Vel Tech Multi Tech
Dr.Rangarajan Dr.Sakunthala Engineering College
An Autonomous Institution

Department of Computer Science and Engineering

Parkinson's Disease Prediction

Team Members:

Girishun Kumar R
113119UG03027

Kishore M
113119UG03050

SRI NANDHIASH KUMAR S
113119UG03104

BATCH : 06

DATE : 24.05.2023

Guided by,
Mr.V.Nehru ,
B.Tech, M.Tech,
Professor CSE Dept.

OUTLINE OF THE PRESENTATION

- Abstrct
- Objective
- Introduction
- Scope of project
- Litrature Survey
- Motivation
- Existing System
- Proposed Work
- System Configuration
- Block Diagram
- Module Description
- Result
- Conclusion & Future work
- References

ABSTRACT

- Early classification Parkinson’s disease of from magnetic resonance imaging (MRI) plays an important role in the diagnosis of such diseases. There are many diagnostic imaging methods used to identify Parkinson’s disease.
- MRI is commonly used for such tasks because of its unmatched image quality. The relevance of artificial intelligence (AI) in the form of deep learning (DL) has revolutionized new methods of automated medical image diagnosis. This study aimed to develop a robust and efficient method based on transfer learning technique for classifying Parkinson’s disease using MRI. In this article, the popular deep learning architectures are utilized to develop Parkinson’s disease diagnostic system..
- The experiment was performed using two benchmark datasets that are openly accessible from the web. Images from the dataset were first cropped, preprocessed, and augmented for accurate and fast training.
- The performance of the transfer learning models is evaluated using performance metrics of accuracy. From the experimental results, our proposed CNN model is using ADAM optimizer. The proposed method is superior to the existing literature, indicating that it can be used to quickly and accurately classify Parkinson’s diseases.

OBJECTIVES

- Anxiety and depression are considered as one of the earliest symptoms of PD.
- Although directly measuring these symptoms is hard, it is possible to infer the conditions of mental health by monitoring smartphone usage.
- Given an example, we can monitor the time of smartphone usage during a day to predict the risk of depression and monitor the movement of a user during and before the calling to predict the risk of anxiety.

INTRODUCTION

- The aging of today's society is associated with an increasing number of patients suffering from neurodegenerative disorders.
- One of these disorders is Parkinson's disease (PD), and current estimates indicate that the number of people with PD will rise more than twofold, from 4 million in 2005 to 9 million by 2030
- The clinical presentations of PD include progressively slowing movements, limb rigidity, restremor, and posture instability . Unfortunately, even those patients who receive dopaminergic treatment or deep brain stimulation still deteriorate with increasing age, and their mortality rate is two- to three-fold higher than that of the general population.
- Therefore, recognizing PD in its early stage is critical for initiating proper treatments to decrease morbidity and ease the medical burden in the elderly The clinical severity of PD can be divided into five stages, called the Hoehn-Yahr Stages I–V .
- In Stage I, the patients experience unilateral symptoms, such as asymmetrical gait or hand swing; in Stage II, the disease influences are bilateral and the patient's stability degrades; in Stage III, the disease affects the central reflex mechanism, and the patient tends to fall because of trunk instability; in Stage IV, the patient needs a wheelchair and other assistive devices; and in Stage V, the patient is wheelchair bound or even bedridden.
- Patients with PD can be classified as having early-stage or advanced-stage disease. In its early stages, denoted in this paper as Early PD and defined as Hoehn-Yahr Stage ≤ 2, the symptoms include asymmetrical movement reduction of one limb, asymmetrical hand movements, and shuffling when walking, with a preserved posture reflex.

SCOPE OF PROJECT

The performance of the classification model is also biased nowadays. claimed that they achieved an accuracy of 99% and 97.5% separately when employing sustained vowel into PD detection, pointed out that the proposed validation approach is speaker-dependent. Although the samples in training and testing set a contrast with each other, they can correspond to the same person. This validation method can lead to an over-optimistic result. In the experiments of claimed this accuracy can even decrease to 60% if the validation process

