Paper 1: DETECTING PARKINSON'S DISEASE USING IBM WATSON CLOUD

Publication Year: July-2022

Author name: Dr. Arun Kumar GH*1, Sachin MN*2, Nivedita K*3, Nischitha N*4, Pooja Mudenur*5

Journal name: https://www.irjmets.com

Summary:

According to the Parkinson's Foundation in worldwide more than 10 million people are suffering from Parkinson's Disease. While Parkinson's cannot be cured, early detection along with proper medication can significantly improve symptoms and quality of life. The researchers found that the drawing speed was slower and the pen pressure is lower among Parkinson's patients. One of the main indications of Parkinson's is tremors and rigidity in the muscles, it will make difficult to draw smooth spirals and waves. According to the researchers, 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 main goal is to quantify the visual appearance using HOG method of these drawings written by the persons and then train a machine learning model to classify these drawings. In this model, we are using, Histogram of Oriented Gradients (HOG) image descriptor along with a Random Forest classifier to automatically detect the Parkinson's disease using hand-drawn images of spirals and waves form drawings.

Conclusion:

Previous work papers have focused only on a particular imaging modality such as MRI or PET, or on one specific type of dementia only such as AD. The proposed method aimed to cover a broader space of imaging and machine learning technologies for mental illness diagnostics such that researchers in the field could readily identify the state of the art in the domain. Moreover, in this we emphasize the importance of early detection and prediction of Parkinson's disease, such that treatment and support can be provided to patients as soon as possible and the effects of the disease can be decreased.

Paper 2: Diagnosis of Parkinson Disease using Handwriting Analysis

Publication Year: March 2022

Author name: Nihar Ranjan, Divya Umesh Kumar, Vaishnavi Dongare, Kiran Chavan, Yuvraj Kuwar.

Journal name: https://www.researchgate.net/publication

Summary:

Parkinson is a neurodegenerative disease that affects your ability to control movement. Parkinson's disease starts slowly and worsens over time. The cured for Parkinson's disease is still unknown; medications might significantly improve your symptoms. Researchers suggest that early diagnosis of Parkinson can help improve the quality of the patient's life. In this survey, handwriting or drawings is considered as an aspect for detecting Parkinson disease using machine learning algorithm such as Random Forest Classifier and for detailed analysis of the drawings we use, Histogram of Oriented Gradients (HOG). We take drawings drawn by Parkinson patients as well as healthy people as input for detecting the Parkinson disease.

Handwriting can be considered as an aspect in the assessment of Parkinson disease. Handwriting consist of cognitive planning, coordination, and execution abilities. To diagnose the disease and its severity handwriting problems can be considered as a prominent aspect, so changes in writing can be considered a prominent biomarker. In this paper we have considered handwriting or drawing as an aspect for detecting the Parkinson disease as it is cost friendly and less time consuming.

Conclusion:

There are systems which use devices like electronic pens or have interview processes based on which detection of Parkinson disease takes place. These processes sometimes become very tiring for the patients and also they are very time consuming. The proposed system is more beneficial. It is cost efficient as we avoid use of electronic or smart pens. The system is easy to understand. As we have used HOG descriptors, they are very powerful descriptors which are extremely helpful in describing the structure, shape and appearance of the input image.

Paper 3: Early Detection of Parkinson's Disease usingContrast Enhancement Techniques and CNN

Publication year: 05 May 2021

Author name: Ishan Vatsaraj, Dr. Gajanan Nagare

Journal name: http://www.ijert.org

Summary:

