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PARKINSON DISEASE MONITORING

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ABSTRACT

Parkinson's disease (PD) is a common and disabling pathology that is characterized by both motor and non-motor symptoms and affects millions of people worldwide. The disease significantly affects quality of life of those affected. Many works in literature discuss the effects of the disease. The most promising trends involve sensor devices, which are low cost, low power, unobtrusive, and accurate in the measurements, for monitoring and managing the pathology. Objectives: This review focuses on wearable devices for PD applications and identifies five main fields: early diagnosis, tremor, body motion analysis, motor fluctuations (ON–OFF phases), and home and long-term monitoring. The concept is to obtain an overview of the pathology at each stage of development, from the beginning of the disease to consider early symptoms, during disease progression with analysis of the most common disorders, and including management of the most complicated situations. Parkinson's Disease is a nervous system disorder and is progressive in nature. It affects body movements. Symptoms begin with a hardly noticeable tremor in body parts. The disorder results in stiffness and slowing down of movements. It's a debilitating neurodegenerative disease and cannot be diagnosed through blood tests. Parkinson' s disease mostly affects the people above 60 and is one of the common diseases among war veterans. We use ML algorithm XG BOOST to diagnose Parkinson's Disease with maximum accuracy using a Sensor dataset. Machine learning algorithms XG BOOST help to generate useful content from it. To increase the lifespan of elderly people the machine learning algorithms are used to detect diseases in the early stages

Keywords: Internet of Things (IoT), Robot control system, Biometric sensor, Neurodegenerative disorder and Dopamine.

1. INTRODUCTION

Parkinson's disease (PD) is a complex neurodegenerative disorder that has a usually asymmetric onset, characterized by typical motor symptoms as bradykinesia, hypo-/akinesia, muscular rigidity, and resting tremor Although the pathology is generally diagnosed on the basis of these motor symptoms, many non-motor manifestations are commonly evident and they may sometimes be more disabling of motor disturbances, such as olfactory disturbances, autonomic dysfunction, sleep fragmentation, depression, and dementia Some NMMs (e.g., sleep disorders, bladder disturbances, gastrointestinal symptoms, olfactory symptoms) may occur throughout the entire course of the disease, even if cognitive symptoms such as hallucinations and dementia tend to occur late in the PD. The disease is difficult to detect and treat promptly, as it shows a wide variability in the clinical expression The research findings proved that sensor based wearable devices, and specially instrumented insoles, help not only in monitoring and diagnosis but also in tracking numerous exercises and

their positive impact towards the improvement of quality of life among different Parkinson and neurocognitive patients.

The Parkinson's disease is due to a loss of neurons that produce a chemical messenger in the brain called dopamine. when there is a decrease in level of the amino acid named dopamine it leads to the abnormal brain activity, which leads to Parkinson's disease. The cause of Parkinson's disease is still a question mark, but several factors appear to play a role, including:

Genes

Environmental

Triggers

As a result, people suffer from this disease for many years before diagnosis. The estimated results have shown that there are 7-10 million people are affected by parkinson's disease worldwide. People with age above 50 are the ones who has the higher possibility of getting Parkinson's disease but still an estimated 4 percentage of people who are under the age 50 are diagnosed with Parkinson's disease. There is no cure or prevention for PD. However, the disease can be controlled in early stage. The data mining techniques is used as an effective way for early detection and diagnosis of the disease. Data mining techniques in medicine is a research area that combines sophisticated representational and computing techniques with the insights of expert physicians to produce tools for improving healthcare. Data mining is a statistical method for finding hidden patterns in datasets by constructing predictive or cla ssification models that can be learned from past experience and applied in future cases, so there is a need for a more accurate, objective means of early detection, ideally one which can be used by individuals in their home setting.

