International Journal of Applied Engineering and Technology ISSN: 2277-212X (Online)
Online International Journal Available at http://www.cibtech.org/jet.htm
2020 Vol. 10, pp.112-122/Ganesh et al.
***Research Article** (Open Access)*

VEHICLE SPEED CONTROL IN ACCIDENT PRONE ZONE

***Ganesh Babu R.,Manirathnam K., Shyam Sundar S.,Siva R.V. and Yougesh R.**
Department of Electronics and Communication Engineering,
SRM TRP Engineering College, Tiruchirappalli, TN, India
**Author for correspondence: ganeshbaburajendran@gmail.com*

ABSTRACT
In our day today life, time is very important thing so everyone trying to complete the task in less time is the human tendency. Therefore to complete the desired task as early as possible we should increase the speed, for example speed of vehicle. As well as the drivers are not following the rules and regulation given by traffic control department at specific areas.It is happened because of vehicle speed control is on drivers hand and over speed driving are there. The over speed of vehicle is the major problem due to number of accidents are increased much more. To overcome these problems we proposed automatic speed control of vehicle using video processing with small modification in existing system. It reduces the speed of vehicle gradually when the restricted areas are detected. For that video recording is done through small camera of road scene and detection and identification of Road Traffic sign/ speed limit/ school zone/hospital zone is done using CNN algorithm in system and vehicle speed is reduced and alert the driver with a help of buzzer and LCD display.

***Keyword**: Vehicle Speed, Image Recognition, Safety and Accidents*

INDRODUCTION
Vehicle is an integral part of our daily life and its growth incremented day by days. The scenario of increased vehicle density in India from 2001 to 2015 is shown in Fig.1. Due to increased vehicle density and over speed driving causes more accidents. The statistical reports of occurred accidents are shown in Fig.2 (GaneshBabu *et al* 2014).There is lot of reasons behind it. These are increased rate of vehicle density, the Indian roads are not changed upto the expecting level excluding the national highway, multiple functioning at the time of driving the vehicle that is like use of mobile, drink while driving, disobey of traffic rules and regulation, crossing speed limits which is dangerous for your own safety and that of others and many more (Santoso *et al.*, 2019; Nedumaran *et al.*, 2020; Karthika, *et al.*, 2019; GaneshBabu *et al.*, 2019; Karthika *et al.*, 2019; GaneshBabu *et al.*, 2019; Karthika *et al.*, 2019; GaneshBabu *et al.*, 2020; GaneshBabu, *et al.*, 2019; GaneshBabu, *et al.*, 2019; GaneshBabu, *et al.*, 2020; GaneshBabu, *et al.*, 2018; GaneshBabu, *et al.*, 2018; GaneshBabu, *et al.*, 2019). Out of them speed limit at specific areas are very important and it is displayed by traffic control system in sign form. For example in residential areas and market places ideal speed should be maximum upto20 km/hrto 30 km/hr. Secondly in the regions of school and hospital speed limits are kept upto 30 km/hr to 40 km/hr and so on. However, unfortunately most of the drivers are not following the rule of speed limit at specific areas and causes the accidents. These accidents are going on increasing because the whole control of the speed of the vehicle is in driver hand. They do not reduce and control the speed in restricted areas as per rules.

The purpose of the proposed work is to identify the factors contributing to fatal accidents. This is achieved by analyzing road accidents using Convolutional Neural Networks by considering appropriate features and effectively clustering the records. Several combinations of attributes of large datasets are analyzed to discover hidden patterns that are the root cause for accidents. The chances of accident occurrence could be identified by considering various criteria like speed limit and injury severity, time of accidents and drunk driver, month and weather during the accident, lightness and speed limit, human factors, surface and light conditions. The experimental results on road accident data set FARS (Fatality

Analysis Reporting System) generated risk factors that cause fatal accidents which will be helpful in generating safer driving principles.

