency regions [18]. Also in [18], SFF envelopes were used for speech and non speech detection as it captures spectral differences between speech and non speech even in the presence of low signal to noise regions highly. Due to that, SFFCC are useful to capture spectral differences more finely between acoustic scenes even in mismatched recording conditions. Motivated by this, we proposed to investigate acoustic scene representations using SFFCC and DNN modelling for ASC and also investigated the effect of raw waveforms with our proposed DNN architecture on DCASE 2018 task I subtask A.

The remainder of the paper is organized as follows. In Section II, SFFCC features extraction is presented. Section III describes the experimental settings and the database used. In Section IV, Section V, and Section VI, results and discussion are presented. Finally, Section VII provides conclusions.

II. SFFCC FEATURES EXTRACTION

In this section, features are extracted using single frequency filtering and feature extraction process was found from [18]–[20]. The aim of Single Frequency Filtering (SFF) is to capture the amplitude envelope of the signal as a function of time. Using these SFF envelopes, we can observe the spectral difference between clean and mismatched recordings more clearly [18]. The spectro-temporal resolution can be adjusted by varying the r parameter used in single pole filter transfer function. The SFF method steps are as follows [18]–[20].


31/12/20

Pothole Detection using CNN and AlexNet

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Abstract

Repairing of roads is one of the challenge for avoiding accidents, heavy traffic and limiting the maintenance cost. Due to bad environmental conditions and heavy usage of roads potholes are formed. Present procedures used for detection of potholes generally is manual, so more time consuming. This paper is on detection of potholes using two approaches, i.e., Spectral Clustering(SC) and Deep learning techniques. In first approach, the input image is processed by SC and morphological operations. Pothole is detected using threshold classifier. This methodology does not need any training phase for detecting the potholes. The second approach of detecting potholes is by CNN and AlexNet. Two methods are tested on balanced dataset formed by 300 images containing pothole and non-pothole images. Since more images are required for training in Deep learning, this is accomplished by using data augmentation, to increase the size of dataset. By using CNN and AlexNet, the accuracy is quite increased compared to the approach of Spectral clustering.

Keywords- Spectral clustering, Region growing, Erosion, ROC Curve, CNN, AlexNet.

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1. Introduction

Distress of asphalt pavement have major impact on accidents, heavy traffic and transport of sensitive goods. Distress pavement include patches, cracks and potholes. Pothole is a bowl shaped or deep holes on road surface which effects road surface. These are formed due to extreme weather conditions and more usage of roads. Repairing of potholes is mandatory to avoid accidents and traffic. Presently, manual approach for detection of potholes is accomplished which is time consuming.

Existing methodologies in research for detecting the potholes include public reporting, Vibration based techniques by Ghadge et al., 2015, 2D vision based techniques by Kristina et al., 2015 and B. H Hang et al., 2017 and 3D reconstruction by X. Yu et al., 2014. In case of vibration based techniques, potholes are detected using accelerometers which will be attached to the vehicles. The accelerometer senses vibrations of the vehicle and then the pothole is detected and updated on virtual road network by R. Fan et al., 2020. This approach is not accurate because the vibrations caused may not be a pothole alone. Further the vehicle with accelerometer has to pass through the pothole, for it to be detected. 2D vision based method captures the 2D images or video data. Nowadays, deep learning techniques has become one of the widely used techniques to detect the potholes, since it does not require any feature extraction. Stereo vision cameras are used to estimate the depth as well as distance of the potholes which is cost effective as compared to other sensors. 3D reconstruction technique is used to capture the appearance, depth as well as shape of the objects. Kinect cameras are used by Rasheed et al., 2015 to capture the pothole images and Stereo cameras by H. Hirschmiller et al., 2005 and Dhiman et al., 2019. The pothole detection using ultrasonic sensor without using expensive equipment is proposed by E.J. Reddy et al., 2020, the location of the pothole will be tracked with GPS.



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Entitled.....Third Eye for Blind using Ultrasonic Sensor.....
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Performance Evaluation of 2X2 MIMO Reconfigurable Testbed Communication System

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Abstract— The main reason for shifting to 5G is to handle the increasing data traffic demands, by using reconfigurable testbed systems in a real-world deployment scenario. Due to advancement in embedded technology cheaper, smaller, lighter and more flexible devices are available in the market, one among them is USRP. In this research work, a 2X2 MIMO-QAM system is simulated, implemented and comparative analysis is done using the SDR test-bed. Further, this paper extends to a 2X2 MIMO-OFDM system and the best sequence for training is obtained based on various parameters such as SNR(dB); BER; delay(μ sec); Error Statistics; Estimated Offset for different training sequences.