Parkinson's Disease is one of the most common CNS diseases in the world. The estimated population of people above the age of 50 suffering from Parkinson's Disease in India by 2030 will be 0.69 million . Parkinson's disease affects human motor movement. It is a progressive nervous system disorder. Dopamine levels in the body drop due to nerve cell damage in the brain which lead to the symptoms of Parkinson's Disease. At the onset, a slight tremor is noticed in one hand. Tremors are a common symptom however as the disorder progresses, it causes stiffness or slowing of movement(bradykinesia) and loss of postural reflexes.The Hoehn and Yahr rating scale is widely used by doctors to classify the severity of symptoms of Parkinson's Disease.The five stages of the Hoehn and Yahr scale help doctors evaluate how far the disease has advanced. Stage 0 indicates no signs of disease. Symptoms like tremors and difficulty in movement, generally exclusive to one side of the body(unilateral) are observed at stage 1. At stage 1.5 the patient experiences unilateral symptoms plus axial involvement (neck and spine). Stage 2 is considered to be a moderate form of Parkinson's, and the symptoms are much more noticeable than those experienced in stage 1. Patients experience symptoms on both sides of the body without impairment of balance. At stage 2.5, patients experience mild symptoms on both sides of the body, with recovery when the doctor stands behind the person and asks them to maintain their balance when pulled backwards (pull test). At stage 3, patient needs assistance to prevent falling on pull test, but are physically independent. It can be regarded as a mild to moderate bilateral disease. Stage 4 patients experience severe disability, but are still able to walk or stand unassisted. Stage 5 patients find it impossible to stand or walk due to advanced stiffness in the legs which causes freezing upon standing, they may need a wheelchair or are bedridden unless assisted. Clinical methods like Magnetic Resonance Imaging (MRI), transcranial Doppler ultrasonography, positron emission tomography (PET), single-photon emission computed tomography (SPECT), morphometric MRI studies, tractography, functional MRI and perfusion imaging are used for detecting and identifying type of parkinsonism . These methods usually have to be performed by doctors and are painstaking for the patients. Identifying accurate biomarkers is an important research goal for neurodegenerative diseases. Many works have used speech processing, handwriting recognition and gait analysis for detection of Parkinson'sDisease . Parkinson's prediction based on speech uses sustained vowels and natural speech and requires high level of signal processing. By performing gait analysis, motor symptoms can be detected . In comparison to these methods, handwriting analysis proves to be a simple, quick and efficient way to diagnose Parkinson's Disease. Patient's symptoms and quality of life can be significantly improved with early diagnosis and proper medication as there is no cure for Parkinson's Disease. An analysis of handwriting and sketching abilities of patients and micrographia is used for early-stage diagnosis of Parkinson's disease. Handwriting analysis is also an effective indicator for detection of

Parkinson's disease. Handwriting of a person can be influenced by a number of factors such as education and language proficiency however sketching of a shape such as the spiral has been found to be a non-invasive and an independent parameter for measurement of onset of symptoms . Hence it may be considered as an objective, easy to administer non- invasive test to measure motor dysfunction in Parkinson disease (PD).

Conclusion

Many researchers have done different studies on Parkinson detection using CNN on Images. A custom Neural Network trained using Dynamic and Static spiral images to detect

Parkinson obtained an overall accuracy of 87% . Fine- tuned VGG-19 model used on the Parkinson's Drawing dataset obtained an accuracy of 88.5% on the dataset . AlexNet obtained an accuracy of 92.14% on the spiral images and 90% on the wave images . Multistage Classifier model used for detection of Parkinson's Disease obtained an overall accuracy of 93.33%.

In this work, the developed methodology and dataset,showed an overall accuracy of 96.67%. It has been observed that the results are in good agreement with the previously reported works. The significant improvement in the accuracy can be attributed to the optimal contrast enhancement technique used and that two different CNN models were used for predicting the spiral and wave patterns respectively. The condition that it should not classify Parkinson patients as healthy is satisfied.

The machine learning architectures using non-invasive biomarkers found to be an effective method for early detection of Parkinson’s disease. The developed models for spiral and wave sketches perform satisfactorily in classifying the sketches of healthy and Parkinson patients. The models obtained an overall accuracy of 96.67%, precision of 93.33% and a recall of 100%. The model does not misclassify any Parkinson patient in the data used in this study as healthy. The developed model can be employed in real life scenarios and stable production environments.