LITERATURE SURVEY

Paper1

Title : Parkinson's Disease Diagnosis Using Machine Learning and Voice

Author : Timothy Wroge, Yasin Serdar Özkanca**.**

YEAR: 2019

Abstract: Biomarkers derived from human voice can offer insight into neurological disorders, such as Parkinson's disease (PD), because of their underlying cognitive and neuromuscular function. PD is a progressive neurodegenerative disorder that affects about one million people in the the United States, with approximately sixty thousand new clinical diagnoses made each year. Historically, PD has been difficult to quantify and doctors have tended to focus on some symptoms while ignoring others, relying primarily on subjective rating scales. Due to the decrease in motor control that is the hallmark of the disease, voice can be used as a means to detect and diagnose PD. With advancements in technology and the prevalence of audio collecting devices in daily lives, reliable models that can translate this audio data into a diagnostic tool for healthcare professionals would potentially provide diagnoses that are cheaper and more accurate. We provide evidence to validate this concept here using a voice dataset collected from people with and without PD. This paper explores the effectiveness of using supervised classification algorithms, such as deep neural networks, to accurately diagnose individuals with the disease. Our peak accuracy of 85% provided by the machine learning models exceed the average clinical diagnosis accuracy of non-experts (73.8%) and average accuracy of movement disorder specialists (79.6% without follow-up, 83.9% after follow-up) with pathological post-mortem examination as ground truth.

Paper 2

Title : EARLY DETECTION OF PARKINSON'S DISEASE USING MACHINE LEARNING

Author : Anitha , Nandhini, Sathish Raj, Nikitha

YEAR: 2020

Abstract: Parkinson's disease (PD) is a neurodegenerative movement disease where the symptoms gradually develop start with a slight tremor in one hand and a feeling of stiffness in the body and it became worse over time. It affects over 6 million people worldwide. At present there is no conclusive result for this disease by non-specialist clinicians, particularly in the early stage of the disease where identification of the symptoms are very difficult in its earlier stages. The proposed predictive analytics framework is a combination of K-means clustering and Decision Tree which is used to gain insights from patients. By using machine learning techniques, the problem can be solved with minimal error rate. Voice data sets obtained from the UCI Machine learning repository if given as the input for voice data analysis. Also our proposed system provides accurate results by integrating spiral drawing inputs of normal and Parkinson's affected patients. From these drawings Random forest classification algorithm is used which converts these drawings into pixels for classification and the extracted values are been matched with the trained database to extract various features and results are produced with maximum accuracy. Also Open CV (Open Source Computer Vision Library) a library of programming functions mainly aimed at real-time computer vision was built to provide an infrastructure for computer vision applications and to accelerate the use of machine perception in the real time. Thus our output will showcase the early detection of the disease and can be able to increase the lifespan of the diseased patient with proper treatments and medications leads to peaceful life.

Paper 3

Title : Prediction of Parkinson's Disease using Machine Learning Techniques on Speech dataset

Author Basil K Varghese, Geraldine Bessie Amali D , Uma Devi K S

YEAR: 2019

Abstract: In the present decade of accelerated advances in Medical Sciences, most studies fail to lay focus on ageing diseases. These are diseases that display their symptoms at a much advanced stage and make a complete recovery almost improbable. Parkinson's disease (PD) is the second most commonly diagnosed neurodegenerative disorder of the brain. One could argue, that it is almost incurable and inflicts a lot of pain on the patients. All these make it quite clear that there is an oncoming need for efficient, dependable and expandable diagnosis of Parkinson's disease. A dilemma of this intensity requires the automating of the diagnosis to lead accurate and reliable results. It has been observed that most PD Patients demonstrate some sort of impairment in speech or speech dysphonia, which makes speech measurements and indicators one of the most important aspects in prediction of PD. The aim of this work is to compare various machine learning models in the successful prediction of the severity of Parkinson's disease and develop an effective and accurate model in order to help diagnose the disease accurately at an earlier stage which could in turn help the doctors to assist in the cure and recovery of PD Patients. For the aforementioned purpose we plan on using the Parkinson's Tele monitoring dataset which was acquired from the UCIML repository.

Paper 4

Title : Classification of Parkinson's disease and its stages using machine learning

Author: John Michael Templeton, Christian Poellabauer & Sandra Schneider

YEAR: 2022

Abstract: As digital health technology becomes more pervasive, machine learning (ML) provides a robust way to analyze and interpret the myriad of collected features. The purpose of this preliminary work was to use ML classification to assess the benefits and relevance of neurocognitive features both tablet-based assessments and self-reported metrics, as they relate to Parkinson's Disease (PD) and its stages [Hoehn and Yahr (H&Y) Stages 1–5]. Further, this work aims to compare perceived versus sensor-based neurocognitive abilities. In this study, 75 participants (n=50 PD; n=25 control) completed 14 tablet-based neurocognitive functional tests (e.g., motor, memory, speech, executive, and multifunction), functional movement assessments (e.g., Berg Balance Scale), and standardized health questionnaires (e.g., PDQ-39). Decision tree classification of sensor-based features allowed for the discrimination of PD from healthy controls with an accuracy of 92.6%, and early and advanced stages of PD with an accuracy of 73.7%; compared to the current gold standard tools [e.g., standardized health questionnaires (78.3% accuracy) and functional movement assessments (70% accuracy)]. Significant features were also identified using decision tree classification.