Keywords—MIMO, OFDM, QAM, 5G, NI-USRP2920, LV(LabVIEW)

I. INTRODUCTION

In this paper, an SDR is designed with LabVIEW, which supports NI-USRP hardware. LabVIEW is compatible with many types of devices and used as an emerging software in the fields of Defence, Communication, Signal Processing, Space Technology etc. LabVIEW provides one of the best Graphical User Interface. The aim is to design a code which works for a real-world indoor scenario and to obtain experimental measurements that prove our theoretical assumptions on the performance of the 5G technology. The purpose of this scenario is to address the potential of upcoming 5G techniques to increase network throughput.

A wireless digital, as well as an analog communication system, can be designed and implemented using LabVIEW. The transmitter design first blocks begin with the bits generation and ends with the OFDM symbols and frame transmission. Then, the USRP upconverts the digital data to an analog signal which is transmitted over the channel using antennas. The USRP at the receiver down-convert these signals. The receiver modules process the digital frames using transmitted symbol pilots to estimate the channel. Next, a USRP network is developed such that it fulfils the criteria for a wireless communication system.

For designing such a system testbed, USRP's are being widely used for experimental evaluation. However, the effectiveness of using a USRP as a measuring device for wireless communication using is not found in the theory. Performance measurement of a MIMO system with antennas

connected to USRP is less expensive than other commercial equipment. Hence, the approach as used in this paper has the potential for practical usage.

MIMO system propagates through reflective paths to output gain, with higher channel connectivity and rate of processing packets by using multiple antennas.

II. 2X2 MIMO-QAM SYSTEM

A. Space Time Block Codes (Alamouti Scheme)

STBC by Alamouti is used in this paper as it provides a reliable transmission in MIMO antenna systems. The orthogonal STBC(OSTBC) transmit leftover duplicates of the data transmitted to overcome variation of attenuation and assuming that few data packets are to be received with lesser interference than others [4].

STBC is used in exploiting spatial diversity i.e. signals are sent again and again in different slots of time, by using more number of antennas at the transmitter side during the transmission [5]. The antennas which are placed at an appropriate distance, have an independent variation of attenuation for each of the duplicate symbols. This makes the probability of occurrence of a deep fade (for slow flat fading channels) very less [5].

B. Alamouti Space-time Coding Scheme

Alamouti technique is preferred as it can be simply extended to two transmitter antennas and N number of receiver antennas, which outputs diversity order of 2N. The advantage is that, it outputs same diversity order as a combiner such as MRC with single transmitter antenna and 2 receiver antennas.

C. QAM System

Quadrature Amplitude Modulation (QAM) techniques can be utilized in analog as well as digital modulation concepts, depending upon the input signal as shown in Fig.1 QAM, first modulates two individual signals and then transmits it to the receiver side, thus increasing the channel bandwidth. The advantages are listed below:

- It supports a high data rate.

Mitigating Jamming Attacks in a MIMO System with Bursty Traffic

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Abstract—In this paper, we study the role of multiple antennas in mitigating jamming attack under Rayleigh fading environment with random arrival of data at the transmitter. The jammer is assumed to have energy harvesting capability with infinite battery size. The outage probabilities under jamming attack are derived for Rayleigh fading scenario with different assumptions on the number of antennas at the transmitter and receiver. The outage probability is also derived for the Alamouti space-time code under the jamming attack. The average service rate and delay performance of the system are characterized with random arrival of data and energy at the transmitter and jammer, respectively. The derived results help to explore the benefits of using multiple antennas in improving average service rate and delay of the system under jamming attack. It is also found that exploitation of space and time diversity with the use of space-time code can improve the performance of the system significantly even under the jamming attack.

Index Terms— Jamming, Space-time code, Stability, Multiple Antenna.