Paper 4: Early Detection of Parkinson’s Disease usingContrast Enhancement Techniques and CNN

Publication year: 05 May 2021

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Paper 5: Predicting Parkinson's Disease Progression: Evaluation of Ensemble Methods in Machine Learning

Publication year: 3 February 2022

Author name: Mehrbakhsh Nilashi , Rabab Ali Abumalloh , Behrouz Minaei-Bidgoli , Sarminah Samad , Muhammed Yousoof Ismail , Ashwaq Alhargan , and Waleed Abdu Zogaan

Summary:

Parkinson's disease (PD) is the second most common and complex neurodegenerative disorder worldwide. Both polygenic and environmental factors can cause PD. It is found that, in about 1%–2% of the PD cases, the disease development occurs through a single gene main symptoms of PD are bradykinesia (motor features), muscle stiffness, and tremor, along with other symptoms such as sleep disorders (nonmotor features), cardiac arrhythmia, and constipation. Alteration of voice and speech is one of the features of PD. Unified Parkinson's Disease Rating Scale or UPDRS, which shows symptoms' presence and severity, is mainly used in tracking PD symptom progression. UPDRS is considered as the well-validated test and the most widely used clinical rating scale for patients with PD . UPDRS includes 4 sections, in which UPDRS I, UPDRS II, UPDRS III, and UPDRS IV are used to evaluate psychiatric symptoms in PD, activities of daily living, reliable motor symptoms measured in PD recognized by physical exam, and complications of treatment . In many studies, this scale is considered

based on Total-UPDRS with the range of 0–176 (176 total disability and 0 representing healthy) and Motor-UPDRS which indicates the UPDRS' motor section with the range of 0–108 (108 indicating severe motor impairment and 0 indicating healthy state) . Machine learning (ML) approaches have demonstrated the capability of handling large volumes of medical datasets and presented perceptive directions .use of MLbased tools could enhance the safety of individuals , enhance the quality of medical care [16–18], minimize the costs of medical care , and support physicians' efforts by manipulating big data of patients' records. ML approaches have been broadly utilized for disorders' classification and prediction [22–30]. Gadekallu et al. investigated the use of machine learning techniques for the prediction of diabetic retinopathy.authors used the PCA-based Deep Neural Network (DNN) model using the Grey Wolf Optimization (GWO) algorithm for of the extracted features of the diabetic retinopathy dataset.)e method was evaluated through the accuracy, recall, sensitivity, and specificity evaluation metrics and compared with the support vector machine (SVM), na¨ıve Bayes classifier, decision tree (DT), and XGBoost. Overall, their method achieved higher accuracy compared with the SVM, DT, and XGBoost techniques. Bhattacharya et al. developed a method for the classification of imbalanced multimodal stroke dataset.)e authors implemented the Antlion optimization algorithm on the DNN model to select optimal hyperparameters in minimal time consumption. A positive aspect of their method was that it consumed only 38.13% of the training time on the stroke dataset. An artificial neural network is among the most significant approaches for disease classification and prediction . Referring to Berner [39], clinical decision support systems (CDSSs) are special tools that are developed to aid medical specialists in their decision-making, considering particular disorders or diseases. ML approaches can be utilized for designing effective CDSS to aid medical specialists in reaching accurate and timely predictions. CDSSs designed using machine learning approaches have played a significant part in evaluating the existence or the severity of the disease. In machine learning methods, unsupervised approaches are used to lower the dimensionality of data, which allows the detection of the disease. Besides, these approaches allow manipulating the data, removing the noise from data, calculating the similarity, and segmenting the data [40]. On the other hand, supervised learning approaches are used to enable the final

