EasyChair Preprint

№ 7869

Ear Disease Detection Using R-CNN

S Anandamurugan, M Saravana Kumar, E G Prashanth and
K Nithin

May 1, 2022

Ear disease detection using R-CNN

S.Anandamurugan
Department of Information Technology
Kongu Engineering College (Anna University)
Erode,TamilNadu,India.
dranandamurugan@gmail.com

M.Saravana Kumar
Department of Information Technology
Kongu Engineering College (Anna University)
Erode,TamilNadu,India.
saravanamuthusamy24@gma.com

E.G. Prashanth
Department of Information Technology
Kongu Engineering College (Anna University)
Erode,TamilNadu,India.
prashanthgurunatha@gmail.com

K.Nithin
Department of Information Technology
Kongu Engineering College (Anna University)
Erode,TamilNadu,India.
nithinkumanan21@gmail.com

Abstract— **Ear is the essential organ in human body. Due to lifestyle changes usage of headphone, speaker and Bluetooth speakers the ear drum gets affected and leads to loss of hearing. Early finds of the ear disease may rectify the problem. This project helps to identify the ear disease in image processing method.**

Early detection of ear disease can easily solve the ear disease with the medical treatment. Due to improper life balance and low diagnosis with an accuracy a new diagnosis method can adopted. This research views the machine learning approach with the large amount inner ear images to perfectly identify the clinical cases of ear disease. This R-CNN algorithm is the new version of the CNN algorithm which convolutes the images into 20,542 parts of convolutional layers. There are eight types of ear disease found in this research. This disease may affect the roots of ear drum accumulation of wax and other common ear disease problem. The disease includes otitis externa, Wax Ear, Glue Ear, Otomycosis etc. The ear disease may have affected other parts of human body. It may affect the sensory roots of brain also to have the serious sensory roots issues.

Keywords— Convolutional Neural Networks (CNN), Artificial Intelligence (AI), Regions with convolutional neural networks (R-CNN), Application Program Interface (API), Single shot Detector (SSD), Computer Vision (CV2), Android Package (APK), Hyper Text Markup Language (HTML), Java Script (JS), Operating System (OS), Portable Network Graphics (PNG), Joint Photographic Expert Group (JPEG).

Introduction

Ear is the sensory organ in human body. The major sense organs are nose, tongue and ear. Ear is the primary sense organ in human body. Due to lifestyle changes the loss of hearing and ear disease also increased. This project helps to find the ear disease with the help of otoscopic images obtained by otoscopy. The algorithm used here is R-CNN and naïve bayes algorithm to find the disease. This project is hosted in the free web hosting web services (Netlify) and also as the android apps (go native).

Artificial neural networks yielded the most successful achievements in the subject of visual recognition and classification. The majority of machine learning models are built on top of these networks. Machine learning refers to a group of algorithms that employ numerous layers of nonlinear processing units. Each level enhances the power to turn its incoming data into a more abstract and composite representation. Other machine learning has already been improved by deep neural networks. This project works on the basis of tensor flow packages and other important python packages. The main usage of python packages is the Flask API packages.

I. RELATED WORK

[1] The segmentation layer is composed of three layers. The Convolutional layer is the mathematical process that generates two functions along with third function called modified function. In R-CNN algorithm the amount of original function is translated with the given new features gives the average accuracy of the given input image. The segmentation operation is called after these layers. The figure.4 shows the architecture of R-CNN.

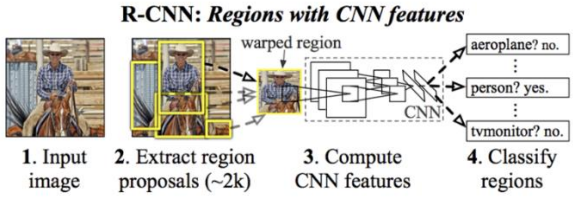


Fig.1. Architecture of R-CNN.

[2] The project only requires a dataset of disease image and normal image. To need an open-source account to host this project. The Classification makes the images under the separating the convolutional layer and pooling the image. This image then classified under many circumstances and provide the result. There are certain limitations in the dataset of existing system, so to use good clarity images as a dataset. The below figure shows flow of project.