I. INTRODUCTION

One of the fundamental assumptions involved in information theoretic secrecy is that the users always have data to send. In many wireless environments such as Internet of Things (IoT), users may not always have data to send. When the traffic is bursty, information theoretic metrics such as capacity or secrecy capacity are no longer suitable to measure the performance of the system. Jamming is one of the common form of denial of service attack where a malicious node intentionally attempts to disrupt the on going communication between the legitimate nodes. The impact of jamming on the system performance and its mitigation has been studied extensively in the existing literature [1]–[4]. However, the role of multiple antennas in mitigating jamming attack under random data arrival in a fading environment is not well explored in the literature.

We consider a point-to-point MIMO system with random arrival of data at the transmitter in the presence of a jammer. We assume that jammer does not have a constant source of power supply but it has energy harvesting capability. This type of scenario can appear in practice where a jammer is deployed in an outdoor environment and due to lack of centralized resources, it does not have a constant source of power supply. As the transmitter may not always have data to send to the legitimate receiver, stable throughput is an appropriate metric to measure the performance of the system. The work also

aims to characterize the delay performance of the system with various antenna configurations under jamming attack.

The impact of jamming on system performance has been explored under various scenarios [1]–[3], [5], [6]. An information theoretic analysis of correlated jamming can be found in [5]. The problem considered in [5] is further studied in [1] for a MIMO fading channel. The capacity for multiuser scenarios such as multiple access channel with correlated jamming can be found in [7]. In [8], an ad hoc network is considered in the presence of a single jammer and a cooperative anti-jamming scheme has been proposed to mitigate jamming attack. The case of malicious user having eavesdropping and jamming capability has been studied in [9]–[11]. Due to the conflicting interest between the transmitter and the jammer, game theory has been used to study various jamming and anti-jamming strategies [3], [9], [12].

In many scenarios, the data arrival at the transmitter varies dynamically and the randomness of the data arrival can be utilized to improve the performance of the system when jammer does not know the state of the queue. The work in [13] considers a game theoretic framework to analyze the role of random arrival of data in mitigating the jamming attack. In [14], the impact of jamming over a collision channel is explored in a non-cooperative game framework. The existing works do not explore the role of multiple antennas in mitigating jamming attack under random arrival of data in fading environment. It is also required to understand the impact of jamming on the delay performance of the system when users are equipped with multiple antennas. This also brings an interesting question on how the spatial and time diversity can be exploited to improve the performance of the system. To answer these questions, this work also considers Alamouti coding to explore the benefit of spatial and time diversity in improving the average service rate and delay of the system. The main contributions of the work are summarized below.

- 1) One of the key contributions of the work is to derive the expressions for outage probability for Rayleigh fading environment in the presence of jammer when transmitter, receiver, or both are equipped with multiple antennas. The outage probability for Alamouti code under jamming attack is also obtained when the transmitter and receiver are equipped with multiple antennas. To the best of authors' knowledge, outage probability under jamming attack for



Integrated IOT Based System for Accident Reporting and Automatic Toll Collection using RFID

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ABSTRACT

In a developing nation like India, with development inside the transportation generation and upward push inside the total variety of automobiles road accidents boom hastily and there's also tax gathering issues. So a solution for both problems is discussed and implemented. For the toll tax collection related issues an automatic tax collecting system is developed with the use of RFID Technology. Whenever a RFID reader receives a signal from its associated RFID tag, checks for the authorization of vehicle and collect the tax accordingly. And for accident related issues the implemented system has two Phases-Accident Detection and Accident Prevention. To avoid Accidents, we are using Alcohol sensor to detect whether the person is alcoholic or not. If any accidents occur on highways immediately MEMS sensor detect the tilted angle of vehicle and when the vehicle is tilted more, then the sensor value becomes high and intimate the camera to capture the images and send the images to the registered mail id and also send the GPS location to registered mobile number through SMS.

Key Words: Accident-detection, Accident-prevention, IOT, RFID, Sensors and Toll Tax.

I. INTRODUCTION

In India, maximum dual carriageway initiatives are developed through private sectors on PPP (Public Private Partnership) basis. This non-public enterprise retains production capitals and reasonable profit from people. After creation of roads, for a few vehicles permissible duration tax is collected by using the companies. This tax is referred to as toll tax. There are many unique toll collection gadget practiced via various corporations at unique toll plazas. However this toll plaza wastes the time and increases site visitors at

the highways. Initially, there has been a guide toll collection device in India. This method is insufficient for toll collection because the vehicle proprietor will pay the toll in the form of physical cash. This was causing congestion of visitors. Automated Toll Collection is useful because with the assist of this machine congestion of traffic at the toll collection regions can lessen and also help in reducing corruption on the toll booth.

