



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 5, May 2024

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.423

 9940 572 462

 6381 907 438

 [ijirset@gmail.com](mailto:ijirset@gmail.com)

 [www.ijirset.com](http://www.ijirset.com)

# Early-Stage Dementia Detection using IoT and Machine Learning

Yogita Narwadkar<sup>1</sup>, Ayesha Mulani<sup>2</sup>, Samruddhi Gawade<sup>2</sup>, Pragati Pate<sup>2</sup>, Trupti Surwade<sup>2</sup>

Assistant Professor, Department of Computer Engineering, PES Modern College of Engineering, Pune,  
Maharashtra, India<sup>1</sup>

U.G. Student, Department of Computer Engineering, PES Modern College of Engineering, Pune, Maharashtra, India<sup>2</sup>

**ABSTRACT:** Dementia is a neurodegenerative disorder that causes the loss of cognitive functioning i.e. thinking, remembering, and reasoning that affects millions of individuals worldwide, imposing a huge burden on healthcare systems and families. Early detection can significantly enhance the quality of life for those affected. Earlier, only the concept of a wearable device to detect dementia was given but, the actual implementation was not done. The proposed system introduces a novel approach to early dementia detection by using Machine Learning and the Internet of Things. Machine learning algorithms are employed to process and interpret the collected data (patient's medical history). Using the machine learning model the detection of dementia can be predicted and based on the results, further treatment may be suggested by the model. If the patient does not have any dementia-related medical record, then using MPU6050 and ESP32, we can detect and measure motion and orientation changes, and we can create a user-friendly interface to receive notifications and alert messages for future dementia chances. The IoT technology proposed system offers several advantages. It provides continuous, harmless monitoring of individuals, allowing for the detection of subtle changes in behaviour. Early detection enables earlier medical intervention and support, potentially slowing down the growth of dementia and improving the patient's quality of life.

**KEYWORDS:** Dementia Detection, Machine Learning, Medical Records, Internet of Things, Motion Pattern.

## I. INTRODUCTION

Early detection of dementia is crucial. This project proposes a novel approach utilizing Internet of Things (IoT) technology and machine learning algorithms to detect early signs of dementia. Machine learning will predict the results while employing the Random Forest algorithm on patient's medical history. The project integrates MPU6050 sensor and ESP32 microcontroller for data acquisition and transmission. This IoT device will check if the patient is demented or not using motion pattern for assurance.

## II. RELATED WORK

1. Chaudhary, Atul, et al. "Sensorsignals-based early dementia detection system using travel pattern classification." IEEE Sensors Journal 20.23 (2020): 14474-14481: The paper proposes a system for early detection of dementia using sensor signals and travel pattern classification. The system utilizes environmental passive sensor signals to monitor the movement of individuals. By segmenting and classifying travel episodes using a recurrent neural network, the system can detect early signs of dementia. The system achieves accurate results through experiments conducted on real-life datasets.
2. Mittal, Pooja. "Machine learning (ml) based human activity recognition model using smart sensors in iot environment." 2022 12th international conference on cloud computing, Data Science Engineering (confluence). IEEE, 2022: The paper proposes an IoT-based human activity monitoring model using smart sensors to track the activities of aged people living alone. The model collects vital data through smart sensors or IoT-based devices and analyzes it using different machine learning algorithms to detect any risk in human activity behaviour. After evaluating the proposed model, Support Vector Machine (SVM) achieved the highest accuracy of 98.03
3. Shah, Syed Aziz, et al. "Privacy-preserving wandering behaviour sensing in dementia patients using modified logistic and dynamic newton leipnik maps." IEEE Sensors Journal 21.3 (2020): 3669-3679: The paper focuses on privacy-preserving wandering behaviour sensing in dementia patients using modified logistic and dynamic Newton Leibnik maps. Radar images are used to detect large-scale body movements, and machine learning and deep learning techniques are applied for image classification. Four experiments are conducted, including applying machine and deep learning to raw image data, using principal component analysis and data augmentation, and combining both

techniques. The results show that the best accuracy of 95.30algorithm with principal component analysis and data augmentation.

4. Narwadkar, Yogita P., and Anant M. Bagade. "Abstractive Text Summarization Models Using Machine Learning Algorithms." 2023 7th International Conference On Computing, Communication, Control And Automation (ICCUBEA). IEEE, 2023.

