iJRASET

International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** XI **Month of publication:** November 2023

DOI: https://doi.org/10.22214/ijraset.2023.56424

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue XI Nov 2023- Available at www.ijraset.com

Parkinson Disease Detection by Analyzing Spiral and Wave Drawings

Anjali Vibhute[1], Yogita Veer[2], Sai Venikar[3], Ketaki Rathod[4]
Computer Science Department, Sinhgad Academy of Engineering

Abstract: Parkinson's disease is a ubiquitous, life altering neurological disorder that affects countless people and is often undiagnosed until its advanced stages. This delay in diagnosis means there is no time for timely intervention and better disease management. Our implementation process is set to change this narrative through the use of multimedia data processing techniques and technologies. Our system begins its mission by capturing and analyzing spiral images, which is a new method for diagnosing Parkinson's disease. It uses advanced image recognition technology to interpret specific patterns in these images, providing insight into possible early stages of the disease. Focused on the analysis of spiral images, our solutions aim to revolutionize the diagnostic process, providing people and doctors with powerful tools to diagnose Parkinson's disease earlier and more easily. This change has the potential to improve quality of life and reduce the burden of Parkinson's disease.
Keywords: spiral image analysis, neurodegenerative disease, machine learning, image recognition, spiral drawing, early diagnosis

I. INTRODUCTION

Since dopamine levels are low in people with Parkinson's disease, communication between cells is difficult. One of the symptoms of Parkinson's disease is hand tremor. We consider data of spiral and wave diagrams from healthy people and Parkinson's patients. Therefore, drawing these charts can be a difficult task for people with Parkinson's disease. Since this is a chart, we use two models; one is a convolutional neural network and the other is Densenet 201. This model will examine spiral and wave diagrams. Therefore, the motivation for our study is to determine whether a person has Parkinson's disease. Spiral art is a valuable fine motor technique, especially as a diagnostic tool in Parkinson's disease (PD). The Unified Parkinson's Disease Rating Scale (UPDRS-III) is a comprehensive assessment tool used to assess the severity of Parkinson's disease. The effects of PD cover a wide range of motor skills, from speech and writing to coordination and movement. However, the process of diagnosing and monitoring PD is often costly and difficult, requiring professional intervention and early treatment procedures.To solve these problems, a digital process is being used throughout the ages, including writing and drawing, without affecting history. The advent of digital tablets allows researchers to use the best visuals and tools to collect data. To address this challenge, our "Parkinson's Detection" project website uses these innovations to improve early diagnosis and support Parkinson's patients. By combining traditional tests with modern technology, we aim to modernize the diagnosis and management of Parkinson's disease, making it practical and effective.

II. LITERATURE SURVEY

“Diagnosis of Parkinson's disease based on machine learning spiral analysis” by T. A. Fernandes et al. (2017) In this study, a model of Parkinson's disease based on spiral analysis was developed. The authors used the SVM radial basis kernel function to classify the spiral image into healthy and parkinsonian groups. They achieved 87.5% accuracy with these strategies. The article “Comparison of speech signal processing algorithms and use of tunable Q-factor wavelet transform for Parkinson's disease classification” by M. P. Nolan et al. (2018) reported an overall classification accuracy of 86.67% for a method based on tunable Q-factor wavelet transform (TQWT) on the same dataset recorded by healthy individuals and individuals with Parkinson's disease. The TQWT-based method outperforms other algorithms such as linear predictive coding and perceptual linear prediction in terms of accurate classification. “Detection of Parkinson's Disease by Spiral and Wave Plots of Convolutional Neural Networks: A Multidisciplinary Approach” by Sabyasachi Chakraborty et al. (2020). This article presents a multilayered approach. The author uses images of spirals and waves. Spiral plans and wave plans are analyzed by CNN, which is the first level of classification. The output of the convolutional neural network model was evaluated with random forest and logistic regression models. These models are used as meta classifiers. "Study of earthquakes using time-frequency spiral analysis" by Decho Surangrirat et al. It achieved 93.3% accuracy. (2013) . This article uses spiral analysis to instantly diagnose tremor. The authors created an Android app that asks people to draw spirals using their dominant and non-dominant hands on a sample app.

“Diagnosis of Parkinson's disease using machine learning and speech,” by Timothy J. Wroge et al. (2018) . This research paper is about PD detection using DNN. Speech (extracted feature) dataset is used as a classification tool. Data were collected from 10-second audio recordings of each participant. They asked DNN to detect the virus. They achieved an accuracy of 85%.