The toll series is a phenomenon to get lower back the investment made on the infrastructure from the folks that are using it. In Indian scenario, there are troubles

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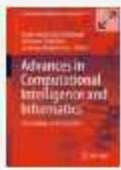
Abstract:

Internet of Things (IOT) is a rapid growing technology in which everything is connected to each other for exchanging the information among them. IOT has taken over the medical field and serves as a catalyst in health care applications. Monitoring the health time to time is a necessity for people due to the increasing rate of diseases or infections that are spreading rapidly in the environment. Proper monitoring of the health could reduce the risk factor of becoming a victim of any illness or disease. This project aims at monitoring various parameters of the patient constantly, using the internet of things. These parameters are stored in the cloud and can be viewed by the user from any part of the world. A wearable device is used, which is equipped with the sensors, collects the body temperature, pulse and bp values and is sent to the mobile app using Bluetooth module. To view the sensor readings that are uploaded to the mobile application, the user must login with their name, age and gender. The health condition of the user along with necessary precautions are displayed to the user with the help of prediction algorithm that has been deployed in the IBM Watson. Such devices are much required in the pandemic like COVID-19 as it helps the individuals to check on themselves constantly and reach out for assistance at the time of emergency.

Key words: *IOT, Arduino uno, IBM Watson, Sensors.*

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An Efficient Intrusion Detection System with Convolutional Neural Network

V. Maheshwar Reddy , I. Ravi Prakash Reddy & K. Adi Narayana Reddy

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Abstract

Cyber security in the networked systems is the most challenging and risky aspects of the modern digital world. Due to the availability of computational resources, the area of deep learning is extensively used in many fields. In this proposal, we use IDS using convolutional neural network. Intrusion detection system with convolutional neural networks helps us to detect, analyze, and categorize the incoming or outgoing traffic into normal or attack. In this paper, we implemented IDS with CNN for binary classification and multiclass classification on given traffic data. The results proved that the proposed IDS using CNN is better than the other existing IDS models using machine learning.

Keywords

Convolutional neural networks **Deep learning** **Neural network**

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Abstract:

In many wireless applications, there is a need for high data rate transmission and reception. Space time coded MIMO-OFDM is the diversity method that is used for transmitting data at a very high data rate. Although the MIMO-OFDM system, experiences the PAPR problem in the present OFDM. The PAPR of the system should be avoided to reduce signal distortion and interference between carriers. The proposed STBC MIMO-OFDM system provides a solution for reducing the PAPR using the technique Selective Codeword Shift Selective mapping (SCSSLM). In the proposed system STBC MIMO-OFDM, high PAPR reduction is achieved by using the Space-Time Block Coding method and Selective Codeword Shift Selective Mapping technique. The SCS-SLM method is the enrichment of the Selective Mapping technique which reduces high PAPR, which will make the power amplifier to work in the non-linear region, which causes intermodulation between the subcarriers and distorts the signal constellation and the Bit Error Rate performance of the system also improved.

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Implementation of Non-Linear Adaptive Equalizer for MIMO-OFDM in Wireless Communication

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Abstract— Wireless communication is playing a major role in our day to day life due to its high demand it is required to provide information at high data rate. Due to which the channel would face impairments like fading and interference.

The two technologies that have got more attention for above problems are multiple input multiple output (MIMO) and orthogonal frequency division multiplexing (OFDM). OFDM has been considered as one of the multicarrier modulation techniques. MIMO system uses more than one antenna at each end of the transmitter and receiver. These two techniques are combined to upgrade the performance.

Equalizer is the device used to reverse the distortion caused by the signal transmitted through a channel. In this, adaptive equalizer algorithms are used. LMS algorithm has low computational complexity but the disadvantage is its convergence rate is very slow. To overcome that, RLS algorithm is used and it significantly improves the convergence. Better Mean Square Error (MSE) and Bit Error Rate (BER) can also be obtained.

Keywords— MIMO, OFDM, Equalizer, RLS, BER, MSE

INTRODUCTION

In wireless communication system [1], using the available spectrum is one of most critical design issues. Therefore, the main aim of communication in wireless medium is to transmit data at high speed but inter symbol interference occurs when high speed data is transmitted over the given channel. The high-speed efficiency can be achieved by MIMO [Multiple input Multiple output] and OFDM [Orthogonal frequency division multiplexing].