The purpose of the proposed work is to identify the factors contributing to fatal accidents. This is achieved by analyzing road accidents using Convolutional Neural Networks by considering appropriate features and effectively clustering the records. Several combinations of attributes of large datasets are analyzed to discover hidden patterns that are the root cause for accidents. The chances of accident occurrence could be identified by considering various criteria like speed limit and injury severity, time of accidents and drunk driver, month and weather during the accident, lightness and speed limit, human factors, surface and light conditions. The experimental results on road accident data set FARS (Fatality Analysis Reporting System) generated risk factors that cause fatal accidents which will be helpful in generating safer driving principles.

Roadway traffic is the major issue these days. Increase in number of vehicles moving on roads accelerated the risk of accidents. Of them, fatal accidents is the major issue where people lose their lives. Also, these accidents are unpredictable that they may occur anywhere, anytime. As a human being we should save the lives of people and avoid these accidents. A secure roadway movement is a major concern for both transportation administering organizations and common nationals. Keeping these facts in mind, the aim of this work is to provide safe driving instructions to people moving on the roads and emergency services to people effected in the accident zone. So, factors like weather conditions, collision manner, surface condition, light condition, speed, drunk driver and so on were considered and examined. Analyzed data can be used to give safer driving suggestions and reduce the accident rate. Also, emergency services can be provided to people affected at accident prone area. Data mining is one of the important mechanisms used in Information Technology from previous times. Data mining techniques best works in processing data and identifying the relationship among data. Association rule mining is a method used for finding interesting patterns among variables from huge databases. To find association among data, support and confidence are calculated by placing a threshold value. Finding related data using association rules helps in frequent item set mining.

Classification is performed on data using some classification model suitable to the given set of data. The purpose is to find out the frequent item sets. During classification a model is constructed in which different records of data set with unspecified class labels are separated easily. Naive Bayesian classification is one of the probabilistic methods used to predicate the independence among variable pairs. It strongly assumes and auto correlates the information. Sometimes these assumptions may go wrong. Thus, a better classification technique proposed to efficiently classify the data is Convolution Neural Network. It assumes data based on the locality. The classification technique proposed can be applied on the data to get effective results. The association rule mining algorithm ever used is Apriori. The algorithm efficiently works based on relevant association rules for frequent item set mining. It uses a bottom up approach. The property followed by this algorithm says any subset of frequent item set must be frequent. It uses larger item sets and can be implemented easily. This algorithm is applied on roadway traffic fatal accident dataset to test the data.

LITERATURE SURVEY

(R.GaneshBabu and Dr.V.Amudha 2014). Real Time Embedded System for Accident prevention 2017.This paper presents autonomous accident prevention with security enabling techniques, speed control and accident detection system. The main objective is to design an Atmega328P controller to monitor the zones, which can run on an embedded system and to automatically locate the site of accident and alert concerned people. It should be done automatically as the person involved in the accident may not be in a circumstance to send the information .The proposed system is composed of two separate design units: transmitter unit and receiver unit .Just before the vehicle is in the transmitter zone, the vehicle speed is controlled by receiving the signal from the RF transmitter. For this, RF transmitter can be kept at a few meters before the zone. Security system includes alcohol sensor

(R.GaneshBabu and Dr.V.Amudha 2015) Design and implementation of automatic headlight dimmer for vehicles using light dependent resistor (ldr) sensor 2016. Headlights of vehicles pose a great danger during night driving. The drivers of most vehicles use high, bright beam while driving at night. This causes a discomfort to the person travelling from the opposite direction and therefore experiences a sudden glare for a short period of time. This is caused due to the high intense headlight beam from the other vehicle coming towards the one from the

opposite direction. In this project, an automatic headlight dimmer which uses a Light Dependent Resistor (LDR) sensor has been designed to dim the headlight of on-coming vehicles to avoid human eye effects. This automatically switched the high beam into low beam, therefore reducing the glare effect by sensing the light intensity value of approaching vehicle and also eliminated the requirement of manual switching by the driver which was not done at all times. Mat lab software was employed in designing the project. The Keil software was also employed to program the microcontroller. The system device was able to automatically switch the headlight to low beam when it sensed a vehicle approaching from the opposite side using LDR sensor. It was observed that the maximum spread angle of the headlight was 135o . At the time the spread light from other sources reached the sensor, its intensity would be very much reduced below the triggering threshold level.l. A server module could be included to this system for receiving and storing headlight rays parameters information in a database application.