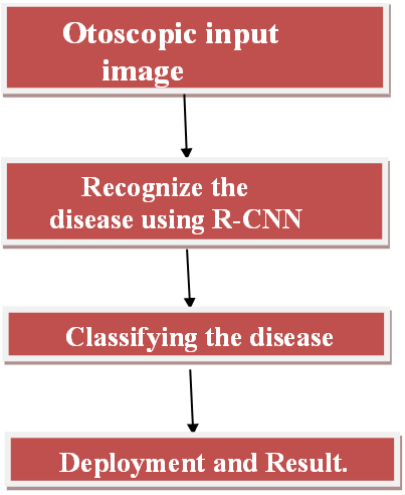


Fig.2. Flow of an Algorithm

[3] The third phase consists of the finding the disease with the confidence of 50 percentage. The disease will be predicted with the convolutional layer of input with the confidence level. Then the image is given to the classification of finding the particular disease name. Here, use Naïve Bayes classification algorithm to classify it. The input image is given with the help of flask API with the given circumstances. Then the image result is given back to the particular API to give the result to the front end. The algorithm first finds the convolutional layer and then find the confidence of the given image.

Fig.3. Finds the confidence of given image.

[4] Of all the previous existing algorithm this R-CNN shows the higher prediction of input image. The first stage the input is given by choosing the file from the system. Then the predict button is clicked. The image gets transferred from the front end to the backend. With the help of R-CNN and naïve Bayes algorithm the results are gets classified and the result are displayed with the frontend. In addition to the result, the confidence level is also displayed in the front end. This project had HTML as front-end and JS for connecting the API to the front end. The classification of result images is sent back to the API. This Figure shows the classification of result Image.

Fig.4.Shows the classification of diseased image.

[5] With the help of flask API this research is connect the project with the front-end free hosting web services. This Project is developed as an Android App with the good uses of project front end to end user. This project is deployed in the Netlify for free hosting Web Services. This project is deployed with the flask API to demonstrate the entire project in the cloud basis.

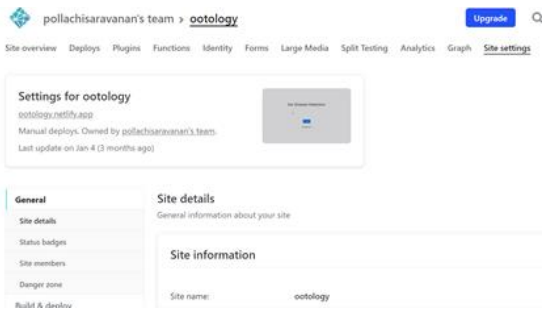


Fig.5.Project host at Netlify.

II. Methodologies and Discussion

A. *Problem Statement*

Ear disease is one of the primary diseases in human body. The loss of hearing may lead to have certain stress problem in that it may affect the brain function also. The existing system doesn't have the open-source project to find the ear disease detection. It's just found the ear disease in their system itself. There is no open-source network to find the ear disease. The existing algorithm also not suits for the betterment of the image classification. This may lead to the wrong prediction of disease. Early identification of ear disease may rectify the ear disease. This research had a solution to find the ear disease with the help of otoscopic image. First step is to upload the image of the otoscopic image in the upload file. Click predict to find the disease or normal ear.

B. *Proposed System*

This system is a new system when compared to the existing one. The existing uses the algorithm of single shot detector (SSD) algorithm to find the disease. Of this proposed system this method is the efficient method to find the ear disease. This system is hosted in the open source to have the better exposure

of project. This method includes the transfer learning to find the result. The R-CNN algorithm may have the better efficiency this may convert the image into 2 power11 parts to find the ear disease in the accurate mode. This project is developed as an android app to use this project in the end user. This project is giving the result of ear disease or normal ear and to have the accuracy percentage. In future this research going to do it in as a health tip providing the solution to the problem. This project develops in four stages to have the o complete this project. This project had an enormous usage to the medical people to reduced their work burden. This system also has an enormous usage of the advantages to have the better of human ear.