MIMO [2] stands for multiple input multiple output takes advantage of multipath because it uses more than one antenna to transmit the signal from the transmitter. In urban environment, these signals will get distorted through the trees, buildings etc., and continue their path to the receiver when different signals are received at the receiver side it gives multipath effect.

OFDM [4] stands for orthogonal frequency division multiplexing mostly used in wide bandwidth and high-speed data in wireless communication including WIFI, cellular telecommunication and many more. OFDM is a form of multicarrier modulation technique.

MIMO-OFDM [8] considered as innovation that combines both the technologies together to transmit

information in wireless communication so as to manage with frequency selective channel effect. As MIMO cannot mitigate the multipath propagation where as OFDM refuses for signal equalization when both the techniques are combined it increases system performance. MIMO-OFDM [7] are able to increase channel capacity even when channel experiences severe conditions and it even gives data throughput and highest capacity. The data transmitted is very fast and not manageable to manage that OFDM is used because it turns high speed of data into various number of parallel low-speed channels.

Equalization [7] purpose is to resolve inter-symbol-interference caused by signals overlapping with each other in channel they are used by equalization at the front of the receiver. The received data samples will be unstable due to ISI but at the receiver side it will have continuous signal whose samples can take random values, rather than taking the discrete levels that are transmitted. The equalizer which recursively updates the time varying channel samples that is known as adaptive equalization.

Adaptive Equalizer [12] has an advantage to adapt the time varying for unknown channels, it requires a special algorithm for better coefficient to trace the changes in the channel. The equalizer uses different algorithm like LMS and RLS.

I. SYSTEM MODEL

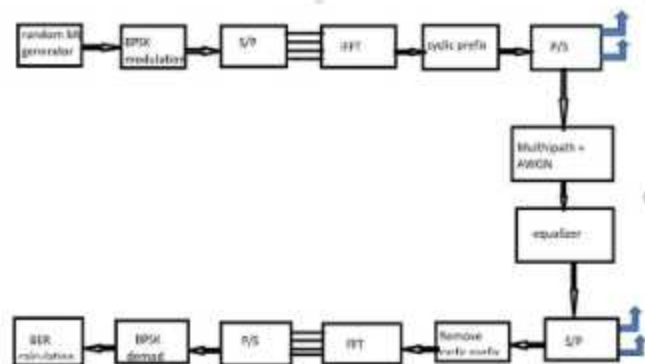


Fig.1 System model of MIMO-OFDM

A Broadband MIMO Array with Gap Coupling For 5G Applications

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Abstract: A Multiple Input Multiple Output (MIMO) array was designed using a Broadband three-patch gap antenna which has both electric and magnetic elements to couple. A step design is implemented between the elements for Electromagnetic coupling. A MIMO Antenna of four element with a gap is designed at 3.75 GHz. It has the advantages of wideband and multiband capabilities, lower in weight, less volume with thinner dimensions. Communication through 5G Applications is the state of art Technology in which the proposed antenna is most suitable. The compact multiple input multiple output four element array is designed at a frequency of 3.75 GHz. The designed MIMO array has good impedance matching and high isolation between channels. A Comparison with different substrates is done for Optimization. The three layered design in which air is considered as one of the substrates gives very good performance characteristics.

Keywords: MIMO (multiple input multiple output) array, 5G Application, High isolation, Three layered design, Gap coupled three patch antenna

Introduction:

Modern communication systems prefer antennas with wider bandwidth and minor in dimensions, which initiated research towards gap coupled with three patch antennas. The motivation for the use of coupling in antenna engineering is to extend antenna design.

Modern communication systems prefer antennas with wider bandwidth and precise in dimensions, which initiated research towards gap coupled with three patch antennas. The motivation for the use of coupling in antenna engineering is to extend antenna design for improvement in characteristics. Various techniques have been implemented for the enhancement of the much more demanded Bandwidth [1-5]. Later MIMO arrays were designed with no mutual coupling [6-9] between elements and at the same time with high Isolation characteristics. Fractal Antenna structures were used for wideband 5G Applications [10]. Arrays using twisted arm slot coupled Waveguides were developed [11] but with a trade off in compactness. The patch antenna geometry gives a good solution to achieve a highly compact, low profile with multiple bands and wideband characteristics. Antenna with

gaps between patches is designed first. A structure of four such antennas is designed on a single substrate confining to a MIMO Array and simulated at 3.75 GHz. A very good performance resulting in Gain of the order of 7.5 dB and a Return loss of -37 dB were obtained at the resonant frequency. Moreover, our antenna pattern had a steady wideband radiation without beam shift in the passband.

