"MACHINE LEARNING BASED CAR DAMAGE IDENTIFICATION"

Article · June 2023

CITATIONS
15

READS
48

3 authors, including:

Rupesh Chandrakant Jaiswal
Pune Institute Of Computer Technology
89 PUBLICATIONS **1,011** CITATIONS

SEE PROFILE

JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

"MACHINE LEARNING BASED CAR DAMAGE IDENTIFICATION"

1Mansi Satpute, 2Sahil Kadadekar, 3Dr. Rupesh C. Jaiswal
1Student, 2Student, 3Professor
1,2,3Department of Electronics and Telecommunication,
1,2,3SCTR's Pune Institute of Computer Technology, Pune, India.

1. ABSTRACT

In this paper, we have designed and used a car injury severance pipeline, which can be used by insurance companies to automate car insurance claims. Recent developments in Computer vision are largely due to the adoption of fast, scalable, and end-to-end training networks of Convolutional Neural Networks (CNNs) making it technically possible to detect motor vehicle damage through deep transforming networks. We collected and commented on various online sources using a web browser containing various types of vehicle damage. Due to the small size of our database, we have used pre-trained large models and various data sets to avoid overcrowding and to learn common features. Using pre-trained CNN models ImageNet data set and advanced processing techniques to improve our system's performance, we obtained 96.39% accuracy, which is much better than the results obtained in the past in the same test set. In addition to locating the damage site, we used the YOLO modern scanner and obtained a high score of 77.78% on the captured test set, indicating that the model was able to successfully detect various vehicle damage. In addition, we have also developed a solid pipeline for identifying damage to vehicles by integrating segmentation and acquisition activities. All in all these results paved the way for further research on this problem area and we believe that the collection of various databases will be sufficient to use the automated vehicle diagnostic system soon.

2. INTRODUCTION

Many cars rental services around the world rent the car orient of the count of hours or days. However, after using the car may have been damaged. Even though there are many automatic car damage detection systems, human intervention is also required, and also the accuracy is very less when compared with recent development in the

field of data science. So there is an urgent requirement to develop a system with improved accuracy which eliminates human intervention. Research on damage detection has been conducted in various areas been actively conducted. In this paper, we use the Convolutional Neural Network (CNN) method to classify the types of motor vehicle injuries. In particular, we consider the most common types of damage such as bump bumps, door bills, broken glass, broken headlamps, broken tail lamps, scratching, and cracking. To the best of our knowledge, no public data is available for the classification of vehicle damage. So, we created our database by collecting images on the web and interpreting them in person. The task of differentiation is challenging due to factors such as high segment, and apparent damage. We tried many techniques such as direct CNN training, pre-training CNN using an automated configuration followed by fine editing, transfer learning from major CNNs trained in ImageNet, and building an integrated classifier over the previous set. -sprained dividers. We see that transfer combined learning and integrated learning work much better. We also include localization of some kind of damage. Test results confirm the effectiveness of the proposed solution.