classification, prediction, and diagnosis of the diseas. While ML has proven its benefits, the effective deployment of ML needs a great effort from human specialists, considering that no particular approach can present acceptable results in all possible scenarios. Although clinical data are available to researchers to explore, the lack of experience to handle big sources of data might restrict the optimum utilization of these sources. Besides, even though several approaches have been used in disease prediction using various real-world medical datasets, the choice of the deployed approach should consider enhancing the accuracy of the prediction and minimizing the time of computation goal of this paper is to present a comparison of machine learning approaches for remote tracking of Parkinson's disease progression.)e comparative study is based on clustering and prediction learning approaches. To further improve the accuracy of UPDRS prediction, this study uses ensemble learning in the final stage of the proposed method. Ensemble learning approaches have proven to be effective in prediction tasks . Few studies have incorporated ensemble learning approaches for the development of the diseases diagnosis systems. Further investigations are needed for the effectiveness of these approaches in UPDRS prediction. Accordingly, we use ensembles of support vector regression and different clustering techniques for PD data clustering.)e results are then compared with other prediction learning approaches, deep belief network (DBN), support vector regression, multiple linear regression, and neurofuzzy techniques.

Conclusion

Most of the presented methods for PD prediction depend strongly on human proficiency .)e benefits of deploying the ML in the medical sector are that they provide objective, context-independent, and data-driven analysis . ML approaches have been utilized effectively in disease diagnosis and severity prediction. Particularly, ML has also been utilized in analyzing the data collected from wearable IMU sensors for automated evaluation of motor disorders like PD. Hence, the practical aim of this study entails providing supplementary, quick, and accurate methods that can aid experts in reaching more objective medical decisions considering the PD diagnosis. By deploying these methods in the appropriate systems, several gains can be acquired that entail reducing the expenses of manual diagnosis and minimizing diagnosis time. Continuing this line of research and supporting previous literature, this study uses both unsupervised and supervised learning techniques to diagnose PD through UPDRS prediction. Besides, clustering, dimensionality reduction, and prediction learning techniques are used to create the PD diagnosis method.)e basic aim of this paper is to conduct comparative research of the ML approaches for PD diagnosis. We concentrated on clustering and prediction learning methods to conduct the comparative study. Particularly, several clustering approaches for PD data segmentation and SVR ensembles to predict Motor-UPDRS and Total-UPDRS were used.)e findings are then evaluated based on other prediction learning methods, MLR, neurofuzzy, and SVR techniques based on a real-world PD dataset.)e finding of the study indicated the superiority of deploying EM with SVR ensembles in relation to decision trees, neurofuzzy and SVR combined with other clustering approaches in the prediction of Motor-UPDRS and TotalUPDRS. Many previous works have been conducted focusing on patients' classifications, severity prediction, and remote monitoring. Still, there are future routes in each field to be investigated. Besides, several sensors such as magnetometer, accelerometer, and gyroscope have been utilized and assessed. Additionally, MRI, EEG signals, f-MRI, and DATSCAN images were utilized to present accurate predictions of the disease. Other research directions can be followed by utilizing other brain signal images such as ECG, EMG, and PCG. Other sensing modalities can be explored and combined to present a more accurate classification of the disease. Even though ML methods in previous literature have presented high classification accuracy for PD detection, still, there are some obstacles related to

feature extraction and selection which need to be addressed [104].)e utilization of several features can increase the computation time [105,106]. On the other hand, if fewer features were utilized, this will increase the complexity of extracting the features, which will accordingly impact the computation time.)is paper has some shortcomings which should be considered in future research.)e study is based on a real-world dataset to assess the proposed approaches, which has one limitation considering the number of features used in the prediction process. Other PD datasets with a larger number of features can be utilized in the evaluation of the deployed approaches. Large datasets can present more generalized outcomes. Emerging technologies can be used to collect data from patients using particular applications, as suggested by Bot et , in which the authors developed an application to collect the data from PD patients using their iPhones.)is approach can ease the data collection from the public because of the availability of smartphones and help to present more generalizable outcomes. Furthermore, this study can be extended by incremental machine learning approaches to improve the computation time of previous PD diagnosis methods in processing large dataset.