### III. METHODOLOGY

**Preprocessing:** The dataset is collected from various sources. The preprocessing is essential stage for the correct analysis. Preprocessing for the ML dataset is done by finding the missing values, removing the irrelevant columns, filling the missing values, etc. For IOT dataset, the charts are plotted by which found the maximum and minimum values of magnitude of dementia detection.

**Model Training and Comparison:** The ML model is trained on two classification models i.e Support Vector Machine(SVM) and Random Forest. Here, it is found that the Random Forest gives more accuracy and better RMSE score than SVM. So, the final ML model used is Random Forest for detecting dementia.

**Classification:** The Random Forest is used in project for classification as Demented or Converted or Non-demented. Here, various attributes from the MRI scan are used for the classification.

**Real-Time Data Collecction:** If the patient is detected as non-demented by the ML model but they are feeling like they can have dementia then the IOT device is used. Here, the real-time data values by the IOT device are collected using the ThingSpeak cloud platform.

**Result Analysis:** The result is analysed by graph comparision. The graph of the dataset values for the non-demented person and the graph of real-time data of the user are compared using Google Colab to find the insights.

### IV. EXPERIMENTAL RESULTS

Using Medical records of the patient, the model provides prediction as demented or not demented.The random forest classification is used to classify the medical records. IoT device which is wearable on the feet of the patient, collects the walking patterns of the patients using sensors and compare them to the normal human being’s walking patterns. The mail get sent to the guardian or hospital staff as an output (Demented or not demented).



(a)



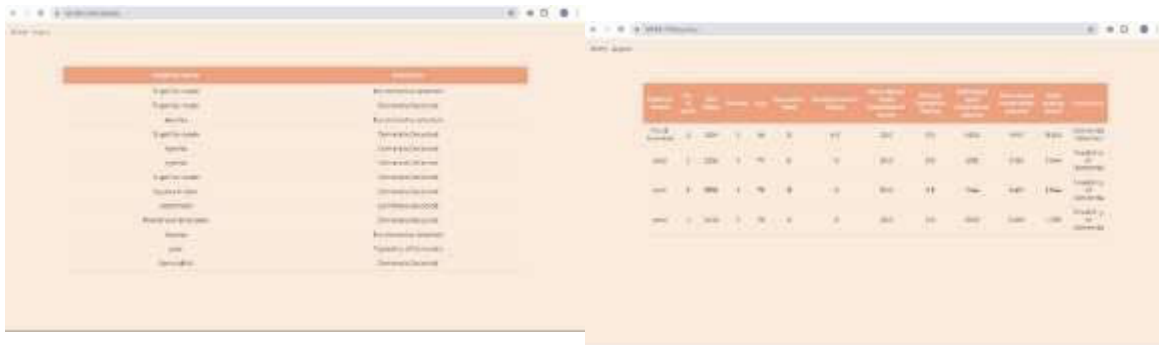
(b)



(c)

Fig. 1. Early State Dementia Detection (a)Main Page (b) Details Form of Medical Records (c) Results for Dementia using ML algorithms.

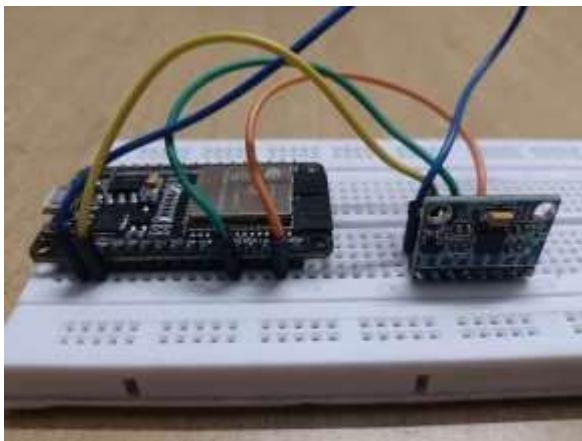




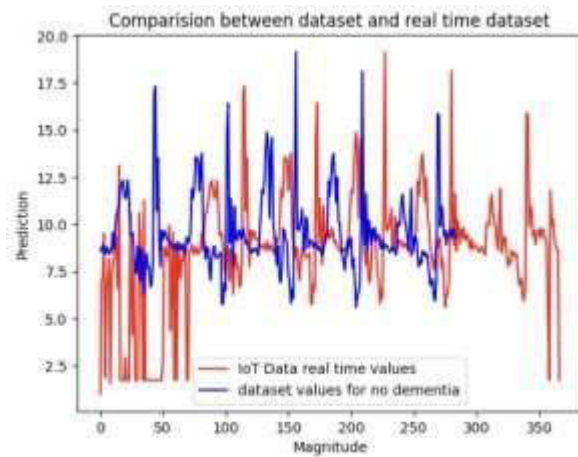
(a)

(b)

Fig. 2. Early State Dementia Detection (a) Dashboard for guardian (b) Dashboard for admin or medical staff.