Paper 5

Title : Detection of Parkinson’s Disease Using Machine Learning and Deep

Author: Shrihari K Kulkarni1, K R Sumana2

YEAR: 2021

Abstract: Neurological diseases, like as Parkinson's disease (PD), may be studied using biomarkers obtained from human speech. PD is a progressive neurodegenerative illness that affects around one million people. In the past, clinicians have relied on subjective grading systems to gauge the severity of Parkinson's disease. Difficulties with motor control make it possible to detect and diagnose PD via vocalization. Healthcare professionals could benefit from cheaper and more accurate diagnoses as a result of technological advancements and the widespread use of audio collecting devices in everyday life. We provide evidence to validate this concept here using a voice dataset collected from people with and without PD using Machine Learning algorithms: Decision Tree, Logistic Regression, and Naive Bayes and Deep Learning algorithm like Recurrent Neural Networks (RNN) by predicting with accuracy rate and performance comparison of all Machine Learning and Deep Learning algorithms.

MOTIVATION OF THE PROJECT

- Aspects of dopaminergic function suggest that dopamine can be involved in different forms of motivation characterized by neuroanatomical specificity and distinct signaling modes, there by accounting for the varied deficits stemming from dopamine dysfunction.
- Paired with a stereotypical disease progression in PD from dorsolateral to ventromedial degeneration of midbrain and striatum function, some specificity in the effects of PD on motivation should be expected and these effects are likely to change with disease progression.
- As outlined above, important progress has been made in under-standing distinctions between different forms of motivation and learning based on computational and neurobiological models.
- In contrast, psychological and personality level theories targeting motivation have not generally been sensitive to such distinctions.

- Instead, broad measures of apathy and depression have been used to demonstrate differences in PD patients, but these measures may not always have the resolution to provide tighter links across neural, computational and psychological levels of analysis.
- Linking self-report measures of motivation with experimental tasks that have been characterized in terms of their computational or neural underpinnings could provide the initial steps needed to bridge across levels of analysis.
- In order to begin understanding whether dopaminergic dysfunction exerts independent influences on learning and motivation, we sought to determine whether differences in regulatory mode motivation are linked to those specific learning deficits that are associated with dopaminergic dysfunction in the striatum.
- We reasoned that if learning deficits associated with striatal dopamine dysfunction were associated with motivational mode scores, this would point to a link between striatal dopamine dysfunction and motivational changes.

EXISTING SYSTEM

- In the first stage, there is a computer based procedures to detect PD and classify the type of PD using Artificial Neural Network Algorithm for MRI images of different patients. The second stage involves the use of different image processing techniques such as histogram equalization, image segmentation, image enhancement, morphological operations and feature extraction are used for Parkinson's disease detection in the MRI images for the PD affected patients.

- This work is introduced one automatic Parkinson's disease detection method to increase the accuracy and decrease the diagnosis time.

- As input for this system is MRI, scanned image and it contain noise. Therefore, our first aim is to remove noise from input image. As explained in system flow we are using high pass filter for noise removal and image preprocessing.

- The feature extraction is used for edge detection of the images. It is the process of collecting higher level information of image such as shape, texture, color, and contrast.

DISADVANTAGES

- It is a more reliable statistical metric for binary classification problems.
- It requires a large training data.
- Due to the lack of data composed of brain MRI usually not feasible to train the model from scratch using randomly initialized weights.

PROPOSE SYSTEM

- The proposed system has mainly five modules. Dataset, Pre-processing, Split the data, Build CNN model train Deep Neural network for epochs, and classification.
- In dataset we can take multiple MRI images and take one as input image. In pre-processing image to encoded the label and resize the image. In split the data we set the image as 80% Training Data and 20% Testing Data.
- Then build CNN model train deep neural network for epochs. Then classified the image as yes or no if PD is positive then it returns yes and the PD is negative the it returns no. The proposed framework model includes four stages.
- First, the input MR image is preprocessed (brain cropping and resizing, data splitting and normalization). Second, the data augmentation technique is used to increase the size of the dataset and extract the features.
- The features extracted by the CNN models are classified using the softmax layer.