Antenna Design:

The design uses non-radiating parasitic patches for the construction of a single gap coupled three patch antenna (GCTP) for wideband application is designed. Uniform parasitic patches were used for the conventional gap-coupled patch antennas [12]. The design differs here by using stepped patches. Fig.1 represents the structure of GCTP antenna.

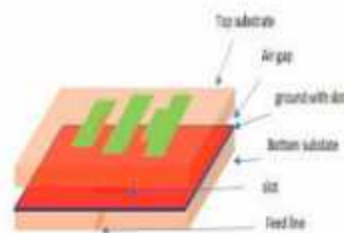


Figure 1: Design structure of proposed GCTP antenna

Step mechanism is implemented in the design so as to realize distinct electric as well as magnetic coupling between the patches. The main patch and the adjacent ones are gap-coupled to each other [13]. The feeding technique used is Aperture coupled feed line with a slot at the top layer of the bottom substrate with an impedance of 50Ω. The feed line is a microstrip given at the bottom layer of the ground plane.

Design Consideration:

GCTP Antenna

This is an advanced design of a non-radiating gap coupled three-patch antenna for wideband applications.



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Improved Training Based Channel Estimation Technique for MIMO-OFDM System

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Abstract

The MIMO and OFDM systems are combined for enhancing the received signal quality without increasing the channel bandwidth in a multi path fading environment. In a fading environment, Channel State Information (CSI) estimation is required to reconstruct the data at the receiver section of the MIMO-OFDM systems. For estimating the channel effects, pilot symbols are mixed with the data symbols and transmitted. The performance of training based channel estimation technique depends on the positions of pilot carriers. In the proposed work, Adaptive ABC optimization technique is used for finding the best positions of pilot signals such that the performance of MIMO-OFDM system is improved when compared to the fixed positions of pilot signals. The performance metrics used in this paper are BER, MSE. According to simulation results, LS channel estimation with Adaptive ABC optimization technique outperforms than the fixed pilot positions.



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Training Based Channel Estimation Technique Using Improved LMS Algorithm for MIMO- OFDM System

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Abstract

In a wireless communication system, multiple-input multiple-output (MIMO) combined with Orthogonal Frequency Division Multiplexing (OFDM) can achieve a high data rate and better spectral efficiency. Channel estimation is very important for improving the performance of MIMO- OFDM system. Training based Channel estimation technique for MIMO-OFDM system under Rayleigh fading channel is proposed in this paper. The channel estimation using block type pilot arrangement is administered with Least Square (LS), Minimum Mean Square Error (MMSE), Least Mean Square (LMS) and improved LMS estimation algorithm through matlab simulation. In this paper the BER and MSE performances of LS, MMSE, LMS and Improved LMS algorithm with channel estimation techniques are analysed for different modulation techniques.

Index terms

channel estimation, least square, minimum mean square, least mean square, OFDM, MIMO-OFDM



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Performance of QAM System with Convolutional Codes

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Abstract

This system proposes a simple series form formula of the bit error rate (BER) for M-ary QAM signals under the AWGN channel. In the QAM modulation techniques used for calculation of BER with QAM system using fading channel. This work presents, a simulation tool MATLAB R2013a to study the performance analysis of Bit Error Rate (BER) V/S Signal to Noise ratio (SNR) E_b/N_0 . Since the BER is represented by the simple series form formula, the proposed approach frees us from the time-consuming computer simulations. Moreover, the proposed formula applies to arbitrary M-ary quadrature amplitude modulations (QAM). the project aims at developing a Simulink model to simulate using Matlab/Simulink Communication System Toolbox. Also, the BERTool under Matlab is used to evaluate the performance of each QAM technique through plotting the Bit Error Rate (BER) vs. the ratio of bit energy to noise power spectral density (E_b/N_0).