"Diagnosis of Parkinson's disease using the combination of wavelet transform and SVM", M. Elazab et al. (2019) . This article introduces a wavelet transform and support vector machine to detect Parkinson's disease using graphs. The authors use discrete wavelet transform (DWT) to separate the spiral graph into frequency subbands and extract features from each subband. Using this method, they achieved an accuracy of 94.7%. "Diagnosis of Parkinson's disease by magnetic resonance imaging based on deep convolutional neural networks", X. Jia et al. (2021) . The paper reports the findings using deep CNN images and MRI. The plan reached a 94.86% accuracy rate

III. EXISTING SYSTEMS

Clinical trials and professional evaluations frequently use the Unified Parkinson's Disease Rating Scale (UPDRS) as a method for diagnosing Parkinson's disease, remaining resourceful and ensuring clinical accuracy. Although cost and access may be prohibitive, medical imaging such as MRI and PET scans can provide information about the brain. New methods include screening for biomarkers and genetic testing by analyzing cerebrospinal fluid. In addition to disruptive technologies such as voice and speech tracking, wearable technologies such as smart watches are also attracting attention. Additionally, the unique diagnostic potential of the helical stretch test, which is often digitized for accuracy, and the important role of machine learning hold promise for early diagnosis and disease control.

These different techniques combine to form a comprehensive tool for the diagnosis and treatment of Parkinson's disease. Observe and decipher the difference between the disease. The future will see the integration of these processes, with a focus on technological solutions that promise to improve early diagnosis, improve control, and ultimately improve the quality of life of people living with Parkinson's disease.

IV. METHODOLOGY

Users, doctors or patients, start the process of diagnosing Parkinson's disease by submitting a copy of the spiral to a special website. The system continues to refine images, improving quality and creating patterns. Advanced image processing algorithms then extract important features of the spiral map, such as beat patterns and kinematic parameters. Data analysis and general data modeling. The data is used as a training ground for learning models, including support vector machines, random forests, and deep neural networks designed to distinguish between healthy and competent individuals. Images are classified and the model generates a prediction score or outcome and eventually makes a diagnosis.

This method provides a simple and easy-to-use tool for early detection of Parkinson's disease and allows for timely intervention and management.

1) *Data Collection:* Data collected from Kaggle repository, publicly shared by Zham P. RMIT University, Melbourne, Australia, was responsible for data collection. A total of 55 people participated in the data collection process, 27 in the Parkinson's group and 28 in the non-Parkinson group. Researchers use different tests to evaluate each participant. To draw spirals, they use a soft-touch computer, place a piece of paper on top, and draw with a pencil. They use the same method to create wavy shapes. Some of the images they took during data collection are shown below.