(R.GaneshBabu, and Dr.V.Amudha 2015). A New Dual Axle Drive Optimization Control Strategy for Electric Vehicles Using Vehicle-to-Infrastructure Communications 2019, In this article, we proposed an optimal torque distribution strategy for pure electric vehicles based on Vehicle-to-Infrastructure (V2I) communication. V2I communication is used to obtain road surface adhesion coefficient, road roughness, and other information. Different speed and torque requirements for different road surface are analyzed. Then, according to motor map characteristics, a dual motor torque optimization distribution control strategy is proposed and a dual motor optimal torque distribution control method for adaptive road surface is established. Finally, the hardware-in-the-loop test system is used to verify the control strategy. New European Driving Cycle is used to simulate the control strategy. The off-line simulation results show that under adaptive road surfaces, the energy optimization rate is improved.

(R.GaneshBabu 2016). Design and implementation of automatic headlight dimmer for vehicles using light dependent resistor (ldr) sensor 2018, In our day today life, time is very important thing so everyone trying to complete the task in less time is the human tendency. Therefore to complete the desired task as early as possiblewe should increase the speed, for example speed of vehicle. If we see the scenarios of vehicle density, it is continuously going on increasing form. As well as the drivers are not following the rules and regulation given by traffic control department at specific areas. But most of the drivers drive the vehicle very fast in that restricted areas with and without reasons. It is happened because of vehicle speed control is on drivers hand and over speeddriving are there. The over speed of vehicle is the major problem due to number of accidents are increased much more (R.GaneshBabu and Dr.V.Amudha 2014). To overcome these problems we proposed automatic speed control of vehicle using video processing with small modification in existing system (R.GaneshBabu and Dr.V.Amudha, 2016 ; R.GaneshBabu, and Dr.V.Amudha, 2018; R.GaneshBabu,2016; R.GaneshBabu, and Dr.V.Amudha, 2016 ; Dr.R.GaneshBabu, *et al* 2019; Rahul Krishnan *et al*.,2017; R.GaneshBabu, and V.Amudha, 2019; R.GaneshBabu, 2016; R.GaneshBabu, 2016; R.GaneshBabu, 2016; R.GaneshBabu, 2016). It reduces the speed of vehicle gradually when the restricted areas are detected. For that video recording is done through small camera of road scene and detection and identification of Road Traffic sign is done using Speeded up Robust Features (SURF) algorithm in MAT LAB Simulink software. To reduce the vehicle speed gradually PID controller is used. The Simulink model is developed in Mat lab environment and results are obtained.

EXISTING SYSTEM

Agent-based approaches have gained popularity in engineering applications, but its potential for advanced traffic controls has not been sufficiently explored. This existing paper presented a multi-agent framework that models traffic control instruments and their interactions with road traffic.A constrained Markov decision process (CMDP) model is used to represent agent decision making in the context of multi-objective policy goals, where the policy goal with the highest priority becomes the single optimization objective and the other goals are transformed as constraints.A reinforcement learning-based computational framework is developed for control applications. To implement the multi-objective decision model, a threshold lexicographicordering method is introduced and integrated with the learning-based algorithm.

DISADVANTAGES

Performance of the intelligent control approach was evaluated by simulation, and compared with several other signal control methods not avoiding vehicle accident in restricted zone