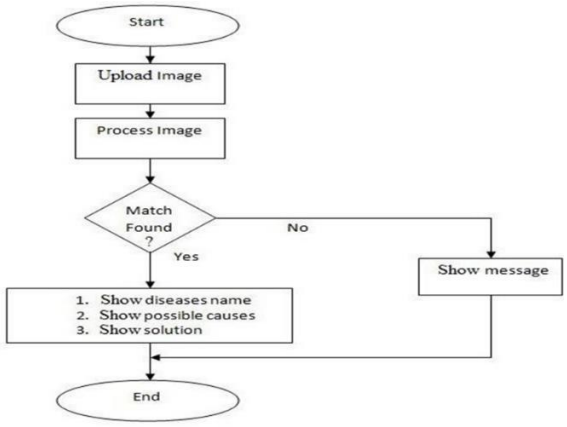


Fig.6. Shows Full Execution System of Project.

C. Regions With Convolutional Neural Networks (R-CNN)

[7] Computer vision is a python algorithm which predicts the object. Since CNN is a best algorithm to detect object, there is a wide range uses of algorithm. Though it has a lot of cons the usage of CNN and computer vision is gets reduced. The R-CNN is an advanced version of the CNN algorithm it subjects the images into convoluting and pooling layers. The R-CNN works on the filter based and max-pooling to have the better exposure of the images into 2 power 11 convolutional layers. The R-CNN algorithm extract region in the images to have the betterment of result display.

[17] R-CNN is an object detection algorithm. It is an advanced version of the CNN algorithm. It separates the images in the boundary box of 2 power 11 boundaries to have the accurate efficiency. It is a best algorithm to find the nano particles of the images.it supports the GPU systems and have the efficiency of 2 times of Convolutional Neural Networks (CNN) algorithm.

D. Naïve Bayes Classification

[8] The naïve bayes classification is one of the classifying algorithms. It is one of the best algorithms when compares with other classification algorithm. It was found by bayes in the year of 1900.It is called naïve bayes because this feature is not dependent on other features. This algorithm is best efficiency algorithm when compared to another algorithm. It works on the probability basis to classify the result. This algorithm is the oldest algorithm, because it gives solution to enormous amount of application.

[16] Bayes' classification, often called as Bayes' law is a scientific method of calculating the probability of a therapeutic approaches prior data. It is conditional probability that controls this. With the help of these algorithm and can classify the types of ear disease as a normal ear, Otomysis, wax and other ear disease are gets classified. It will the return the type of the disease as a text format to API. Before you begin to format your paper, first write and save the content as a separate text file. Complete all content and organizational editing before formatting. Please note sections A-D below for more information on proofreading, spelling and grammar.

$$\mathrm{P(A|B)} = \frac{P(B|A)P(A)}{P(B)}$$

Were,

P(B|A) is Posterior probability: Probability of hypothesis A on the observed event B.

P(A|B) is Likelihood probability: Probability of the evidence given that the probability of a hypothesis.

E. Deployment

[9] To illustrate this research as such an open-source program, these ear illness detections are hosted on a free hosting service. It is hosted by Netlify. This app is maintained via Flask Model. Netlify is an expansive web hosting service that's also free for using. This is one of Netlify's most useful features. Changes from the branch are deployed immediately without any preparation when you create a PR. This makes it a lot easier to test and showcase features before merging pull requests during the development phase. You could set up an SSL certificate for the site inside Domain control after the registered domain redirect to the Netlify site is running (HTTPS section). Let's Encrypt is used (a free service for providing SSL certificates). It is critical to plan ahead of time.

[14] This research is also implemented as an android app to have the better usage of project as an open source. The app is developed by using go native. This APK is hosted in my github repository. It can easily download the APK. It’s just about 2.5 MB.