3. LITERATURE SURVEY

Machine Learning Techniques for Detecting Insurance Claims Fraud [1]. Written by Riya Roy, Thomas George K. Identify and collect data with necessary attributes. Perform necessary data cleansing Segregate data into a training set and testing set Select algorithm like a decision tree and random forest Execute algorithm with training data Evaluate algorithm with testing data Use classified for the new dataset. Form a confusion matrix that provides information on the false positive, false negative, true positive, and true negative. The decision tree and Random Forest algorithm have better performance than naïve Bayes and calculate the accuracy, precision, and recall. Limitation- use only a large dataset the number of samples used in this paper is small. The explanatory variables involved in the sample are fewer, which reduced the prediction accuracy of the model to a certain extent. Research and Application of Random Forest Model in Mining Automobile Insurance Fraud [2]. Yaqi Li, Chun Yan, Wei Liu, Maozhen Li. Random Forest was used for the classification and prediction. The data used was the automobile insurance data of a vehicle insurance company in 2011. The sample contains 1000 data. choose the following 10 indexes from the customer's basic insurance information. A tool used- R software The 10 indicators include insurance maturity (V1), vehicle property (V2), automated underwriting (V3), car-testing (V4), site report (V5), driver gender (V6), survey type (V7), repair-shop type (V8), number of damage photos (V9) and historical times (not including this time) (V10). Automatic License Plate Detection System Based on the Point Weighting and Template Matching [3]. Hossein Vahid Dastjerdi, Vahid Rostami, and Farid Kheiri Pre-processing Obtaining the center of the weight for the pixels of the boundary. Through the use of line templates, a plane's existing lines can be obtained. Finding a required template for locating the license plate. Comparing the proposed model with other techniques being used currently in the industry, the proposed model is capable of recognizing license plates in the fixed distance range faster. Besides the 93% accuracy rate of this method, it can work in environments with strong noise. Through the use of line templates, a plane's existing lines can be obtained. Finding a required template for locating the license plate. Comparing the proposed model with other techniques being used currently in the

industry, the proposed model is capable of recognizing license plates in the fixed distance range faster. Also, the role of ML and ESPs [11-69] are becoming important in recent applications, recognition, and control.

4. PROPOSED BLOCK DIAGRAM

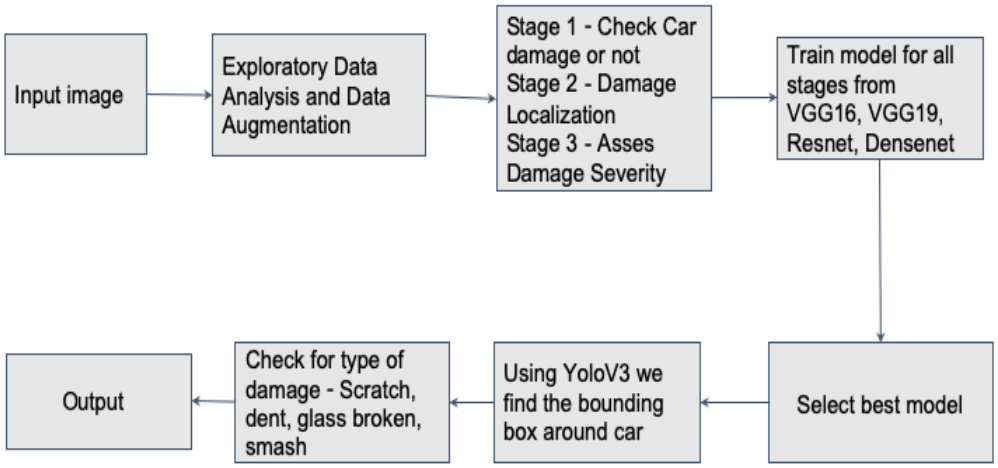

Fig 1. Block Diagram

In image analysis, CNNs are mostly used to recognize images, detect objects, and segment them.

1) Convolutional Layer

2) Pooling Layer

3) Fully-Connected layer

The architecture of our proposed technique is to give out a car damage assessment method. First, the user will give an input image and our model will detect if the image is of a car or not then it detects whether the car in the image is damaged or not then it detects the location of the damage i.e., front, rear, side and finally it detects the severity of the damage. Then finally it passes the parameters to another model which predicts the probability of the insurance that the user can claim.