ADVANTAGES

- It is considered as the best DL technique for image classification due to high accuracy.
- Image pre-processing required is much less compared to other algorithms.
- CNN has been widely used to solve different problems, but its performance is very good for image processing in health applications.

SYSTEM CONFIGURATION

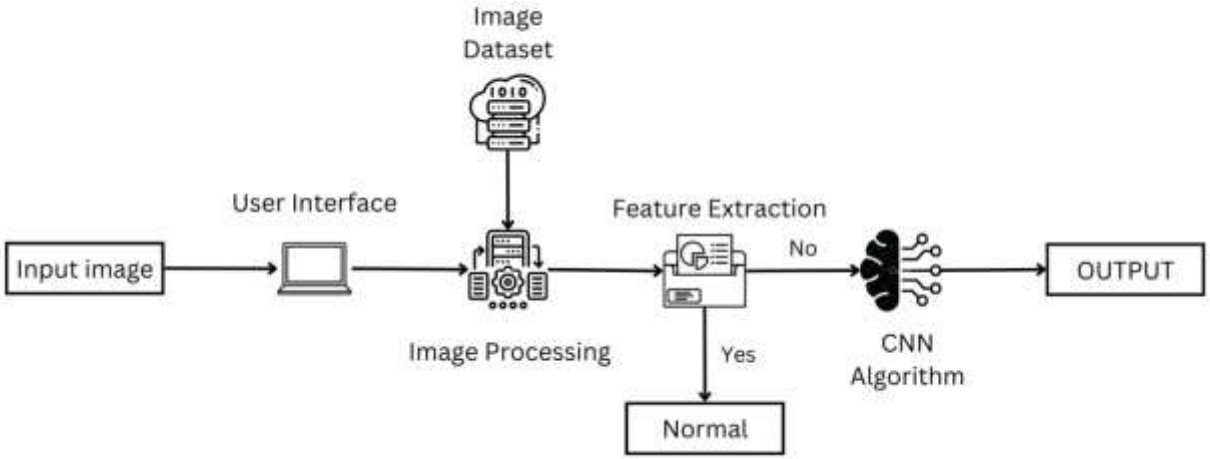
HARDWARE :

- PROCESSOR-I3,I5,I7
- RAM – 4 GB
- HARD DISK-250 GB

SOFTWARE :

- OPERATING SYSTEM - WINDOWS 8/10
- LANGUAGE - PYTHON(3.10) VERSION.
- SERVER - GUI

BLOCK DIAGRAM



MODULES DESCRITION

MODULES LIST:

- Image Acquisition
- Image Pre-Processing
- Image Segmentation
- Feature Extraction
- MRI Classification
- Convolutional Neural Network

IMAGE ACQUISITION:

The parkinson’s disease MRIs dataset acquisition has been used to implement the proposed methods. This method is used to design for extraction of Parkinson’s with accuracy and composed number of stages is including image capturing, edge detection, and classification of Parkinson’s disease.

IMAGE PRE-PROCESSING:

In this module, we are performing some basic operation on image to get proper image for processing. In this module, we are perform certain operation like gray-scale conversion, filtering, sharpening, smoothing, edging, and image segmentation to get proper and clean image. Preprocessing step enhances the quality of the images by eliminating noise. The Gray scale images, kind of black-and-white or gray monochrome images, are composed exclusively of shades of gray. Gray scale images can be measuring the intensity of light at each pixel. The Filtering operation is performed on the image to increase the smoothness, sharpness as well as edge enhancement. In sharpening filter is used to enhancement the images in sharpening and to enhance detail that has been blurred. Smoothing filter is used to reduce the noise. It has used many different algorithms. Edging is a technique of finding and identifying sharpness presented in an image.

IMAGE SEGMENTATION:

Image Segmentation is an important step in domain of computer vision based on emerging applications including medical imaging, video surveillance and many more. The image segmentation is a step of processing which is used threshold method to segment the MRI (Magnetic Resonance Images) image gray level to binary image. Segmentation means partitioning the digital images into multiple parts of segments or objects. Segmentation is a process of grouping the pixels that have similar attributes. Is used to locate the objects and boundaries in images. Basically, the segmentation process performed to extract important features from the image for further analysis.

FEATURE EXTRACTION:

In this module, we are performing some more operation on segmented image. In this module we will perform feature extraction operation to get all detailed information about brain image. Feature Extraction and reduction has been playing a vital role for Parkinson's disease region into their relevant categories in the field of computer vision and machine learning. The major issue behind feature extraction is to compute the most active or robust features for classification, which produced an efficient performance. The Feature extraction is used related to dimensionality reduction.