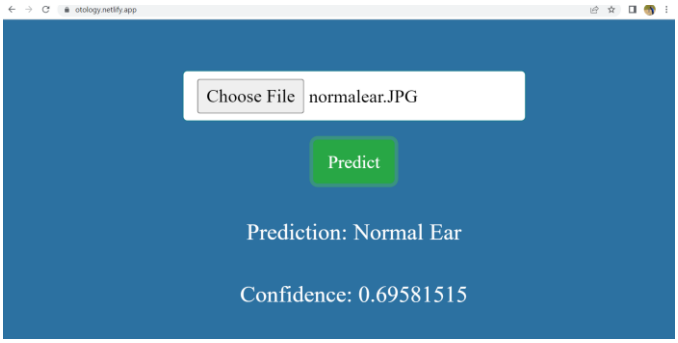
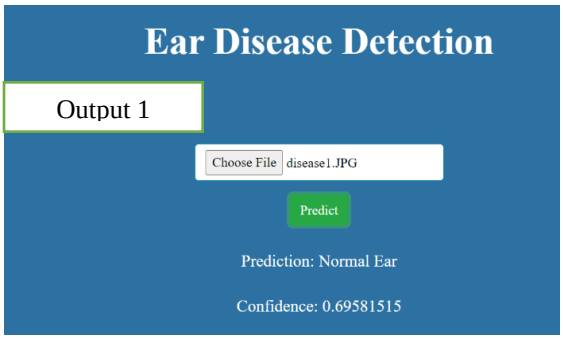


Fig.7. Shows the Deployment at Netlify.



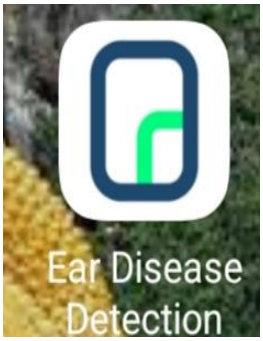
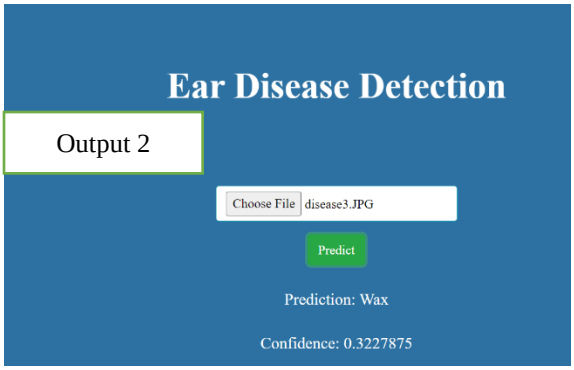


Fig.8. Shows the project as Android App.



F. R-CNN Function and Structure

[11] R-CNN is an image detection algorithm which is an advanced program of CNN algorithm. The creation of region offers,' or regions in an image that potentially relate to a particular piece, is the first stage of the R-CNN pipeline. The author applied a search algorithm called as selective search. The selective search algorithm generates post of a picture that could be focused on a single object based on skin color, material, size, and shape, and then repeatedly combines comparable parts to build objects. This provides a large variety of 'object proposals' in various scales.

G. Ear disease detection

[12] The disease is found by uploading the photo of diseased image and also to have the predict the type of ear disease in the particular disease. This project may help the medical people to find the ear disease in the open-source project. Transferring learning is the process of applying features learnt on one problem to a new, severe issues. Properties from such a model that has trained to detect racoons, for example, would be used to pop a model that trains to identify.

III. RESULTS.

A. Accuracy Loss and Validation

label	**Disease**	**Confidence**
Output 1	Normal Ear	60%
Output 2	wax	32%

TABLE 1(Disease Prediction)

[13] This table shows the disease prediction when tested at the front-end. In addition to prediction the confidence level of the prediction is also obtained. This result shows for different images different confidence level will be there. The Normal Ear has the highest confidence Level of 60 % when compared to other disease. This project is slow because it takes long time to predict the disease. It has many pros when compare to the existing system.