Parkinson's disease is a movement disorder that affects the central nervous system. The symptoms start gradually because of low dopamine levels in the brain. Dopamine is a chemical and is a neurotransmitter responsible for sending signals from the body to the brain. Reduction in the neurons responsible for production of dopamine leads to lowering of dopamine levels resulting in reduced coordination between the brain and the body. Till date there's not any cure for this disease and with the advancement of technology, it is necessary to introduce a quick and reasonable tool to predict the disease.

2. LITERATURE SURVEY

2.1 ANALYSIS OF TREMORS IN PARKINSON'S DISEASE USING ACCELEROMETER NIYA ROMY MARKOSE SCHOOL OF ELECTRONICS ENGINEERING VELLORE INSTITUTE OF TECHNOLOGYVELLORE 63201 INDIA, NIYAROMYMARKOSE@GMAIL.COM

Parkinson's disease is a disorder that affects the central nervous system which in turn has a deteriorating effect on the movements of a person. According to the US Census Bureau, there were 680,000 Parkinson's disease patients in US, and it is estimated to rise to 1,300,000 in the year 2030. Although, the chance of developing Parkinson's disease increases with age, there are people who are less than 50 years of age who suffer from Parkinson's disease. Symptoms of this disease develop when the dopamine level drops due to nerve cell damage and this the neurotransmitter that is involved is important for movement and coordination. Symptoms include tremors, slow movement, and difficulty to speak. The tremor usually starts in one hand. Tremor as it is known, is the involuntary shaking of body parts, and it is one of the most observable symptoms that Parkinson's disease patients can develop. Nearly 80% of the patients develop tremor. This tremor holds much significant medical or physiological information which can be considered for therapy. Two important points to be considered are Firstly, a good tremor assessment is important to decide the differential diagnosis of Parkinson's disease. Secondly, tremor assessment is another method which enables us to measure the severity of the disease and hence decide upon the treatments. It is important to understand that the tremor signals are highly variable in terms of frequency and distribution. It varies from person to person, and it is different in different contexts observing the changes that take place. The severity of the disease can be observed by IMU by taking tremor signals. Parkinson's disease tremor can be used to discriminate between the postural tremor and resting tremor in terms of band limited energy and amplitude. Some use this wearable device to acquire tremor in order to screen patients forthe onset of the diseases

2.2 A STUDY ON GAIT-BASED PARKINSON'S DISEASE DETECTION USING A FORCE SENSITIVE PLATFORM - XI WU1, XU CHEN1, YOU DUAN1, SHENGQIANG XU2, NAN CHENG3, NING AN

Gait analysis or human gait assessment is to systematically study human movement and aims at quantifying gait characteristics with various temporal and spatial gait parameters, such as stride speed, stride length, step length, cadence, standing time, double support time, and swing time. Furthermore, researchers have pointed out that gait is linked to the functional health of an individual and can be an indicator for the occurrence of a disease and for rehabilitation feedback. For example, previous studies have shown that the elderly with central dysfunction have a higher rate of disordered walking and instability. Accordingly, gait analysis has been drawing researchers from many fields with the aim to study human movement mechanism and facilitate health evaluation and medical decision-making. In gait analysis, researchers have explored different types of sensing technologies to measure human gait. Generally, we can group existing methods into vision-based methods and sensor-based. Gait sensing platform the self-developed gait sensing platform is a u-shape electronic walkway that consists of flexible force sensitive pressure sensors. It is comprised of 14 pressure pads (0.8m*0.8m in size, 4 pressure points per cm2, sampling frequency 100Hz), 5 pressure stations (0.8m*0.8m in size, sampling frequency 500Hz), a balance tester (0.8m*0.8m in size, sampling 5 frequency 500Hz), and 2 ramp modules (0.8m*1.0m in size). The ramp modules are placed at the beginning and end parts of the walkway for users to adapt.