MRI CLASSIFICATION:

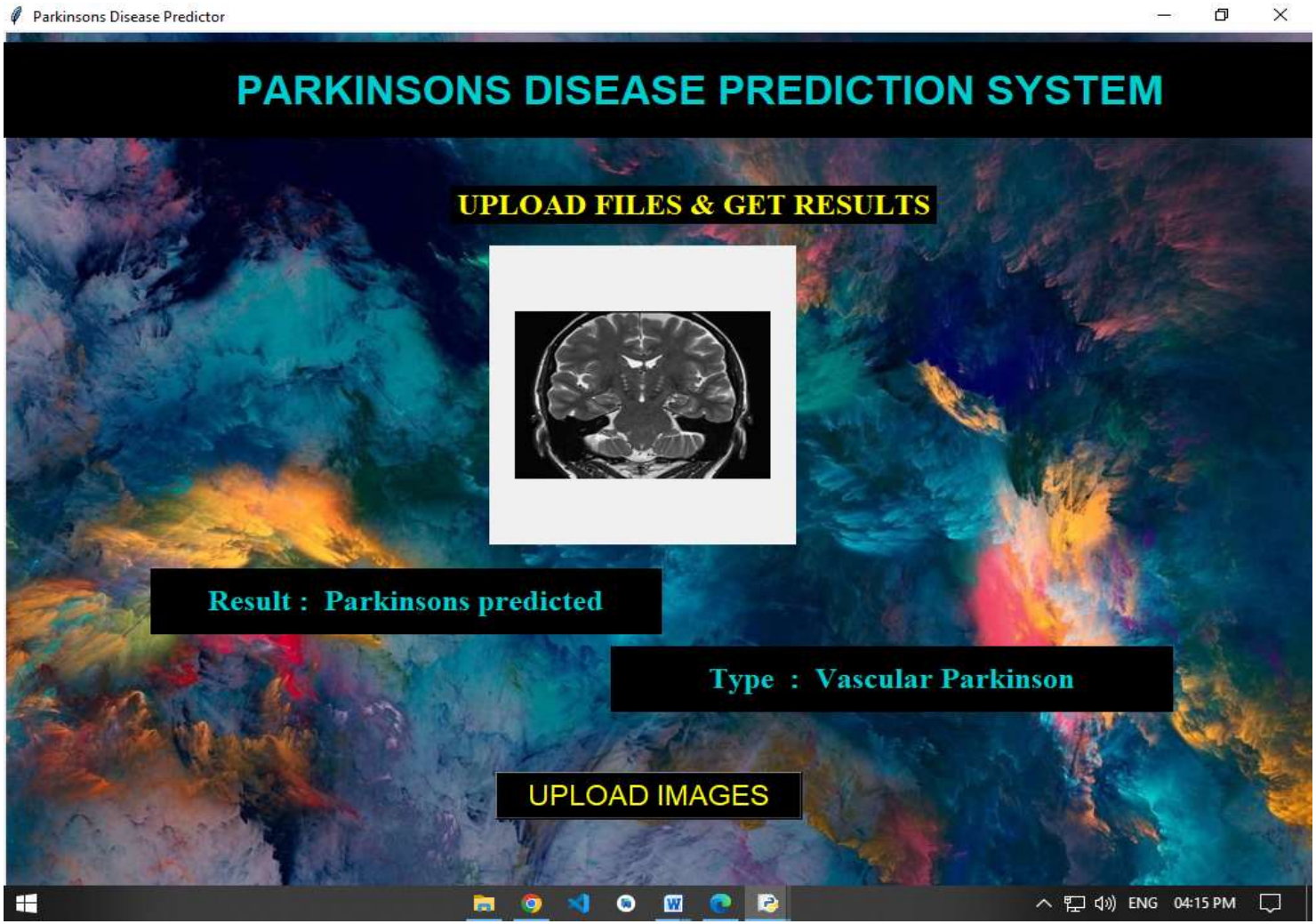
In this module, we are performing classification techniques with help of deep learning algorithm to determine Parkinson disease condition. The Parkinson’s disease classification is the final step of the proposed approach that is used to identify the type of Parkinson’s disease normal or abnormal. After features are extracted and selected the classification step using CNN is performed on the resulted feature vector. Classification is performed by using training phase and testing phase of CNN structure

CONVOLUTIONAL NEURAL NETWORK:

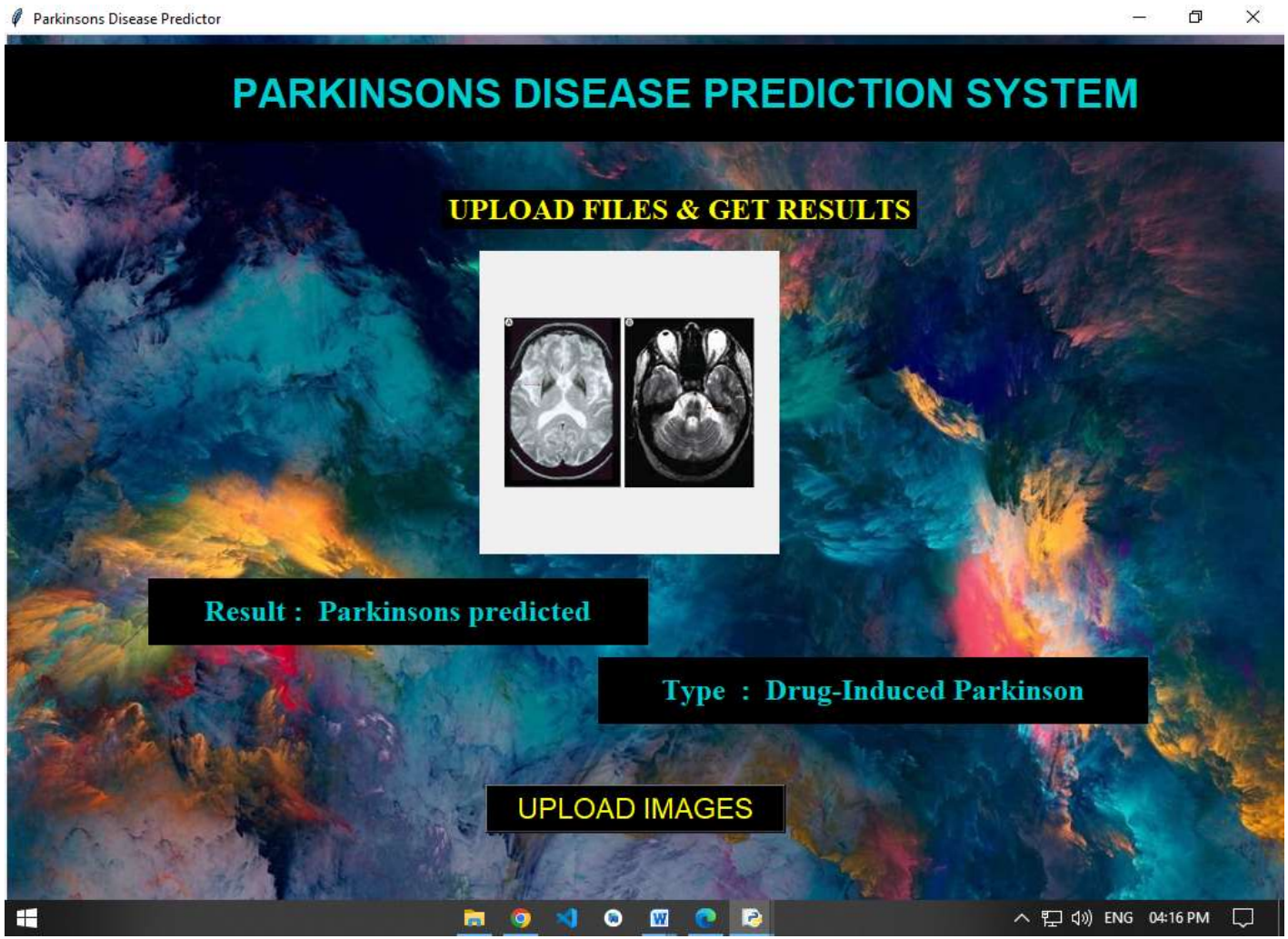
The name of “Convolutional Neural Network” performs the mathematical operation called convolution. Convolution is a specialized kind of linear operation. In deep learning, a convolutional neural network (CNN, or ConvNet) is a class of deep neural networks, Convolutional networks are simply neural networks that use convolution in matrix multiplication in at least one of their layers. ConvNets have been successful in Identifying faces, objects, and diseases detection. A convolutional neural network consists of an input layer, output layer, as well as multiple hidden layers. CNN which is feed forward neural network and is widely used for image recognition and classification. The Convolutional neural layers convolve the input and pass its result output to the next layer. CNNs are regularized versions of multilayer perceptron’s. The Multilayer perceptron’s are the fully connected networks each one neuron is connected to all other neurons in next layer. The "fully-connected" network means over fitting data.