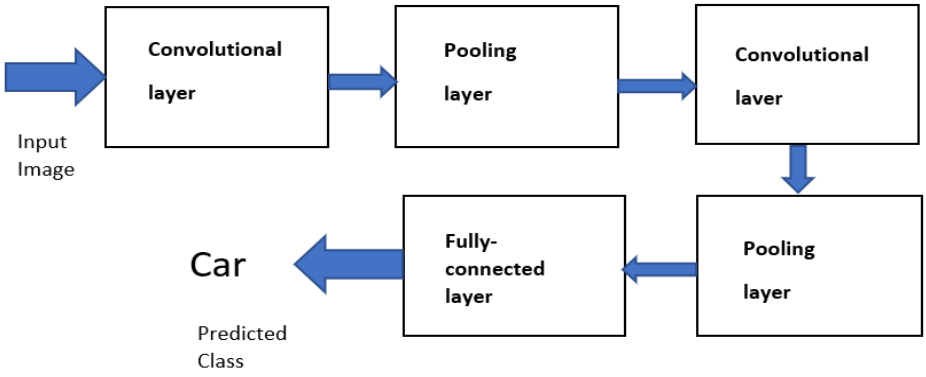

Fig 2. CNN Architecture and Class Prediction

Class1: Damage Detected, Glass Broken and Dent,
Class2: Damage Detected, Scratch Only,
Class3: Damage Detected, Scratch and Dent,
Class4: Damage Detected, None,

5. CONCLUSION

After renting a car from a car rental service in case the car is damaged, then by using the Car Damage Assessment website successful detection is possible by uploading an image by the user of whether it is damaged or not, and if it is damaged then what is its damage type? Accuracy could be improved further; it could be trained for another dataset of two-wheelers or trucks. An expanded dataset would improve the results and make this system more effective in real-life situations.

6. FUTURE SCOPE

1. We could get more data by downloading images so that the training accuracy improves.
2. Using Cloud services to deploy the web app

ACKNOWLEDGEMENT

It has been a pleasure working with all the members in completing this research work and paper. Throughout my research work, Dr. Rupesh Jaiswal Sir provided me with all the necessary guidance. Lastly, I would like to express my appreciation to all my close friends, family members, and other members who have directly or indirectly contributed to the successful completion of this research work.

REFERENCES

[1] R. Roy and K. T. George, "Detecting insurance claims fraud using machine learning techniques," 2017 International Conference on Circuit, Power and Computing Technologies (ICCPCT), 2017, pp. 1-6, DOI: 10.1109/ICCPCT.2017.8074258.

[2] Aayush Bhardwaj, Ankit Gupta, Pallav Jain, Asha Rani, and Jyoti Yadav," Classification of human emotions from EEG signals using SVM and LDA classifiers", In IEEE International Conference on Signal Processing and Integrated Networks (SPIN), pages 180 185, Noida, Feb. 2015.

[3] Zhu, Z., Chen, H., Hu, Y. et al., Age estimation algorithm of facial images based on multi-label sorting Eurasip Journal of Image Video Proc. (2018) 2018: 114

[4] Sivanandan and Deepa, Principles of Soft Computing, II edition, Wiley Publication, 2013. India

[5] U. Waqas, N. Akram, S. Kim, D. Lee, and J. Jeon, "Vehicle Damage Classification and Fraudulent Image Detection Including Moiré Effect Using Deep Learning," 2020 IEEE Canadian Conference on Electrical and Computer Engineering (CCECE), 2020, pp. 1-5, DOI: 10.1109/CCECE47787.2020.9255806.

[6] M. Koch, H. Wang, and T. Bäck, "Machine Learning for Predicting the Damaged Parts of a Low-Speed Vehicle Crash," 2018 Thirteenth International Conference on Digital Information Management (ICDIM), 2018, pp. 179-184, DOI: 10.1109/ICDIM.2018.8846974.

[7] Q. Zhang, X. Chang and S. B. Bian, "Vehicle-Damage-Detection Segmentation Algorithm Based on Improved Mask RCNN," in IEEE Access, vol. 8, pp. 6997-7004, 2020, DOI: 10.1109/ACCESS.2020.2964055.

[8] G. Kowshalya and M. Nandhini, "Predicting Fraudulent Claims in Automobile Insurance," 2018 Second International Conference on Inventive Communication and Computational Technologies (ICICCT), 2018, pp. 1338-1343, DOI: 10.1109/ICICCT.2018.8473034.