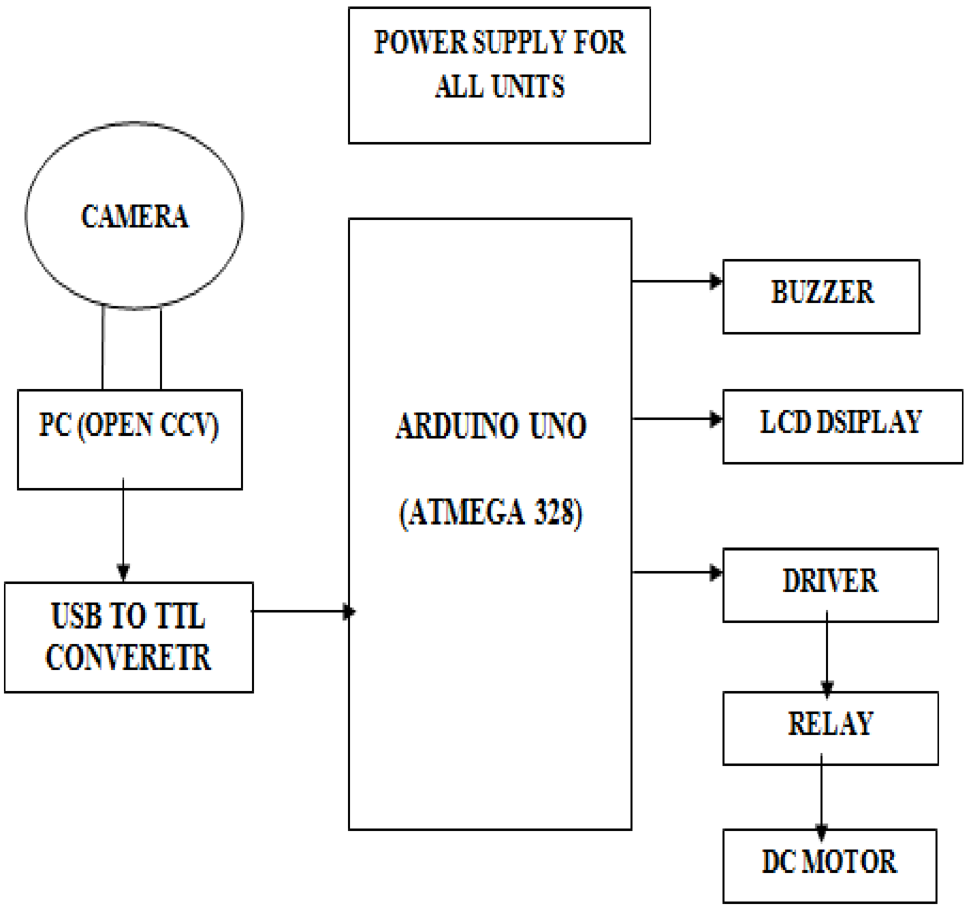
PROPOSED SYSTEM

A Convolutional Neural Network is a class of deep learning, feed-forward artificial neural networks, and most commonly useful for several analyses. They visualize metaphors and Numerical data. It can use a difference of multilayer perceptron designed to need minimal pre-processing. It is very similar to normal Neural Networks. They are made up of neurons that have learned weights and biases. Each neuron receives several inputs, performs a dot product and optionally follows it with a non-linearity. The complete network at rest articulates to achieve the function from the raw input data on one end to achieve the class at the other end. It can make a clear hypothesisthat the inputs allow us to encode certain possessions into the CNN process and then, make the forward function more efficient to implement. They very much reduce the number of parameters in the network. Neural Networks consider an input and transform it through a series of hidden layers. Each hidden layer is made up of a set of neurons, where each neuron is fully connected to all neurons in the previous layer. Neurons in a single layer function in a completely separate manner and do not share any relations. The very last fully-connected layer is called the output layer and it represents the class achieved. There are three main Layers that build Convolutional Neural Networks. They are Convolution Layer, Pooling Layer, and Fully-Connected Layer**.** The input [HxWxD] initially will hold the input values and in this case an input data of width (rows), height (columns), and depth 1 are considered. CONV layer will compute the output of neurons that are connected to local regions in the input. It has independent set of filters that work with the input and a small region is connected to in the input volume. The output volume willbe as [32x32x12] and 12 is the number of filters that were used. RELU layer applies an element wise activation function, such as max (0, x) where zero is threshold value. Here the volume size remains unchanged ([32x32x12]). POOL layer performs down sampling operation throughout the spatial dimensions (width, height). It resultant volume is [16x16x12]. Its function is to reduce the spatial size of the representation progressively. Therefore, it reduces the number of parameters and computation in the network. Fully-connected layer will compute the class scores. It results in volume of size [1x1x10], where each of the 10 numbers corresponds to a class achieve. As with ordinary Neural Networks and as the name implies, each neuron in this layer will be connected to all the numbers in the earlier volume. In this fashion, Convolutional Neural Networks transform the input raw data, layer by layer from the input raw values to the final class scores. Particularly, the Convolution and Fully Connected layers perform transformations that are a function of not only the activations in the input volume, but also of the parameters (the weights and biases of the neurons). On the other hand, the RELU layer and Pooling layer will implement a fixed function. The parameters in the Convolutional and Full-Connected layers will be qualified with gradient descent so that the class scores that the Convolution Neural Networks computes are consistent with the labels in the training set for each input. To implement convolutional neural networks a training dataset is considered as input. The dataset contains numerical values that correspond to some nominal data.