B. Analysis of Output.

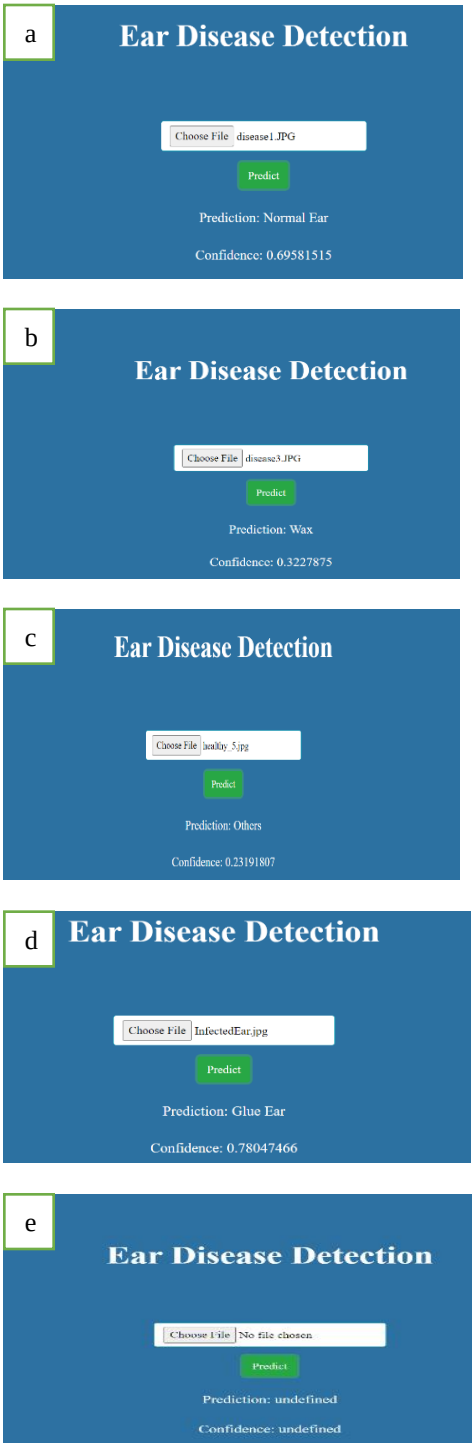


Fig.9. Ear disease Testing.

Image: JPEG or PNG.

Convolutional Layer: 2^11.

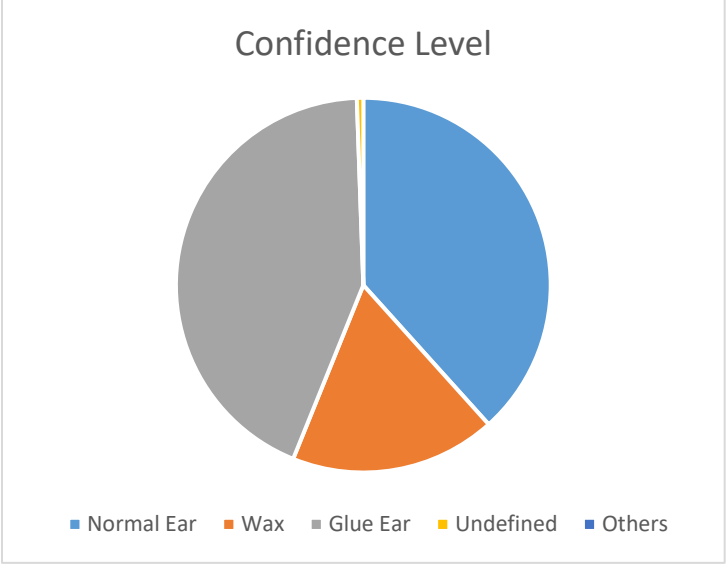
The above images show that the testing of ear disease with the various type of ear images. When click the predict button without choosing the file it shows undefined. When others disease image is loaded it shows others. When there is no regular file is uploaded it shows Upload correct file.

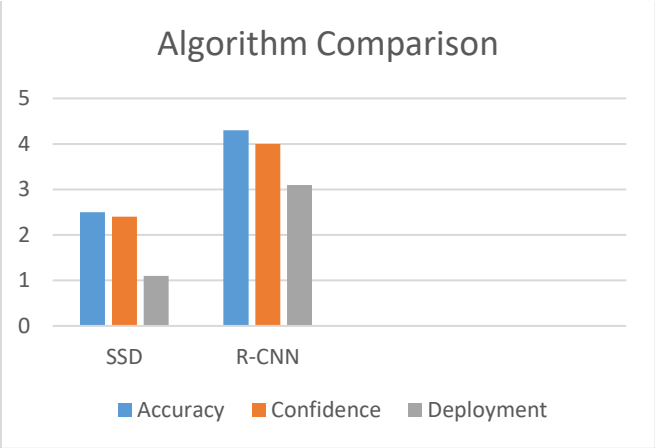
label	Disease	Prediction
a	Normal Ear	Yes (69%)
b	Wax	Yes (32%)
c	Others	No (23%)
d	Glue Ear	Yes (78%)
e	Undefined	No