[9] J. Wu, J. Wang, and Y. Liu, "Design and Research of Insurance Survey Claims System Based on Big Data Analysis," 2019 International Conference on Virtual Reality and Intelligent Systems (ICVRIS), 2019, pp. 211-214, DOI: 10.1109/ICVRIS.2019.00059.

[10] Goundar, Sam, et al. "Health Insurance Claim Prediction Using Artificial Neural Networks." IJSDA vol.9, no.3 2020: pp.40-57. http://doi.org/10.4018/IJSDA.2020070103.

[11] Jaiswal R.C. and Lokhande S.D., "Systematic Performance Analysis of Bit-Torrent Traffic", Helix SCI INDEXED E-ISSN: 2319-5592; P-ISSNs: 2277-3495, Helix Vol. 9 (2): pp. 4858- 4863, DOI 10.29042/2019-4858-4863, April 2019.

[12] Jaiswal R.C. and Aishwarya Gaikwad, "Experimental Analysis of Bit torrent Traffic based on Heavy-Tailed Probability Distributions", International Journal of Computer Applications, ISSN No. (0975 – 8887),Impact Factor .3.1579(2016),Volume 155 – No 2, December 2016.

[13] Jaiswal R.C. and Lokhande S.D., "Evaluation of Effect of Seeds and downloaders on the Performance of Bit Torrent Network using Markov Chain Modelling", Journal of Communication Engineering & Systems, Volume 6, Issue 1. (ISSN: 2321-5151 (print version), ISSN: 2249-8613 (electronic version) IF (2016): 0.709).

[14] Jaiswal R.C. and Lokhande S.D., A. Ahmed, P. Mahajan, "Performance Evaluation of Clustering Algorithms for IP Traffic Recognition", International Journal of Science and Research (IJSR), volume-4, Issue-5, May-2015, pp. 2786-2792. (ISSN (Online): 2319-7064, Index Copernicus Value (2013): 6.14|Impact Factor (2013):4.438

[15] Jaiswal R.C. and Lokhande S.D., Gulavani Aditya "Implementation and Analysis of DoS Attack Detection Algorithms", International Journal of Science and Research (IJSR), volume-4, Issue-5, May-2015, pp. 2085-2089. (ISSN (Online): 2319-7064, Index Copernicus Value (2013): 6.14 | Impact Factor (2013):4.438

[16] Jaiswal R.C. and Lokhande S.D., "Performance Analysis for IPv4 and IPv6 Internet Traffic", ICTACT Journal on Communication Technology, September 2015, volume: 06, issue: 04, pp. 1208-1217. (Print: ISSN: 0976-0091, Online ISSN:2229-6948 (Impact Factor: 0.789 in 2015).

[17] Jaiswal R.C. and Lokhande S.D, "Performance Evaluation of Wireless Networks", Coimbatore Institute of Information Technology International Journal, volume-7, Issue-8, July-2015, pp. 1237-1242. (Print: ISSN 0974 – 9616 |Impact Factor: 0.572)

[18] Jaiswal R.C. and Lokhande S.D, "A Novel Approach for Real Time Internet Traffic Classification", ICTACT Journal on Communication Technology, September 2015, volume: 06, issue: 03, pp. 1160-1166. (Print: ISSN: 0976-0091, Online ISSN:2229-6948 (Impact Factor: 0.789 in 2015).

[19] Jaiswal R.C. and Lokhande S.D, "Measurement, Modeling and Analysis of HTTP Web Traffic", IMCIET-International Multi Conference on Innovations in Engineering and Technology-ICCC-International Conference on Communication and Computing -2014, PP-242-258, ISBN:9789351072690, VVIT, Bangalore.