ADVANTAGES

Minimize accidents in accident prone zones such as school, college and hospital zones by reducing the speed of the vehicles using image processing and also giving a warning to the driver about such zones.

ARCHITECTURE DIAGRAM



International Journal of Applied Engineering and Technology ISSN: 2277-212X (Online)
Online International Journal Available at http://www.cibtech.org/jet.htm
2020 Vol. 10, pp.112-122/Ganesh et al.
***Research Article** (Open Access)*

XPERIMENTALRESULT

tf_record.py - E:\vehicle final\vehicle project\PROJECT\tf_record.py (3.6.5)

File Edit Format Run Options Window Help

```
"""
Usage:
  # From tensorflow/models/
  # Create train data:
  python generate_tfrecord.py --csv_input=data/train_labels.csv  --output_
  # Create test data:
  python generate_tfrecord.py --csv_input=data/test_labels.csv  --output_p
"""
from __future__ import division
from __future__ import print_function
from __future__ import absolute_import

import os
import io
import pandas as pd
import tensorflow as tf
#import tensorflow.compat.v1 as tf
from PIL import Image
from object_detection.utils import dataset_util
from collections import namedtuple, OrderedDict

flags = tf.app.flags
#flags = tf.compat.v1.app.flags
flags.DEFINE_string('csv_input', '', 'Path to the CSV input')
flags.DEFINE_string('output_path', '', 'Path to output TFRecord')
flags.DEFINE_string('image_dir', '', 'Path to images')
FLAGS = flags.FLAGS


# TO-DO replace this with label map
def class_text_to_int(row_label):
    if row_label == 'hospital_zone':
        return 1
    elif row_label == 'school_zone':
        return 2
    elif row_label == 'pedestrian_cross':
        return 3
    elif row_label == 'speed_limit':
        return 4
    else:
        return 0
```

train.py - E:\vehicle final\vehicle project\PROJECT\train.py (3.6.5)

File Edit Format Run Options Window Help

```
  assert FLAGS.train_dir, '`train_dir` is missing.'
  if FLAGS.task == 0: tf.gfile.MakeDirs(FLAGS.train_dir)
  if FLAGS.pipeline_config_path:
    configs = config_util.get_configs_from_pipeline_file(
        FLAGS.pipeline_config_path)
    if FLAGS.task == 0:
      tf.gfile.Copy(FLAGS.pipeline_config_path,
                    os.path.join(FLAGS.train_dir, 'pipeline.config'),
                    overwrite=True)
  else:
    configs = config_util.get_configs_from_multiple_files(
        model_config_path=FLAGS.model_config_path,
        train_config_path=FLAGS.train_config_path,
        train_input_config_path=FLAGS.input_config_path)
    if FLAGS.task == 0:
      for name, config in [('model.config', FLAGS.model_config_path),
                           ('train.config', FLAGS.train_config_path),
                           ('input.config', FLAGS.input_config_path)]:
        tf.gfile.Copy(config, os.path.join(FLAGS.train_dir, name),
                      overwrite=True)

  model_config = configs['model']
  train_config = configs['train_config']
  input_config = configs['train_input_config']

  model_fn = functools.partial(
      model_builder.build,
      model_config=model_config,
      is_training=True)

  def get_next(config):
    return dataset_builder.make_initializable_iterator(
        dataset_builder.build(config)).get_next()

  create_input_dict_fn = functools.partial(get_next, input_config)

  env = json.loads(os.environ.get('TF_CONFIG', '{}'))
  cluster_data = env.get('cluster', None)
  cluster = tf.train.ClusterSpec(cluster_data) if cluster_data else None
  task_data = env.get('task', None) or {'type': 'master', 'index': 0}
  task_info = type('TaskSpec', (object,), task_data)

  # Parameters for a single worker.
  ps_tasks = 0
```

