PARKINSON'S DISEASE DETECTION USING MACHINE LEARNING

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Abstract

More than 10 million people are living with Parkinson's Disease worldwide, The researchers found that the drawing speed was slower and the pen pressure is lower among Parkinson's patients. One of the indications of Parkinson's is tremors and rigidity in the muscles, making it difficult to draw smooth spirals and waves. It is possible to detect Parkinson's disease using the drawings alone instead of measuring the speed and pressure of the pen on paper. Our goal is to quantify the visual appearance(using HOG method) of these drawings and then train a machine learning model to classify them. In this project, We are using, Histogram of Oriented Gradients (HOG) image descriptor along with a Random Forest classifier to automatically detect Parkinson's disease in hand-drawn images of spirals and waves.

Problem Definition

Medical observations and assessment of clinical indicators, including the identification of a variety of motor symptoms, are often used to diagnose Parkinson's disease (PD). Traditional diagnostic procedures, on the other hand, may be vulnerable to subjectivity because they rely on the assessment of motions that are sometimes subtle to human sight and hence difficult to define, potentially leading to misdiagnosis. Meanwhile, early nonmotor symptoms of Parkinson's disease can be minor and be caused by a variety of other illnesses. As a result, these symptoms are frequently missed, making early PD diagnosis difficult

Survey Paper-1

- <u>Author Name</u> : Indira R
- <u>Title</u> : Diagnosis of Parkinson's Disease using Fuzzy C-Means Clustering and Pattern Recognition
- <u>Publication website</u> : https://www.researchgate.net/publication/283453672_Diagnosis_of_Parkinson's_Disease_using_Fuzzy_C-Means_Clustering_and_Pattern_Recognition
- <u>Published Year</u>: 2013
- <u>Objective</u> :An automatic machine learning approach and detection of the Parkinson disease on behalf of speech/voice of the person.
- <u>Technology used</u>:

The author used fuzzy C-means clustering and pattern recognition based approach for the discrimination between healthy and parkinson disease affected people. The authors of this paper have achieved 68.04% accuracy, 75.34% sensitivity and 45.83% specificity

Survey Paper-2

- <u>Author Name</u> :R. Geeta
- <u>Title</u> :Feature Relevance Analysis and Classification of Parkinson Disease TeleMonitoring Data Through Data Mining Techniques
- <u>Publication website</u> : https://www.semanticscholar.org/paper/Feature-Relevance-Analysis-and-Classification-of-Ramani-Sivagami/291ec451967e81db4f6b2d08090f435990d24a24
- <u>Published Year</u>: 2012
- <u>Objective</u> :To perform feature relevance analysis to calculate the score to classify the Parkinson diseases from healthy individuals
- <u>Technology used</u>:
  Tele-monitoring dataset and dataset comparison classes Motor-UPDRS and Total-UPDRS (Unified Parkinson Disease Rating scale). Random tree classification 100% accuracy

Survey Paper-3

- <u>Author Name</u> : Cho, C.
- <u>Title</u> : A vision-based analysis system for gait recognition in patients with Parkinson's disease.
- <u>Publication website</u> : https://scholar.nycu.edu.tw/zh/publications/a-vision-based-analysis-system-for-gait-recognition-in-patients-w
- <u>Published Year</u>: 2009
- <u>Objective</u> :To propose a gait analysis system which can detect the gait pattern of Parkinson's disease using computer vision
- <u>Technology used</u>:
- Cho, C. at al. (2009) proposed system utilizes an algorithm combining principal component analysis (PCA) with linear discriminant analysis (LDA). We propose a gait analysis system which can detect the gait pattern of Parkinson's disease using computer vision. This system comprises three main parts: pre-processing, training and recognition. Experimental results showed that LDA had a recognition rate for Parkinsonian gait of 95.49%.

Survey Paper-4

- Author Name :Azad, C

- Title :Design and Analysis of Data Mining Based Prediction Model for Parkinson's disease.