(TABLE 2 Ear disease Testing)

The table 2 shows the ear disease testing with confidence level and also it finds the prediction which is found or not. The above table shows that the confidence level is differ from disease to disease. This shows that the glue ear confidence level is higher when compared to other disease.

[18] Ear is the primary sense organ in human body. Early find of ear disease will lead to loss of hearing. This Project may help the ENT doctor to have the betterment of results. The primary steps of this project are to get the dataset for the project. The dataset is count is low for this project. This project was had higher precision rate.





[15] This Pie chart and line graph shows the Confidence level and algorithm comparison of existing and proposed system. This shows that the Glue ear confidence level is higher when compare to other disease. The existing algorithm is SSD its accuracy and confidence and deployment percentage are highest in this proposed research.

[20] This project gives the accuracy of 80% while the existing system had a 60% of accuracy. This states that the usage of this project will be high in the future. This project will be very helpful to doctor and also the people who having the ear disease. This project is maintained in both status such as website and Android App.This above two figures shows that algorithm difference between existing and proposed system. This project will help the normal people to find their ear disease at the early stage to have the knowledge of ear disease what they have.

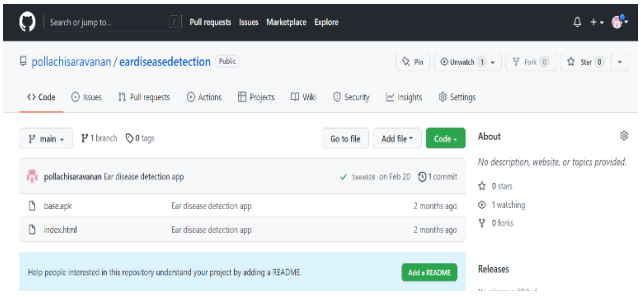


Fig.10.Android App hosted in github.

Fig.11.Prediction in Android App.

[19] This above two pictures shows that the Android App is hosted in the Github Repository. Ear disease detection is the repository to host this app. This to enter into the link there will be a button shows click here to download the APK will there at centre. This may help the user to have the disease prediction in Android App itself.

IV. SUMMARY AND CONCLUSION

This research can be done with the low cost due and also have a lot of pros when compared to the existing system. This research had a huge number of advantages. This project use R-CNN algorithm and naïve bayes classification to find the disease.

In future this project going to it implement for giving health tips and also to have an importance of ear in human body. Dos and Don'ts to avoid the ear disease. To implement this for hybrid platform to use it for another Operating System (OS) also.

REFERENCES

[1] Lalitha, K., Varadhaganapathy, S., Santhoshi, S., & Kumar, D. R. (2018, December). A Review on Possibilities of Hearing Loss and Implantable Hearing Devices for Teenagers. 2018 4th International Conference on Computing Communication and Automation (ICCCA). 2018 4th International Conference on Computing Communication and Automation (ICCCA).

[2] Rajesh Kumar, D., Rajkumar, K., Lalitha, K., & Dhanakoti, V. (2020). Bigdata in the Management of Diabetes Mellitus Treatment. In Studies in Big Data (pp. 293–324). Springer Singapore.

[3] Lalitha, K., Kumar, D. R., Poongodi, C., & Arumugam, J. (2021). Healthcare Internet of Things – The Role of Communication Tools and Technologies. In Blockchain, Internet of Things, and Artificial Intelligence (pp. 331–348). Chapman and Hall/CRC.

[4] Poongodi, C., Lalitha, K., & Dhanaraj, R. K. (2021). The Role of Blockchains for Medical Electronics Security. In Essential Enterprise Blockchain Concepts and Applications (pp. 231-262). Auerbach Publications.