Index terms

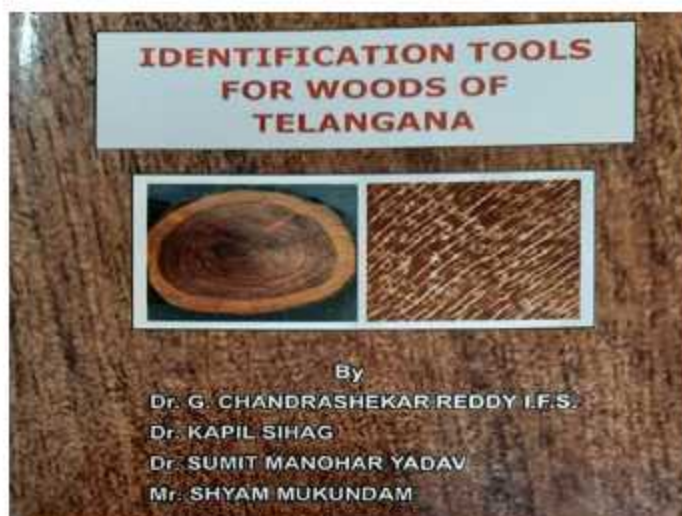
bit error rate (BER), M-ary QAM, AWGN channel, SNR, BER Tool, Simulink.



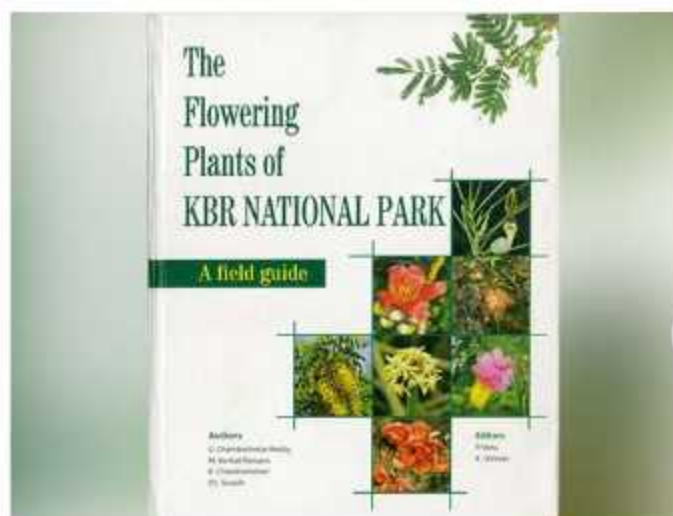
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Book on Identification tools for Woods of
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Advances in Energy Materials pp 1–28

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Studies on Synthesis and Various Characteristics of Green Materials for Energy Conversion Applications

[Ranjana Jha](#) , [Medha Bhushan](#) & [Rekha Bhardwaj](#)

Chapter | [First Online: 22 July 2020](#)

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Abstract

Energy has become one of the major concerns of the twenty-first century because of the social progress and development in human standard of living. The requirement for energy is increasing constantly, even though conventional combustion-based energy will keep on playing a leading role in gathering our demands in near future. The impending scarcity, rising price and increasing environmental pollution of fossil fuels are approaching humans to build up sustainable, low-cost and clean energy. Sustainable development is integrity of multidiscipline thought combining social, environmental and economical aspects to build a liveable human system. The sustainable development can be done by synthesizing green materials. Green materials hold exceptional physical and chemical properties and are found in nature in plenty, non-toxic and cost-effective. This chapter focuses on green materials originating from the principles to reduce or eliminate the hazardous substances in synthesis of chemical products. At fundamental level, researches in green materials create alternatives to conventional materials or process that present an ecological benefit. So, it deals with the description of cost-effective and low-temperature-based synthesis which involves handling of non-toxic elements. Green materials can be useful for a variety of fields such as in science and technology for energy, construction of buildings, pollution management, engineering applications and materials science. Green materials can be synthesized with the aim of energy production.