SCREENSHOTS

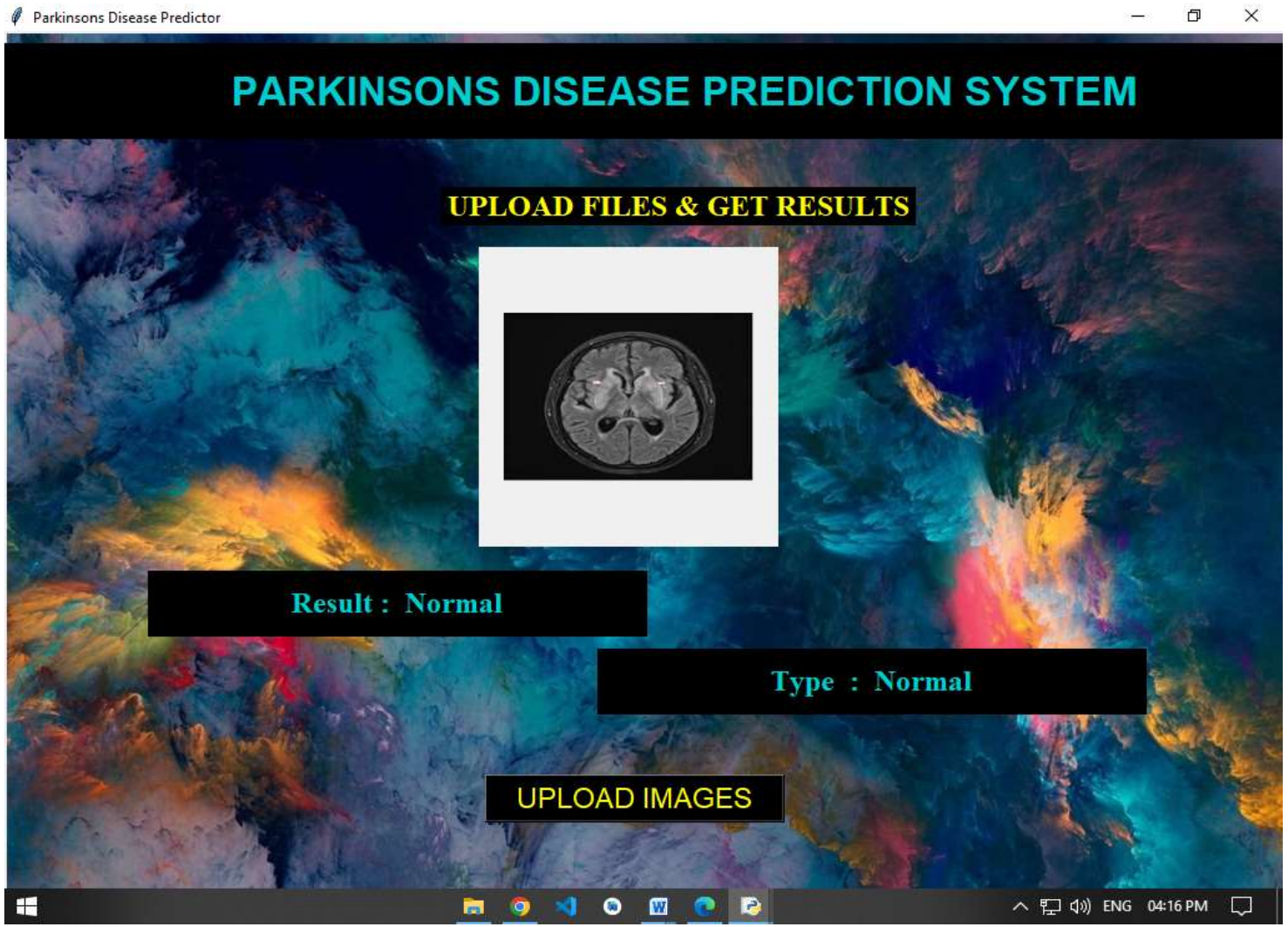
SCREENSHOTS



SCREENSHOTS



SCREENSHOTS



FUTURE WORK

Although this study focused on five other convolutional models and transfer learning designs for Parkinson's disease in the medical imaging field, further research is needed. We will investigate more significant and influential deep CNN models for Parkinson disease classification and conduct segmentation with reduced time complexity in future approaches. Also, to improve the accuracy of the proposed model, we will increase the number of MRI scans in the dataset used for this study. Furthermore, we will also be applying the proposed approach to other medical images such as x-ray, computed tomography (CT), and ultrasound which may serve as a foundation for future research.