[5] Asaoka R, Murata H, Hirasawa K, Fujino Y, Matsuura M, Miki A, et al. Using deep learning and transfer learning to accurately diagnose early-onset glaucoma from macular optical coherence tomography images. Am J Ophthalmol 2019;198:136–45.

[6] Mazo C, Bernal J, Trujillo M, Alegre E. Transfer learning for classification of cardiovas- cular tissues in histological images. Comput Methods Programs Biomed 2018;165:69–76.

[7] Nguyen LD, Lin D, Lin Z, Cao J. Deep CNNs for microscopic image classification by exploiting transfer learning and feature concatenation.

2018 IEEE International symposium on circuits and systems (ISCAS): IEEE; 2018. p. 1–5.

[8] Arvindhan, M., D. Rajeshkumar, and Anupam Lakhan Pal. "A Review of Challenges and Opportunities in Machine Learning for Healthcare." Exploratory Data Analytics for Healthcare (2021): 67-84.

[9] Kumar, D. R., & Sathish, R. (2013). Mitigation of Replication Attack Detection in Clusters through a Mobile Agent in Wireless Sensor Networks. International Journal of Engineering Research and Applications (IJERA) ISSN, 2248-9622.

[10] Dhanaraj, R. K., Rajkumar, K., & Hariharan, U. (2020). Enterprise IoT Modeling: Supervised, Unsupervised, and Reinforcement Learning. In Business Intelligence for Enterprise Internet of Things (pp. 55–79). Springer International Publishing.

[11] Cao H, Bernard S, Heutte L, Sabourin R. Improve the performance of transfer learning without fine-tuning using dissimilarity-based multi-view learning for breast cancer histology images. International conference image analysis and recognition. Springer;2018. p. 779–87.

[12] Krishnasamy, L., Dhanaraj, R. K., Ganesh Gopal, D., Reddy Gadekallu, T., Aboudaif, M. K., & Abouel Nasr, E. (2020). A Heuristic Angular Clustering Framework for Secured Statistical Data Aggregation in Sensor Networks. Sensors, 20(17), 4937.

[13] Ramakrishnan, V., Chenniappan, P., Dhanaraj, R. K., Hsu, C. H., Xiao, Y., & Al-Turjman, F. (2021). Bootstrap aggregative mean shift clustering for big data anti-pattern detection analytics in 5G/6G communication networks. Computers & Electrical Engineering, 95, 107380.

[14] KRISHNASAMY, L., RAMASAMY, T., DHANARAJ, R., & CHINNASAMY, P. (2021). A geodesic deployment and radial shaped clustering (RSC) algorithm with statistical aggregation in sensor networks. Turkish Journal of Electrical Engineering & Computer Sciences, 29(3).

[15] Kumar, D. R., Krishna, T. A., & Wahi, A. (2018). Health Monitoring Framework for in Time Recognition of Pulmonary Embolism Using Internet of Things. Journal of Computational and Theoretical Nanoscience, 15(5), 1598–1602.

[16] R. K. Dhanaraj, L. Krishnasamy, O. Geman and D. R. Izdrui, "Black hole and sink hole attack detection in wireless body area networks," Computers, Materials & Continua, vol. 68, no.2, pp. 1949–1965, 2021.

[17] M. D. Ramasamy, K. Periasamy, L. Krishnasamy, R. K. Dhanaraj, S. Kadry and Y. Nam, "Multi-Disease Classification Model using Strassen's Half of Threshold (SHoT) Training Algorithm in Healthcare Sector," in IEEE Access.

[18] Rajesh Kumar Dhanaraj, Lalitha Krishnasamy et al Black-Hole Attack Mitigation in Medical Sensor Networks using the Enhanced Gravitational Search Algorithm, International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems.

[19] Dhanaraj, Rajesh Kumar, et al. "Random Forest Bagging and X-Means Clustered Antipattern Detection from SQL Query Log for Accessing Secure Mobile Data." Wireless Communications and Mobile Computing 2021 (2021).

[20] Kumar, D. R., Krishna, T. A., & Wahi, A. (2018). Health Monitoring Framework for in Time Recognition of Pulmonary Embolism Using Internet of Things. Journal of Computational and Theoretical Nanoscience, 15(5), 1598–1602.