Fig1 : Spiral image of PD person

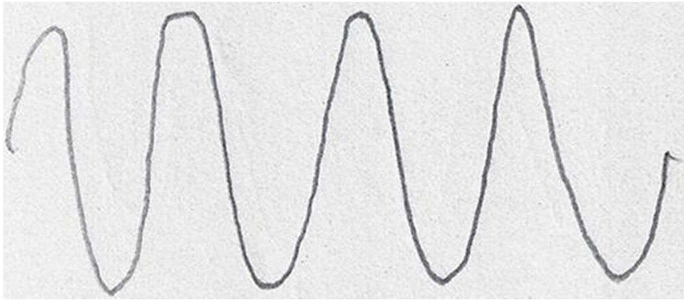

Fig 2: Spiral image of Non-PD person

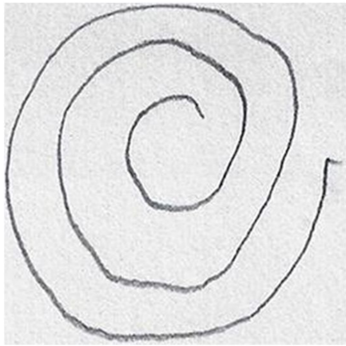

Fig 3: Spiral image of Non-PD person

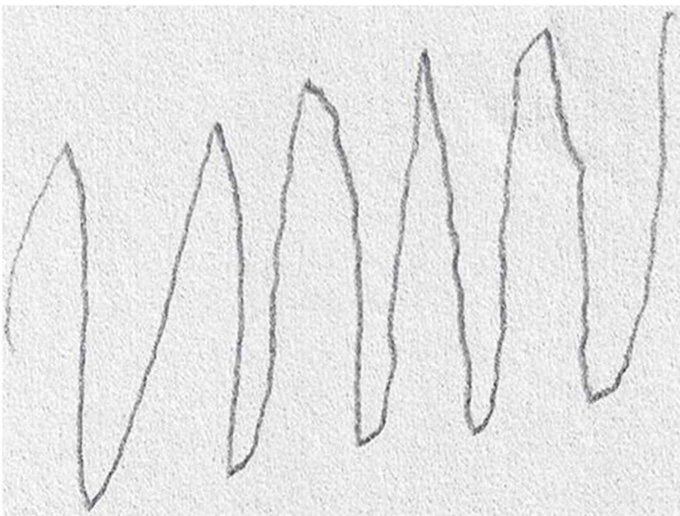

Fig 4: Wave image of PD person

2) *CNN (Convolutional Neural Network):-* Convolutional Neural Network (CNN) is a neural network (NN) that can take image data as input and distinguish between objects or features in the image. Compared to other classification methods, CNN requires less data upfront. CNN architecture consists of the following layers.
3) *Convolutional Layer*: This process learns features in a small part of the image by applying a filter layer to the input data.
4) *Maximum Pooling*: At runtime, the pixel with the highest value is selected and fed to the output .The density layer is near the end of the network and can define features related to the output. Creates a vector by smoothing the results from the pooling layer.
5) *Drop Layers*: This method is used to solve the overfitting problem of the model by randomly removing a subset of neurons in a layer, usually connected by a thick layer. SoftMax layer: The last layer of the network helps in splitting the input data into different groups in one go.

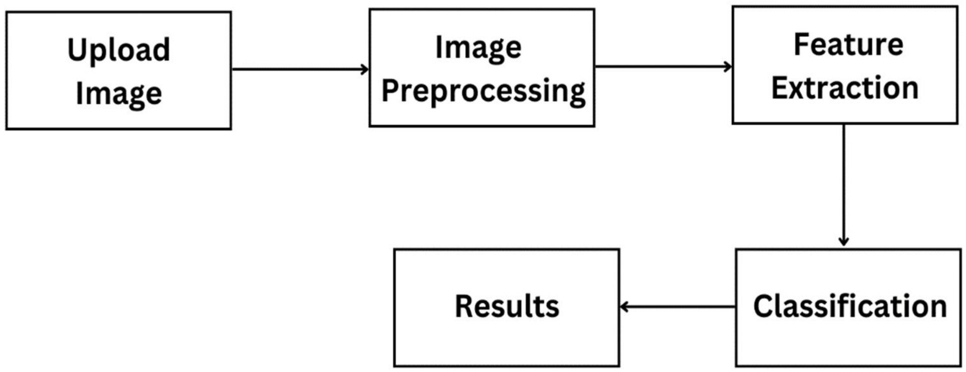

Fig (5)

6) *Image Upload and Progress:* Users and doctors provide a copy of the spiral image through the user interface to initiate the process. This component allows users to send images in different formats (such as JPEG, PNG) to ensure a good experience. After loading, the system pre-processes the image to improve image quality and ensure uniformity. This includes techniques such as noise reduction, contrast adjustment and editing to create a standard output image for subsequent analysis. Users can also receive reminders to check the authenticity of uploaded photos to provide information.
7) *Feature Extraction:* The next step will extract important features from the loaded spiral graphs. Feature extraction algorithms are responsible for identifying and analyzing effects such as beat patterns, curvature, tremor features, and other kinematic parameters. These features form the basis for subsequent evaluation and diagnosis. The goal is to convert drawn images into data that can be used by machine learning.
8) *Image Classification:* At the heart of the system is a machine learning model trained specifically for the diagnosis of Parkinson's disease. The model was trained on a dataset containing images of healthy people and people with Parkinson's disease, and the images were classified as showing healthy people or people with Parkinson's disease. The loaded spiral diagram is combined with the features extracted as input to this model. Machine learning algorithms (such as support vector machines, random forests, and deep neural networks) analyze data to create predictive scores or results, ultimately providing a diagnosis.
9) *Result presentation:* The final step involves presenting the diagnostic results to the user or doctor through the user interface. User usually gets clear results, good on user report screen or score. The report includes an evaluation of the spiral sentence that indicates whether Parkinson's disease is present. The results may include a confidence score or probability that indicates the degree of accuracy. The user interface should facilitate understanding of the diagnosis, enable timely intervention and management when necessary, and provide important tools for early diagnosis and effective care of Parkinson's disease.