- Publication website:

  https://www.researchgate.net/publication/362446752_A_Survey_of_Machine_Learning_Based_Approaches_for_Parkinson_Disease_Prediction

- Published Year: 2013

- Objective :Proposed prediction model tree based classification model decision tree, ID3 and decision stumps are used for training and testing the effectiveness many symptoms that lead to Parkinson's disease

- Technology used:

  Azad, C., et al. (2013) proposed prediction model tree based classification model decision tree, ID3 and decision stumps are used for training and testing the effectiveness many symptoms that lead to Parkinson's disease such age environmental factor, trembling in the legs, arms, hands, impaired speech articulation and production difficulties. Decision tree, ID3 and decision stumps our prediction model provides accuracy 85.08%, 75.33% and 83.55% or classification error 14.92%, 24.67% and 16.45% respectively

Survey Paper-5

- <u>Author Name</u> :A.Tsans
- <u>Title</u> :Novel speech signal processing algorithms for high accuracy classification of Parkinson's disease.
- <u>Publication website:</u>
  https://ieeexplore.ieee.org/document/6126094
- <u>Published Year</u>: 2011
- <u>Objective</u> :To propose a nonlinear signal approach for Novel speech signal processing algorithms for high accuracy classification of Parkinson's disease.
- <u>Technology used</u>:
  A.Tsanas et al. (2011) proposed a nonlinear signal approach large dataset (dataset are voice/speech recorded without requiring physician presence in the clinical) apply wide range known speech signal algorithm. This paper was performed using nonlinear regression and classification algorithm, and support visibility of frequent, remote, cost-effective, accurate UPDRS telemonitoring based on self-administered speech tests.

Survey Paper-6

- <u>Author Name</u> :Caglar
- <u>Title</u> : Automatic recognition of Parkinson's disease from sustained phonation tests using ANN and adaptive neuro-fuzzy classifier.
- <u>Publication website:</u>
  https://dergipark.org.tr/tr/download/article-file/195366
- <u>Published Year</u>: 2010
- <u>Objective</u> : To discriminate between healthy people and people with PD using ANN.
- <u>Technology used</u>:
  Caglar et al. (2010) proposed ANN (Two types of the ANNs were used for classification: Multilayer Perceptron (MLP) and Radial Basis Function (RBF) Networks) and Adaptive Neuro-Fuzzy Classifier (ANFC) with linguistic hedges to discriminate between healthy people and people with PD. Adaptive Neuro-Fuzzy Classifier with linguistic hedges gave the best recognition results with %95.38 training and %94.72 testing classifying performance indeed.

Survey Paper-7

- <u>Author Name</u> : Shahbakhi

- <u>Title</u> :Speech Analysis for Diagnosis of Parkinson's Disease Using Genetic Algorithm and Support Vector Machine

- <u>Publication website:</u>
  https://www.scirp.org/journal/paperinformation.aspx?paperid=43493

- <u>Published Year</u>: 2014

- <u>Objective</u> :Proposed classification of healthy and people with Parkinson using Genetic Algorithm and Support Vector Machine

- <u>Technology used</u>:
  Shahbakhi et al. (2014) presented that a Genetic Algorithm (GA) and SVM were used for classification between healthy and people with Parkinson. Voice signals that 14 features were based on F0 (fundamental frequency or pitch), jitter, shimmer and noise to harmonics ratio, which are main factors in voice signal. Results show that classification accuracy 94.50, 93.66 and 94.22 per 4, 7 and 9 optimized features respectively.

De-merits

The Random Forest Classifier had the maximum accuracy of 83.12 percent. The diagnosis of bradykinesia and tremor,the tangible results for the early detection of this disease. Furthermore, it was discovered that the detection accuracy might be improved in two ways: by incorporating ensemble algorithms such as bagging, boosting, and voting, and by expanding the dataset size

Hardware & Software Requirements

- **<u>Software Required</u> :** Python, Jupyter notebook .
- **<u>System Required</u> :** 8GB RAM, Intel Core i3, OS-Windows/Linux/MAC, Laptop or Desktop

Objective

The main aim of this thesis is to automate the PD diagnosis process in order to discover this disease as early as possible. If we discover this disease earlier, then the treatments are more likely to improve the quality life of the patients and their families

Much research has taken place in this field, but the aim of this thesis is to use different Machine learning techniques to detect PD accurately by analysing the patients' motor features and hand-drawn images.

Thank You!