two categories: vision-based methods and sensor-based. Gait sensing platform the self-developed gait sensing platform is a u-shape electronic walkway that consists of flexible force sensitive pressure sensors. It is comprised of 14 pressure pads (0.8m*0.8m in size, 4 pressure points per cm2, sampling frequency 100Hz), 5 pressure stations (0.8m*0.8m in size, sampling frequency 500Hz), a balance tester (0.8m*0.8m in size, sampling 5

2.3. IMPLEMENTATION OF AN IPHONE FOR CHARACTERIZING PARKINSON'S DISEASE TREMOR THROUGH A WIRELESS ACCELEROMETER APPLICATION - ROBERT LEMOYNE, TIMOTHY MASTROIANNI, MICHAEL COZZA, CRISTIAN COROIAN, AND WARREN GRUNDFEST, MEMBER, IEEE

The rampant incidence of Parkinson's disease, the implementation of devices for accessing status attributes, such as tremor, may alleviate strain on specialized medical resources. With the progressive evolution of wireless and accelerometer technology, the capacity to evaluate Parkinson's disease tremor attributes has been advocated. For instance, multiple applications addressing wireless accelerometers for evaluating Parkinson's tremor and simulated Parkinson's tremor have been demonstrated. Therefore, the capacity to potentially measure Parkinson's disease tremor attributes in the autonomous environment unique to an individual subject has become increasingly plausible. The iPhone provides the capacity to evaluate tremor characteristics, as the iPhone is equipped with a three dimensional accelerometer subsystem. As the iPhone incorporates the capacity to transmit data wireless, the amalgamation with the integral three dimensional accelerometer represents a functional wireless accelerometer capable of evaluating Parkinson's tremor. The iPhone is also equipped with a highly robust and scalable software package. The implications of the software capabilities associated with the iPhone may further expand the ability to measure Parkinson's disease tremor at the convenience of a subject's own autonomous environment, such as a homebound setting. A novel iPhone application functioning as an effective wireless accelerometer device was evaluated from an engineering proof of concept perspective. The test and evaluation of the application involved two subjects: one subject with Parkinson's disease tremor characteristics contrasted to one subject without Parkinson's disease. For application congruency, the iPhone was mounted to the dorsum of the hand through a comfortable glove. The software enabled the iPhone to be activated for recording a predefined time sample at a prescribed sampling rate. The accelerometer signal data of both subjects was *conveyed wireless and through email to* resources conducting the experiment in Pittsburgh, Pennsylvania and subsequently to resources reducing and post-processing the data in the proximity. 7 Future evolutions of the application are envisioned, such as the progressive evolution of the iPhone in terms of processing speed, storage capacity, mass reduction, battery lifetime, and software. Integration with machine learning may permit advanced systems for diagnostics and prescriptions augmented by artificial intelligence. The parameter selections for deep brain

stimulation may be facilitated through the quantified feedback from an iPhone wireless accelerometer application for quantifying Parkinson's disease tremor characteristics

2.4 MONITORING OF MOTOR AND NON-MOTOR SYMPTOMS OF PARKINSON'S DISEASE THROUGH A MHEALTH PLATFORM - JORGE CANCELA, SAMANTA VILLANUEVA MASCATO, DIMITRIOS GATSIOS, GEORGE RIGAS, ANDREA MARCANTE, GIOVANNI GENTILE, ROBERTA BIUNDO, MANUELA GIGLIO, MARIA CHONDROGIORGI, ROBERT VILZMANN, SPYROS