Keywords

Sustainable development **Green materials** **Synthesis** **Characteristics**

Clean energy

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Abbreviations

ZnO: Zinc oxide

TiO₂: Titanium dioxide

MoO₃: Molybdenum trioxide

NiS: Nickel sulphide

ZnS: Zinc sulphide

g-C₃N₄: Graphitic carbon nitrides

I_{sc}: Short-circuit current

V_{oc}: Open-circuit voltage

I: Current

V: Voltage

P_{max}: Maximum power

MPP: Maximum power point

I_{mp}: Maximum current

V_{mp}: Maximum voltage

LED: Light-emitting diode

OCV: Open-circuit voltage

P_{ej} : Power

j : Current density

$P_{ef,max}$: Maximum power

j_{mp} : Current density at maximum point

V_{mp} : Voltage at maximum point

η_{PCE} : Efficiency

PCE: Photovoltaic conversion efficiency

I_{LED} : Particular value of current for which its efficiency is maximum

V_{LED} : Particular value of voltage for which its efficiency is maximum

Φ_T : Total power radiated by the LED

P_{LED} : Electrical power ($I_{LED} \cdot V_{LED}$) supplied to it

FF: Fill factor

j_{ph} : Short-circuit photocurrent

V_{oc} : Open-circuit voltage

P: Power

SQ limit: William Shockley and Hans Queisser limit

HER: Hydrogen evolution reaction

OER: Oxygen evolution reaction

PEC: Photoelectrochemical cell

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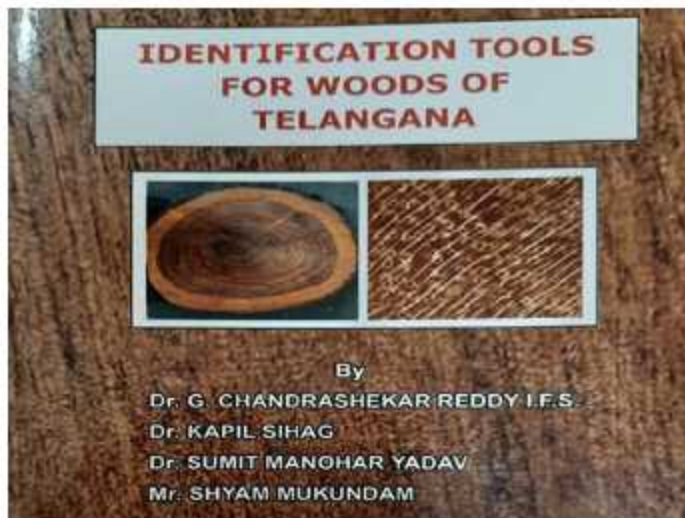
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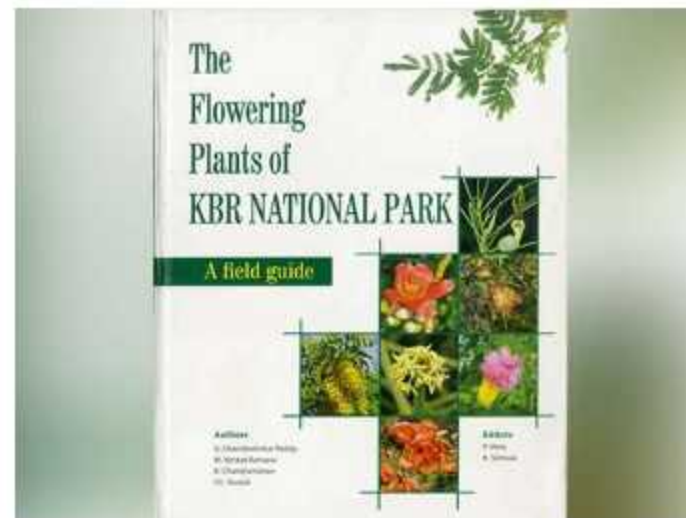
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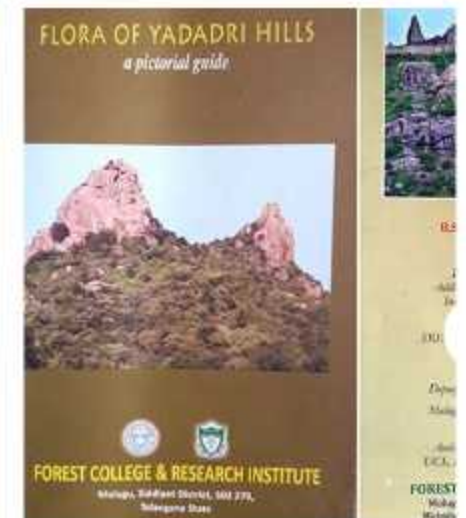
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