labelmap.pbtxt - Notepad

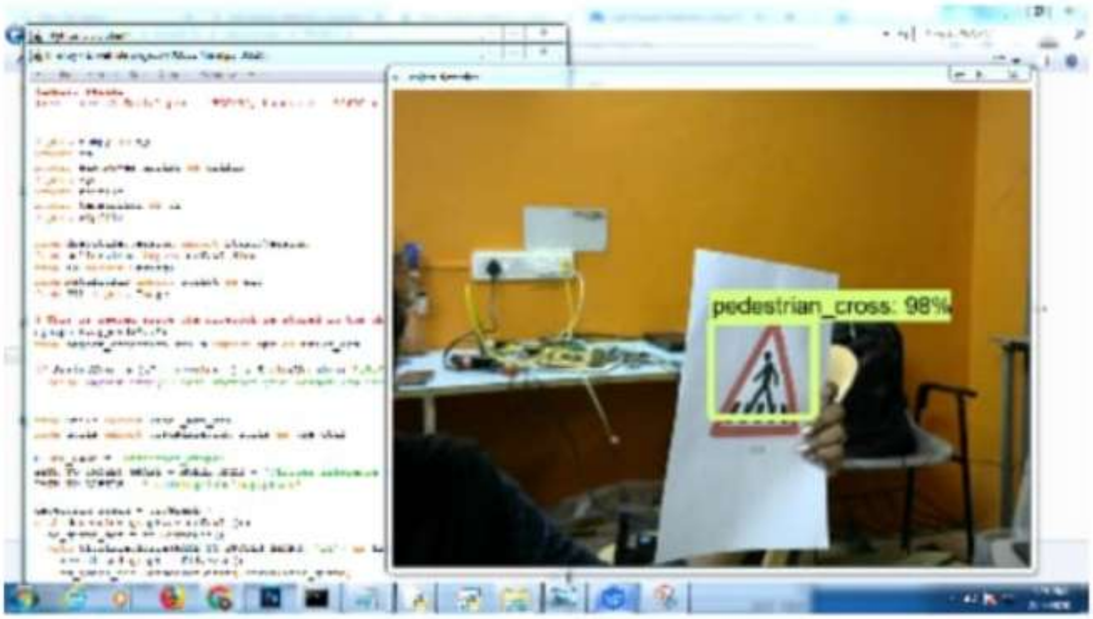
File Edit Format View Help

```
item {
   id: 1
   name: 'hospital_zone'
}

item {
   id: 2
   name: 'school_zone'
}

item {
   id: 3
   name: 'pedestrian_cross'
}

item {
   id: 4
   name: 'speed_limit'
}
```


pedestrian_cross: 98%


school_zone: 77%

CONCLUSION

In this work, a classification technique named Convolution Neural Networks has been used that effectively identified the conditions contributing to fatal accidents. Using these conditions, the public could identify dangerous zones and take measures to avoid accidents. Experimental results have shown that CNN is more efficient than Naïve Bayes classifier in identifying the risk factor and also vehicle speed will be reduced without any invention. In the future it could be planned to make analysis on road accident dataset by considering more features and more clusters and to use deep learning techniques.

REFERENCES

[1] **GaneshBabu R and Dr.V.Amudha (2014)**. *Spectrum Sensing Techniques in Cognitive Radio Networks: A Survey, International Journal of Scientific and Engineering Research*, **5(**4), April, 23-32.

[2] **GaneshBabu R and Dr.V.Amudha (2015).** *Analysis of Distributed Coordinated Spectrum Sensing in Cognitive Radio Networks, International Journal of Applied Engineering Research*, **10**(6) March, 5547-5552.

[3] **GaneshBabu R, and Dr.V.Amudha (2015).** *Performance Analysis of Distributed Coordinated Spectrum Sensing in Cognitive Radio Networks, Middle East Journal of Scientific Research*, **23**(23), May, 50-55.

[4] **GaneshBabu R, (2016)**. *Resource Allocation in QoS Scheduling for IEEE 802.16 Systems, International Journal of Science and Innovative Engineering and Technology*, **1(**5), May, 50-55.

