DETECTING PARKINSON'S DISEASE USING MACHINE LEARNING

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INTRODUCTION:

Parkinson's disease (PD), which affects the quality of life for millions of elderly people worldwide, is fast emerging as a significant central nervous system degenerative illness. Due to the variability of the disease, PD symptoms might progress differently from one person to the next. Patients with Parkinson's disease may experience symptoms, primarily tremors while at rest. There are numerous tremor kinds that can occur, including hand tremors, limb rigidity, and issues with walking and balance. Generally speaking, there are two categories of PD symptoms: those that are motor-related and those that are not (non-motor). Patients who exhibit non-motor symptoms are really more adversely affected than those whose primary symptoms are motor. Depression, sleep behaviour issues, a loss of smell, and cognitive impairment are examples of non-motor symptoms. More than 10 million people are living with Parkinson's Disease worldwide, according to the Parkinson's Foundation.

LITERATURE SURVEY:

Paper1

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

Author: Wu Wang, Junho Lee, Fouzi Harrou, Ying Sun

Year:2020

An innovative deep learning technique is introduced to early uncover whether an individual is affected with PD or not based on premotor features. Specifically, to uncover PD at an early stage, several indicators have been considered in this study, including Rapid Eye Movement and olfactory loss, Cerebrospinal fluid data, and dopaminergic imaging markers. A comparison between the proposed deep learning model and twelve machine learning and ensemble learning methods based on relatively small data including 183 healthy individuals and 401 early PD patients shows the superior detection performance of the designed model, which achieves the highest accuracy, 96.45% on average. Besides detecting the PD, we also provide the feature importance on the PD detection process based on the Boosting method.

Paper2:

Title: High-accuracy detection of early Parkinson's Disease using multiple characteristics of finger movement while typing

Author: Warwick R Adams

Year: 2017

In this investigation, keystroke timing information from 103 subjects (comprising 32 with mild PD severity and the remainder non-PD controls) was captured as they typed on a computer keyboard over an extended period and showed that PD affects various characteristics of hand and finger movement and that these can be detected. A novel methodology was used to classify the subjects' disease status, by utilising a combination of many keystroke features which were analysed by an ensemble of machine learning classification models. When applied to two separate participant groups, this approach was able to successfully discriminate between early-PD subjects and controls with 96% sensitivity, 97% specificity and an AUC of 0.98. The technique does not require any specialised equipment or medical supervision, and does not rely on the experience and skill of the practitioner. Regarding more general application, it currently does not incorporate a second cardinal disease symptom, so may not differentiate PD from similar movement-related disorders.

Paper3:

Title: Reliable Parkinson’s Disease Detection by Analyzing Handwritten Drawings: Construction of an Unbiased Cascaded Learning System Based on Feature Selection and Adaptive Boosting Model

Author: Liaqat Ali,Ce Zhu,Noorbakhsh Amiri Golilarz, Ashir Javeed, Mingyi Zhou, Yipeng Liu

Year:2019

Different computer vision and machine learning researchers have proposed micrography and computer vision based methods. But, these methods possess two main problems. The first problem is biasedness in models caused by imbalanced data i.e. machine learning models show good performance on majority class but poor performance on minority class. Unfortunately, previous studies neither discussed this problem nor took any measures to avoid it. In order to highlight the biasedness in the constructed models and practically demonstrate it, we develop four different machine learning models. To alleviate the problem of biasedness, we propose to use random undersampling method to balance the training process. The second problem is low rate of classification accuracy which has limited clinical significance. To improve the PD detection accuracy, we propose a cascaded learning system that cascades a Chi2 model with adaptive boosting (Adaboost) model. The Chi2 model ranks and selects a subset of relevant features from the feature space while Adaboost model is used to predict PD based on the subset of features. Experimental results confirm that the proposed cascaded system shows better performance than other six similar cascaded systems that used six different state of the art machine learning models. Moreover, it was also observed that the

proposed cascaded system improves the strength of conventional Adaboost model by 3.3% and reduces its complexity. Additionally, the cascaded system achieved classification accuracy of 76.44%, sensitivity of 70.94% and specificity of 81.94%.

Paper4:

Title: Parkinson's Disease Detection from Spiral and Wave Drawings using Convolutional Neural Networks: A Multistage Classifier Approach

Author: Chakraborty, Sabyasachi & Aich, Satyabrata & Jong-Seong-Sim, & Han, Eunyoung & Park, Jinse & Kim, Hee-Cheol

Year:2020

Identification of the correct biomarkers with respect to particular health issues and detection of the same is of paramount importance for the development of clinical decision support systems. For the patients suffering from Parkinson's Disease (PD), it has been duly observed that impairment in the handwriting is directly proportional to the severity of the disease. Also, the speed and pressure applied to the pen while sketching or writing something are also much lower in patients suffering from Parkinson's disease. Therefore, correctly identifying such biomarkers accurately and precisely at the onset of the disease will lead to a better clinical diagnosis. Therefore, in this paper, a system design is proposed for analyzing Spiral drawing patterns and wave drawing patterns in patients suffering from Parkinson's disease and healthy subjects. The system developed in the study leverages two different convolutional neural networks (CNN), for analyzing the drawing patters of both spiral and wave sketches respectively. Further, the prediction probabilities are trained on a metal classifier based on ensemble voting to provide a weighted prediction from both the spiral and wave sketch. The complete model was trained on the data of 55 patients and has achieved an overall accuracy of 93.3%, average recall of 94 % , average precision of 93.5% and average f1 score of 93.94%

Paper5:

Title: Parkinson's Disease Detection Using ResNet50 with Transfer Learning

Author: Jahan, Nusrat & Nesa, Arifatun & Layek, Abu.

Year:2020

In this study, a fine motor symptom that is sketching has been studied. The experiments are done on a significant number of PD patients and Healthy Group (without PD). We proposed a system that can determine the sketching and reports whether a PD patient's sketch or not. Deep learning algorithms can deal with the solution of different brain generalizing neural networks with the same design. Thus, we applied Convolutional Neural Network (CNN) to classify sketched images to discriminate or identify Parkinson's Disease (PD) affected patients from the regular healthy (without PD) control group. The experiment was done on different CNN models with transfer learning method and applying on Spiral and Wave sketched data. The proposed system achieved 96.67% accuracy on the ResNet50 model with spiral sketching. Contribution of the Paper: The main contribution of this paper is, we have used Transfer learning which enhanced the model performance.

REFERENCES:

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