[20] Jaiswal R.C. and Lokhande S.D, "Comparative Analysis using Bagging, Logit Boost and Rotation Forest Machine Learning Algorithms for Real Time Internet Traffic Classification", IMCIP-International Multi Conference on Information Processing –ICDMW- International Conference on Data Mining and Warehousing-2014, PP113-124, ISBN: 9789351072539, University Visvesvaraya College of Engg. Department of Computer Science and Engineering Bangalore University, Bangalore.

[21] Jaiswal R.C. and Lokhande S.D, "Statistical Features Processing Based Real Time Internet Traffic Recognition and Comparative Study of Six Machine Learning Techniques", IMCIP- International Multi Conference on Information Processing-(ICCN- International Conference on Communication Networks-2014, PP-120-129, ISBN: 9789351072515, University Visvesvaraya College of Engg. Department of Computer Science and Engineering Bangalore University, Bangalore.

[22] Jaiswal R.C. and Lokhande S.D, "Analysis of Early Traffic Processing and Comparison of Machine Learning Algorithms for Real Time Internet Traffic Identification Using Statistical Approach ", ICACNI-2014-International Conference on Advanced Computing, Networking, and Informatics), Kolkata, India, DOI: 10.1007/978-3-319-07350-7_64, Volume 28 of the book series Smart Innovation, Systems and Technologies (SIST),Page:577-587.

[23] Jaiswal R.C. and Lokhande S.D, "*Machine* Learning Based Internet Traffic Recognition with Statistical Approach ", INDICON-2013-IIT Bombay IEEE Conference. Inspec Accession Number: 14062512, DOI: 10.1109/INDCON.2013.6726074.

[24] Jaiswal R.C. and Aryan Bagade, " Metaverse Simulation Based on VR, Blockchain, and Reinforcement Learning Model", International Journal for Research in Applied Science & Engineering Technology (IJRASET), Open Access, Peer Reviewed and refereed Journal, ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:7.538, Volume 10 Issue X, pp. 67-75, October 2022.

[25] Jaiswal R. C. and Atharva Agashe, " A Survey Paper on Cloud Computing and Migration to the Cloud", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, Indexed in Google Scholar, Microsoft Academic, CiteSeerX, Thomson Reuters, Mendeley : reference manager, ISSN-2349-5162, Impact Factor:7.95, Volume 9, Issue 10 pp. a258-a265, October 2022.

[26] Jaiswal R. C. and Taher Saraf, " Stock Price Prediction using Machine Learning", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, Indexed in Google Scholar, Microsoft Academic, CiteSeerX, Thomson Reuters, Mendeley : reference manager, ISSN-2349-5162, Impact Factor:7.95, Volume 9, Issue 9 pp. e33-e41, September 2022.

[27] Jaiswal R. C. and Ritik Manghani, "Pneumonia Detection using X-rays Image Preprocessing", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, Indexed in Google Scholar, Microsoft Academic, CiteSeerX, Thomson Reuters, Mendeley : reference manager, ISSN-2349-5162, Impact Factor:7.95, Volume 9, Issue 9 pp. c653-c662, September 2022.

[28] Jaiswal R. C. and Apoorva Ushire, " Real Time Water Monitoring System Using NodeMCU ESMP8266 ", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, Indexed in Google Scholar, Microsoft Academic, CiteSeerX, Thomson Reuters, Mendeley : reference manager, ISSN-2349-5162, Impact Factor:7.95, Volume 9, Issue 9 pp. c1-c8, September 2022.

[29] Jaiswal R. C. and Firoz Saherawala, " Smart Glasses ", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, Indexed in Google Scholar, Microsoft Academic, CiteSeerX, Thomson Reuters, Mendeley : reference manager, ISSN-2349-5162, Impact Factor:7.95, Volume 9, Issue 8 pp. f393-f401, August 2022.

[30] Jaiswal R. C. and Asawari Walkade, " Denial of Service Detection and Mitigation ", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, Indexed in Google Scholar, Microsoft Academic, CiteSeerX, Thomson Reuters, Mendeley : reference manager, ISSN-2349-5162, Impact Factor:7.95, Volume 9, Issue 5 pp. f108-f116, May 2022.