[5] **GaneshBabu R and Dr.V.Amudha (2016).** *Cluster Technique Based Channel Sensing in Cognitive Radio Networks, International Journal of Control Theory and Applications*, **9**(5), May, 207-213.

[6] **GaneshBabu R and Dr.V.Amudha (2018).** *Allow an Useful Interference of Authenticated Secondary User in Cognitive Radio Networks", International Journal of Pure and Applied Mathematics*, **119**(16), May, 3341-3354.

[7] **GaneshBabu R (2016).** *Dynamic Spectrum Access Techniques in Cognitive Radio Networks, International Journal of Emerging Technology in Computer Science and Electronics*, **22**(2), May, 508-512.

[8] **GaneshBabu R and Dr.VAmudha (2016).** *Spectrum Sensing Cluster Techniques in Cognitive Radio Networks", Proceedings of 4th International Conference on Recent Trends in Computer Science and Engineering (ICRTCSE'16) in association with Elsevier-Procedia Computer Science, Apollo Engineering College, Chennai, India,* April 29-30, 258-263.

[9] **Dr. GaneshBabu R, P.Karthika, and K.Elangovan (2019)**. *Performance Analysis for Image Security Using SVM And ANN Classification Techniques, Proceedings of Third IEEE International Conference on Electronics, Communication and Aerospace Technology (ICECA 2019) with ISBN.No-978-1-7281-0167-5, RVS Technical Campus, Coimbatore, India,* June 12-14, 460-465.

[10] **Krishnan Rahul, R.GaneshBabu, S.Kaviya, N.Pragadeesh Kumar, C.Rahul, and S.Santhana Raman (2017)**. *Software Defined Radio (SDR) Foundations, Technology Tradeoffs: A Survey, Proceedings of IEEEInternational Conference on Power, Control, Signals & Instrumentation Engineering(ICPCSI' 17) with ISBN.No-978-1-5386-0814-2, Saveetha Engineering College, Chennai, India,* September 21-22,2677-2682.

[11] **GaneshBabu R, and V.Amudha (2019)**. *A Survey on Artificial Intelligence Techniques in Cognitive Radio Networks, In: Abraham A., Dutta P., Mandal J., Bhattacharya A., Dutta S. (eds) Emerging Technologies in Data Mining and Information Security.Advances in Intelligent Systems and Computing*, **755**, 99–110. Springer, Singapore,.

[12] **GaneshBabu R (2016).** *Helium's Orbit Internet of Things (IoT) Space, International Journal of Computer Science and Wireless Security*, **03**(02), Mar-Apr, 123-124.

[13] **GaneshBabu,R (2016).** *Mismatch Correction of Analog to Digital Converter in Digital Communication Receiver, International Journal of Advanced Research Trends in Engineering and Technology*, **3(**19), April, 264-268.

[14] **GaneshBabu R (2016).** *WIMAX Capacity Enchancements Introducing Full Frequency Reuse Using MIMO Techniques, International Journal of Advanced Research in Biology Engineering Science and Technology,* **2**(6), May, 1-7.

[15] **GaneshBabu R (2016).** *Cognitive Radios Spectrum Allocation in Wireless Mesh Networks, International Journal of Global Research and Development*, **1**(6), July, 289-294.

[16] **Santoso LW, R GaneshBabu and S SumanRajest, (2019).** *A Genetic Programming Approach to Binary Classification Problem, International Journal of Innovative Computing and Applications, in Press*

[17] **Nedumaran A, R.GaneshBabu, Mesmer MeseleKass and P.Karthika (2020)**. *Machine Level Classification Using Support Vector Machine, AIP Conference Proceedings of International Conference on Sustainable Manufacturing, Materials and Technologies (ICSMMT 2019), Coimbatore, India*, October 25-26, , **2207**(1), 020013-1–020013-10.