CONCLUSION

- In this study, we used transfer learning to develop a CNN model for automatic Parkinson's disease detection using MR images.
- Transfer learning uses weights from networks previously trained on millions of data.
- The proposed study implements four different transfer learning models with different optimizers (ADAM, SGD, RMSprop), and extensive experiments were performed on the two datasets with the largest number of MR images currently available.
- For these four models, the features are extracted using transfer learning, and three dense layers along with the softmax layer are used for classification purposes.
- The proposed deep TL models shows fast learning by using the Adam optimizer, and the dropout method avoids the problem of over fitting. In future work, the performance of the system can still be improved by using larger data sets and using other deep learning techniques.

REFERENCES

[1] N. S. Hoang, Y. Cai, C.-W. Lee, Y. O. Yang, C.-K. Chui, and M. C. Heng Chua, ‘‘Gait classification for Parkinson’s disease using stacked 2D and 1D convolutional neural network,’’ in Proc. Int. Conf. Adv. Technol. Commun. (ATC), Oct. 2019, pp. 44–49, doi: 10.1109/ATC.2019.8924567.

[2] K. Hu, Z. Wang, S. Mei, K. A. E. Martens, T. Yao, S. J. G. Lewis, and D. D. Feng, ‘‘Vision-based freezing of gait detection with anatomic directed graph representation,’’ IEEE J. Biomed. Health Informat., vol. 24, no. 4, pp. 1215–1225, Apr. 2020, doi: 10.1109/JBHI.2019. 2923209.

[3] G. Solana-Lavalle, J.-C. Galán-Hernández, and R. Rosas-Romero, ‘‘Automatic Parkinson disease detection at early stages as a pre-diagnosis tool by using classifiers and a small set of vocal features,’’ Biocybern. Biomed. Eng., vol. 40, no. 1, pp. 505–516, Jan. 2020, doi: 10.1016/j. bbe.2020.01.003.

[4] S. Sivaranjini and C. M. Sujatha, ‘‘Deep learning based diagnosis of Parkinson’s disease using convolutional neural network,’’ Multimedia Tools Appl., vol. 79, nos. 21–22, pp. 15467–15479, Jun. 2020, doi:10.1007/s11042-019-7469-8.

[5] F. Aydın and Z. Aslan, ‘‘Recognizing Parkinson’s disease gait patterns by vibes algorithm and Hilbert–Huang transform,’’ Eng. Sci. Technol. Int. J., vol. 24, no. 1, pp. 112–125, Feb. 2021, doi: 10.1016/j.jestch. 2020.12.005.

[6] I. El Maachi, G.-A. Bilodeau, and W. Bouachir, ‘‘Deep 1D-convnet for accurate Parkinson disease detection and severity prediction from gait,’’ Expert Syst.Appl.,vol. 143, Apr. 2020, Art. no. 113075, doi: 10.1016/j.eswa.2019.113075.

[7] B. Karan and S. Sekhar Sahu, ‘‘An improved framework for Parkinson’s disease prediction using variational mode decomposition-Hilbert spectrum of speech signal,’’ Biocybern. Biomed. Eng., vol. 41, no. 2, pp. 717–732, Apr. 2021, doi: 10.1016/j.bbe.2021.04.014.

[8] H. Gunduz, ‘‘An efficient dimensionality reduction method using filterbased feature selection and variational autoencoders on Parkinson’s disease classification,’’ Biomed. Signal Process. Control, vol. 66, Apr. 2021,Art. no. 102452, doi: 10.1016/j.bspc.2021.102452.

[9] D. Yang, R. Huang, S.-H. Yoo, M.-J. Shin, J. A. Yoon, Y.-I. Shin, and K.-S. Hong, ‘‘Detection of mild cognitive impairment using convolutional neural network: Temporal-feature maps of functional near-infrared spectroscopy,’’ FrontiersAgingNeurosci.,vol.12,p. 141, May 2020, doi: 10.3389/fnagi.2020.00141.

[10] S.-H. Yoo, S.-W. Woo, M.-J. Shin, J. A. Yoon, Y.-I. Shin, and K.-S. Hong, ‘‘Diagnosis of mild cognitive impairment using cognitive tasks: A functional near-infrared spectroscopy study,’’ Current Alzheimer Res., vol. 17, no. 13, pp. 1145–1160, Mar. 2021, doi: 10.2174/1567205018666210212154941.