[31] Jaiswal R. C. and Fiza Shaikh, " Augmented Reality based Car Manual System ", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, Indexed in Google Scholar, Microsoft Academic, CiteSeerX, Thomson Reuters, Mendeley : reference manager, ISSN-2349-5162, Impact Factor:7.95, Volume 9, Issue 5 pp. c326-c332, May 2022.

[32] Jaiswal R. C. and Tejveer Pratap, " Multiparametric Monitoring of Vital Signs in Clinical and Home Settings for Patients ", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, Indexed in Google Scholar, Microsoft Academic, CiteSeerX, Thomson Reuters, Mendeley : reference manager, ISSN-2349-5162, Impact Factor:7.95, Volume 9, Issue 5 pp. a701-a705, May 2022.

[33] Jaiswal R. C. and Sahil Nahar, "Recognition and Selection of Learning Styles to Personalize Courses for Students", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, Indexed in Google Scholar, Microsoft Academic, CiteSeerX, Thomson Reuters, Mendeley : reference manager, ISSN-2349-5162, Impact Factor:7.95, Volume 9, Issue 2 pp. b235-b252, February 2022.
[34] Jaiswal R. C. and Rushikesh Karwankar, " Demand Forecasting for Inventory Optimization ", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, Indexed in Google Scholar, Microsoft Academic, CiteSeerX, Thomson Reuters, Mendeley : reference manager, ISSN-2349-5162, Impact Factor:7.95, Volume 8, Issue 12 pp. 121-131, January 2022.
[35] Jaiswal R. C. and P. Khore, " Exo-skeleton Arm ", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, Indexed In Google Scholar, Microsoft Academic, CiteSeerX, Thomson Reuters, Mendeley : reference manager, ISSN-2349-5162, Impact Factor:7.95, Volume 8, Issue 12 pp. 731-734, December 2021.
[36] Jaiswal R. C. and Shreyas Nazare, " IoT Based Home Automation System", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, ISSN-2349-5162, Impact Factor:7.95, Volume 8, Issue 11 pp. 151-153, November 2021.
[37] Jaiswal R. C. and Prajwal Pitlehra, "Credit Analysis Using K-Nearest Neighbours' Model", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, ISSN-2349-5162, Impact Factor:7.95, Volume 8, Issue 5, pp. 504-511, May 2021.
[38] Jaiswal R. C. and Rohit Barve, "Energy Harvesting System Using Dynamo", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, ISSN-2349-5162, Impact Factor:7.95, Volume 8, Issue 5, pp. 278-280, May 2021.
[39] Jaiswal R. C. and Sharvari Doifode, "Virtual Assistant", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, ISSN-2349-5162, Impact Factor:5.87, Volume 7, Issue 10, pp. 3527-3532, October 2020.
[40] Jaiswal R. C. and Akshat Kaushik, "Automated Attendance Monitoring system using discriminative Local Binary Histograms and PostgreSQL", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, ISSN-2349-5162, Impact Factor:5.87, Volume 7, Issue 11, pp. 80-86, November 2020.
[41] Jaiswal R. C. and Danish khan, "Arduino based Weather Monitoring and Forecasting System using SARIMA Time-Series Forecasting", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, ISSN-2349-5162, Impact Factor:5.87, Volume 7, Issue 11, pp. 1149-1154, November 2020.
[42] Jaiswal R.C. and Param Jain, "Augmented Reality based Attendee Interaction at Events", International Journal for Research in Applied Science & Engineering Technology (IJRASET), Open Access, Peer Reviewed and refereed Journal, ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:7.429, Volume 8 Issue VI, pp. 1578-1582, June 2020.
[43] Jaiswal R.C. and Akash Pal, "Cosmetics Application Using Computer Vision", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, ISSN-2349-5162, Impact Factor:5.87, Volume 7, Issue 6, pp. 824-829, June 2020.
[44] Jaiswal R.C. and Jaydeep Bhoite, "Home Renovation Using Augmented Reality", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, ISSN-2349-5162, Impact Factor:5.87, Volume 7, Issue 6, pp. 682-686, June 2020.
[45] Jaiswal R.C. and Aashay Pawar, "Stock Market Study Using Supervised Machine Learning", International Journal of Innovative Science and Research Technology (IJISRT), Open Access, Peer Reviewed and refereed Journal , ISSN: 2456-2165; IC Value: 45.98; SJ Impact Factor:6.253, Volume 5 Issue I, pp. 190-193, Jan 2020.
[46] Jaiswal R.C. and Deepali Kasture, "Pillars of Object-Oriented System", International Journal for Research in Applied Science & Engineering Technology (IJRASET), Open Access, Peer Reviewed and refereed Journal , ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:7.177, Volume 7 Issue XI, pp. 589-591, Nov 2019.
[47] Jaiswal R.C. and Yash Govilkar, "A Gesture Based Home Automation System", International Journal for Research in Applied Science & Engineering Technology (IJRASET), Open Access, Peer Reviewed and refereed Journal, ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:7.177, Volume 7 Issue XI, pp. 501-503, Nov 2019.