[18] **Karthika P, R GaneshBabu and PA Karthik (2019).** *Fog Computing using Interoperatibility and IoT Security Issues in Health Care*. *In: Devendra Kumar Sharma., Valentina Emilia Balas., Le Hoang Son.,Rohit Sharma., KorhanCengi. (eds) Proceedings of Third International Conference on Micro-Electronics and Telecommunication Engineering. Lecture Notes in Networks and Systems, Springer, in Press*

[19] **GaneshBabu R, P Karthika and G Manikandan (2019).** *Polynomial Equation Based Localization and Recognition Intelligent Vehicles Axis using Wireless Sensor in MANET, In: Second International Conference on Computational Intelligence and Data Science in association with Elsevier-Procedia Computer Science, Gurugram, India, in Press*

[20] **Karthika P, R GaneshBabu and K Jayaram (2019**). *Biometric Based on Steganography Image Security in Wireless Sensor Networks, In: Second International Conference on Computational Intelligence and Data Science in association with Elsevier-Procedia Computer Science, Gurugram, India, in Press*

[21] **GaneshBabu R, M.N.Saravana Kumar and R Jayakumar (2019).** *Dynamic Exchange Buffer Switching and Blocking Control in Wireless Sensor Networks. In: Devendra Kumar Sharma., Valentina Emilia Balas., Le Hoang Son.,Rohit Sharma., KorhanCengi. (eds) Proceedings of Third International Conference on Micro-Electronics and Telecommunication Engineering. Lecture Notes in Networks and Systems, Springer, in Press*

[22] **Karthika P, R GaneshBabu and A Nedumaran (2019)**. *Machine Learning Security Allocation in IoT, In: IEEE International Conference on Intelligent Computing and Control Systems, Madurai, India, in press*.

[23] **GaneshBabu R, P Karthika and V AravindaRajan (2020).** *Secure IoT Systems Using Raspberry Pi Machine Learning Artificial Intelligence. In:Smys S., Senjyu T., Lafata P. (eds) Proceedings of Second International Conference on Computer Networks and Inventive Communication Technologies. Lecture Notes on Data Engineering and Communications Technologies*,**44**, 797–805. Springer, Singapore,.

[24] **Dr.GaneshBabu R, Dr.A.Nedumaran and AsefaSisay**. *Machine Learning in IoTSecurity Performance Analysis of Outage Probability of Link Selection for Cognitive Networks,In: IEEE Third International Conference on IOT in Social, Mobile, Analytics and Cloud(I-SMAC), Palladam, India*,15-19.

[25] **Dr. GaneshBabu R, D.Antony Joseph Rajan and SudhanshuMaurya (2019).** *Multi Data Users Using Novel Privacy Preserving Protocol in Cloud Networks", Fourth International Conference on Information and Communication Technology for Competitive Strategies (ICTCS-2019) in association with CRC Press (Taylor and Francis Group), Udaipur, Rajasthan, India,* Dec 13-14, in Press

[26] **Dr. GaneshBabu R, Dr.G.Ramesh, and G.Manikandan (2019).** *A survey of Fog and Cloud Computing Framework based on IoT Signal Solutions for Secure Communication, Universal Journal of Electrical and Electronic Engineering, in Press*.

[27] **GaneshBabu R, Dr.V.Amudha and Ms.P.Karthika, (2020).** *Machine Learning and Cognitive Computing for Mobile Communications and Wireless Networks, (eds.) Dr. Krishna Kant Singh, Dr.KorhanCengiz, Dr.Dac-Nhuong Le, Dr.Akansha Singh Scrivener Publishing Partnering with Wiley*, 133-141.

[28] **GaneshBabu R and Dr.V.Amudha (2018).** *Comparative Analysis of Distributive Firefly Optimized Spectrum Sensing Clustering Techniques in Cognitive Radio Networks, Journal of Advanced Research in Dynamical and Control Systems*, **10**(9) June, 1364-1373.

[29] **GaneshBabu R and Dr.V.Amudha (2018).** *Comparative Analysis of Distributive Optimized Clustering Techniques in Cognitive Radio Networks, International Journal of Engineering and Technology-UAE*, **7**(3).27, August, 504-507.

[30] **GaneshBabu R and Dr.V.Amudha (2019)**. *Distributed Cooperative AI Techniques for Cognitive Radio Networks, International Journal of Recent Technology and Engineering*, **8**(1)S2, May 198-203.