(a)



(b)

Fig. 3. Early State Dementia Detection (a) Connectivity of IoT devices (b) comparison between dataset and real time dataset

Identify subtle changes in behaviour and activity patterns that might be indicative of early dementia. Enable healthcare professionals to monitor patients remotely, reducing the burden of frequent clinic visits, particularly beneficial for those with mobility limitations.

### V. CONCLUSION

In conclusion, the integration of IoT and ML technologies holds significant promise for early-stage dementia detection. We have successfully implemented early dementia detection system using IoT and ML. We have used medical records for predicting dementia using random forest algorithm. We have also used ESP32 microcontroller and MPU6050 sensor for motion tracking of the patient and analyze the collected IoT data for dementia prediction. Combining these, we have successfully predicted dementia with ML model accuracy of 92.55%. Ultimately, by enabling early detection and personalized care, IoT and ML have the potential to significantly improve outcomes for individuals at risk of dementia, enhancing their quality of life and reducing the burden on healthcare systems and caregivers alike.

### REFERENCES

1. System and Method for Early Detection and Post Disease Detection of Dementia Patients <https://ieeexplore.ieee.org/document/9885629>
2. The Early Detection of Dementia Disease Using Machine Learning Approach <https://ieeexplore.ieee.org/document/10128411>
3. A Predictive Analysis for Early Signs of Dementia <https://ieeexplore.ieee.org/document/9988972>

4. Arulraj AM, Sugumar, R., Estimating social distance in public places for COVID-19 protocol using region CNN, Indonesian Journal of Electrical Engineering and Computer Science, 30(1), pp.414-424, April 2023
5. A Machine Learning Approach for the Early Detection of Dementia <https://ieeexplore.ieee.org/document/9795717>
6. Early Detection of Alzheimer's Disease Using Various Machine Learning Techniques: A Comparative Study <https://ieeexplore.ieee.org/document/9142975>
7. A Novel Approach to Detect Dementia Using ML <https://ieeexplore.ieee.org/document/10276307>
8. Design of an Automatic Monitoring System for People with Dementia with an IOT control <https://ieeexplore.ieee.org/document/10304956>
9. Smart Shoes for Temporal Identification and Corrections to Assist People with Abnormal Walking Patterns <https://ieeexplore.ieee.org/document/9288093>
10. R.Udayakumar, R.Sugumar, Weighted Particle Swarm Optimization Algorithms and Power Management Strategies for Grid Hybrid Energy Systems, MDPI Engineering Proceedings, Volume 59, Issue 123, pp.1-11, December 2023.
11. IoT-Based Unobtrusive Physical Activity Monitoring System for Predicting Dementia <https://ieeexplore.ieee.org/document/9727152>
12. Complex Pattern Recognition and Understanding Model in English Linguistics based on Random Walk and Measure Analysis Algorithm <https://ieeexplore.ieee.org/document/9850630>
13. Sensor Signals-Based Early Dementia Detection System Using Travel Pattern Classification <https://ieeexplore.ieee.org/document/9136771>
14. Using a touch screen computer to support relationships between people with dementia and caregivers <https://ieeexplore.ieee.org/document/8147287>
15. Poonam Panwar, Mohammad Shabaz, Shah Nazir, Ismail Keshta, Ali Rizwan, R. Sugumar, Generic Edge Computing System for Optimization and Computation Offloading of Unmanned Aerial Vehicle Author links open overlay panel, Computers and Electrical Engineering, Volume 109, Part A, July 2023, 108779.
16. An Innovative Method in Improving the accuracy in Intrusion detection by comparing Random Forest over Support Vector Machine <https://ieeexplore.ieee.org/document/9759062>
17. Edge Computing-Based Localization Technique to Detecting Behaviour of Dementia <https://ieeexplore.ieee.org/document/9072425>
18. Narwadkar Yogita P., and Anant M. Bagade. "Abstractive Text Summarization Models Using Machine Learning Algorithms." 2023 7th International Conference On Computing, Communication, Control And Automation (ICCUBEA). IEEE, 2023.



INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  [ijirset@gmail.com](mailto:ijirset@gmail.com)



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details