[48] Jaiswal R.C. and Onkar Gagare, "Head Mounted Display", International Journal for Research in Applied Science & Engineering Technology (IJRASET), Open Access, Peer Reviewed and refereed Journal, ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:7.177, Volume 7 Issue XI, pp. 535-541, Nov 2019.
[49] Jaiswal R.C. and Nehal Borole, "Autonomous Vehicle Prototype Development and Navigation using ROS", International Journal for Research in Applied Science & Engineering Technology (IJRASET), Open Access, Peer Reviewed and refereed Journal, ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:7.177, Volume 7 Issue XI, pp. 510-514, Nov 2019.
[50] Jaiswal R.C. and Vaibhav Pawar, "Voice and Android Application Controlled Wheelchair", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, ISSN-2349-5162, Volume 6, Issue 6, pp. 635-637, June 2019.
[51] Jaiswal R.C. and Shreya Mondhe, " Waste Segregation & Tracking", International Journal for Research in Applied Science & Engineering Technology (IJRASET), Open Access, Peer Reviewed and refereed Journal , ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:7.429, Volume 8, Issue 5, pp. 2085-2087, May 2019.
[52] Jaiswal R.C. and Shreya Mondhe, "Stock Market Prediction Using Machine Learning & Robotic Process Automation", Journal of Emerging Technologies and Innovative Research (JETIR), Open Access, Peer Reviewed and refereed Journal, ISSN-2349-5162, Volume 6, Issue 6, pp. 926-929, February 2019.
[53] Jaiswal R.C. and Samruddhi Sonare, "Smart Supervision Security System Using Raspberry Pi ", Journal of Emerging Technologies and Innovative Research (JETIR), ISSN-2349-5162, Volume 6, Issue 4, pp. 574-579, April 2019.
[54] Jaiswal R.C. and Manasi Jagtap, "Automatic Car Fragrance Dispensing System", International Journal of Research and Analytical Reviews (IJRAR), ISSN-2349-5138, Volume 6, Issue 1, pp. 315-319, March 2019.
[55] Jaiswal R.C. and Sumukh Ballal, "Scalable Healthcare Sensor Network", Journal of Emerging Technologies and Innovative Research (JETIR), ISSN-2349-5162, Volume 6, Issue 2, pp. 350-354, February 2019.
[56] Jaiswal R.C. and Samruddhi Sonare, "Multiple Camera Based Surveillance System Using Raspberry Pi", International Journal of Research and Analytical Reviews (IJRAR), ISSN-2348-1269, Volume 6, Issue 1, pp. 1635-1637, February 2019.
[57] Jaiswal R.C. and Reha Musale, "Application of Digital Signature to Achieve Secure Transmission", International Journal for Research in Applied Science & Engineering Technology (IJRASET),ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887, Volume 7 Issue II, pp. 150-153, February 2019.
[58] Jaiswal R.C. and Himanshu Mithawala, "Automatic Gate Monitoring System", Journal of Emerging Technologies and Innovative Research (JETIR), ISSN-2349-5162, Volume 6, Issue 1,pp. 88-94, January 2019.
[59] Jaiswal R.C. and Bernard Lewis, "Dynamic Runway and Gate Terminal Allocation for Flights", Journal of Emerging Technologies and Innovative Research (JETIR), UGC approved Journal, ISSN-2349-5162, Volume 5, Issue 12, December 2018.
[60] Jaiswal R.C. and Sakshi Jain, "Text Search Engine",', Journal of Emerging Technologies and Innovative Research (JETIR), UGC approved Journal ISSN-2349-5162, Volume 5, Issue 11, November 2018.
[61] Jaiswal R.C. and Arti Gurap, "Design of Different Configurations of Truncated Rectangular Microstrip Patch Antenna For 2.4 GHz And 1.6 GHz ', Journal of Emerging Technologies and Innovative Research (JETIR),UGC Approved Journal, ISSN-2349-5162, Volume 5, Issue 10, October 2018.
[62] Jaiswal R.C. and Atharva Mahindrakar, " Mine Warfare and Surveillance Rover", International Journal for Research in Applied Science & Engineering Technology (IJRASET), ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887, Volume 6 Issue III, March 2018.
[63] Jaiswal R.C. and Saloni Takawale "Multi-Client Server Communication Enhancement through Intranet", International Journal for Research in Applied Science & Engineering Technology (IJRASET), ISSN: 2321-9653; UGC approved Journal, IC Value: 45.98; SJ Impact Factor :6.887, Volume 6 Issue 1, January 2018.
[64] Jaiswal R.C. and Nikita Kakade, "Skin disease detection and classification using Image Processing Techniques", Journal of Emerging Technologies and Innovative Research (JETIR), ISSN-2349-5162; UGC approved Journal:5.87, Volume 4, Issue 12, December 2017.
[65] Jaiswal R.C. and Nikita Kakade, "OMR Sheet Evaluation Using Image Processing", Journal of Emerging Technologies and Innovative Research (JETIR), ISSN-2349-5162; UGC approved Journal:5.87, Volume 4, Issue 12, December 2017.