V. SYSTEM ARCHITECTURE

A. Software Requirements

Operating System: Windows 10
Coding Language: HTML, CSS, ReactJS, Python
IDE: Visual Studio Code

B. Hardware Requirements

System: Intel I3 Processor
Hard disk: 40 GB
Monitor: 15
RAM: 8 GB

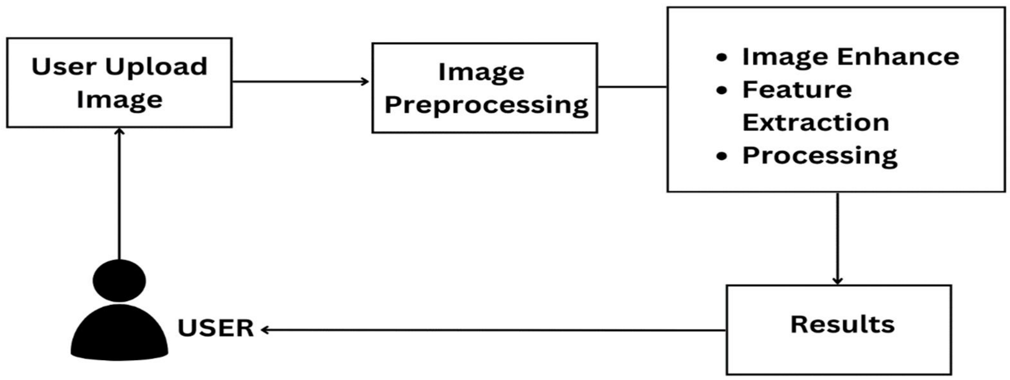

Fig (6)

VI. CONCLUSION

In the ever-evolving world of healthcare, our bodies serve as a beacon of hope for people struggling with the challenges of Parkinson's disease. By combining technology and machine learning, we have created a platform that not only simplifies the process of diagnosing Parkinson's disease but also promises early intervention and improved patient outcomes. The process from image loading and pre-processing to image removal, image distribution and result presentation utilizes the full capabilities of digital graphics. This system provides an important tool in the fight against Parkinson's disease by allowing both users and doctors to receive a reliable, objective and timely diagnosis.

The future is full of hope for innovation and advancement in medical technology. Based on an effective combination of data analysis and machine learning, our system holds the promise of meaningfully impacting the lives of people living with Parkinson's disease. This demonstrates our commitment to improving early diagnosis, patient care and ultimately improving the overall quality of life of people living with Parkinson's disease.

REFERENCES

[1] Bernardo, L. S., Damaševičius, R., De Albuquerque, V. H. C., & Maskeliūnas, R.(2021). A hybrid two-stage SqueezeNet and support vector machine system for Parkinson’s disease detection based on handwritten spiral patterns. International Journal of Applied Mathematics and Computer Science, 31(4), 549-561.
[2] Sakar, C. O., Serbes, G., Gunduz, A., Tunc, H. C., Nizam, H., Sakar, B. E., ... & Apaydin, H. (2019). A comparative analysis of speech signal processing algorithms for Parkinson’s disease classification and the use of the tunable Q-factor wavelet transform. Applied Soft Computing, 74, 255-263.
[3] Chakraborty, S., Aich, S., Han, E., Park, J., & Kim, H. C. (2020, February). Parkinson's disease detection from spiral and wave drawings using convolutional neural networks: a multistage classifier approach. In 2020 22nd International Conference on Advanced Communication Technology (ICACT) (pp. 298-303). IEEE.
[4] Surangsrirat, D., Intarapanich, A., Thanawattano, C., Bhidayasiri, R., Petchrutchatachart, S., & Anan, C. (2013, April). Tremor assessment using spiral analysis in time-frequency domain. In 2013 Proceedings of IEEE Southeastcon (pp. 1-6). IEEE.
[5] Wroge, T. J., Özkanca, Y., Demiroglu, C., Si, D., Atkins, D. C., & Ghomi, R. H. (2018,December). Parkinson’s disease diagnosis using machine learning and voice. In 2018 IEEE signal processing in medicine and biology symposium (SPMB) (pp. 1-7). IEEE.
[6] Vatsaraj, I., & Nagare, G. (2021). Early detection of Parkinson’s Disease using contrast enhancement techniques and CNN. International Journal of Engineering Research & Technology (IJERT), 10(05), 2278-0181.
[7] X. Jia et al. (2021). Detection of Parkinson's Disease Using Magnetic Resonance Imaging Based on Deep Convolutional Neural Networks
[8] T. A. Fernandes(2017) Diagnosis of Parkinson's disease based on machine learning spiral analysis
[9] M. P. Nolan(2018) Comparison of speech signal processing algorithms and use of tunable Q-factor wavelet transform for Parkinson's disease classification
[10] Sabyasachi Chakraborty(2020) Detection of Parkinson's Disease by Spiral and Wave Plots of Convolutional Neural Networks: A Multidisciplinary Approach