[66] Jaiswal R.C. and Swapnil Shah, "Customer Decision Support System", International Research Journal of Engineering and Technology (IRJET), e-ISSN: 2395-0056; p-ISSN: 2395-0072; UGC approved Journal, SJ Impact Factor:5.181, Volume: 04 Issue: 10 | Oct -2017.

[67] Jaiswal R.C. and Ketan Deshpande, "IOT Based Smart City: Weather, Traffic and Pollution Monitoring System", International Research Journal of Engineering and Technology (IRJET), e-ISSN: 2395-0056; p-ISSN: 2395-0072; UGC approved Journal, SJ Impact Factor:5.181, Volume: 04 Issue: 10 | Oct -2017.

[68] Jaiswal R.C. and Vipul Phulphagar, "Arduino Controlled Weight Monitoring With Dashboard Analysis", International Journal for Research in Applied Science & Engineering Technology (IJRASET), ISSN: 2321-9653; UGC approved Journal, IC Value: 45.98; SJ Impact Factor:6.887, Volume 5 Issue XI November 2017.

[69] Jaiswal R.C. and Siddhant Sribhashyam, "Comparison of Routing Algorithms using Riverbed Modeler", International Journal of Advanced Research in Computer and Communication Engineering (IJARCCE), ISSN: (Online) 2278-1021; online) 2278-1021 ISSN (Print) 2319 5940; UGC approved Journal, Impact Factor 5.947Vol. 6, Issue 6, June 2017.