Entire population and about 1% in people over 60 years of age. The major motor disturbances in PD are: Bradykinesia (i.e. slowness in movements); Hypokinesia (decreased amplitude movements); Resting tremor (usually in the hand is often described as 'pill rolling'); Rigidity (stiffness of muscles); Postural instability (associated with gait and balance) and Dyskinesia i.e. the unintended, involuntary and uncontrollable movements including twitches, jerking, twisting or simple restlessness. Furthermore, PD patients are affected by a wide range of non-motor signs and symptoms such as loss of sense of smell (anosmia), nerve pain, urination 8 problems, constipation, depression and anxiety, sleeping problems (insomnia) leading in excessive sleepiness during the day, cognitive impairments, visual hallucinations (perception of something that does not exist), delusions (believing things that are not true). Current clinical practice is mainly focused on the management of motor symptoms through pharmacotherapy. The monitoring and assessment of symptoms in PD is mostly based on historical information, home diaries and neurological examination during visits to the clinic that in most countries occur every 6 months. These methods clearly suffer from many drawbacks: data from these sources can be highly subjective, they rely on the patient's memory and perception of his own symptoms (as well as his capacity to identify symptoms and the medical terminology) and they depend on the physician's experience on the field. In an attempt to solve these problems and to find more objective assessments, several rating scales have been designed and used. Among them, the Unified Parkinson's disease Rating Scale (UPDRS) is the most widely used. This rating scale tries to quantify selected symptoms and signs in a 5-points scoring system (from 0 for no sign, to 4 for a marked severity of the sign). Unfortunately, like any other semi-objective rating scale, has several limitations such as intra and inter-observer inconsistencies and bias by subjectivity issues related to the historical information have been demonstrated

2.5 ADVANCED AND EFFECTIVE CLASSIFICATION OF PARKINSON'S DISEASE USING ENHANCED NEURAL NETWORKS - KAVETI KIRAN KUMAR ASSISTANT PROFESSOR, CSE DEPARTMENT, VIGNAN'S FOUNDATION FOR SCIENCE TECHNOLOGY AND RESEARCH UNIVERSITY, VADLAMUDI, ANDHRA PRADESH, INDIA. KKK_CSE@VIGNAN.AC.IN

Parkinson's disease (PD) is a slowly developing disease in tissues, it implies that the symptoms proceed and become more severe in later times. Around ten lakh people in the united states are enduring this disease. The reason for this isn't known to everybody, and even though at present there is no heal for this, there are just medicines, for example, surgeries and medical procedures to cope up with its manifestations. Parkinson's includes just the malfunctions and death of most crucial nerve cells that reside in the mind which are said to be neurons. This malady principally influences on the neurons in the region of the cerebrum called the substantia nigra. The neurons which die produce a chemical considered dopamine that sends messages to some piece of the cerebrum that controls development and coordination. As this disease advances, the measure of the synthetic dopamine created in the brain diminishes, with the goal that the individual can't control his developments ordinarily.

3. EXISTING SYSTEM

The Parkinson's disease tremor attributes may be recorded in either an effectively autonomous public or private setting, for which the resultant accelerometer signal of the tremor can be conveyed wireless and through email to a remote location for data post-processing. The initial testing and evaluation of the iPhone wireless accelerometer application for quantifying Parkinson's disease tremor successfully demonstrates the capacity to acquire tremor characteristics in an effectively autonomous environment, while potentially alleviating strain on limited and highly specialized medical resources. In existing system, PD is detected at the secondary stage only (Dopamine deficiency) which leads to medical challenges. Also doctor has to manually examine and suggest medical diagnosis in which the symptoms might vary from person to person so

suggesting medicine is also a challenge. Thus the mental disorders are being poorly characterized and have many health complications

4. PROPOSED SYSTEM

The project is to develop a gait monitoring system for patients with Parkinson's disease (PD) using wearable sensors. To achieve this objective, the first step of our work is to identify the most significant features that would best distinguish between subjects with PD and healthy control subjects. Here, various gait features were extracted using data obtained from a wearable sensor based band further analyzed to find the most significant features that would provide the best discrimination between the two groups. user will gather the sensor dataset required to make a diagnosis of Parkinson Disease. Once the data has been loaded, system will preprocess the data and extraction of features will be done. Once the features required for the prediction have been extracted system will compare the features with model and prediction will be given as final result in the end. Graphical visualization was made

5. SYSTEM SPICIFICATION:

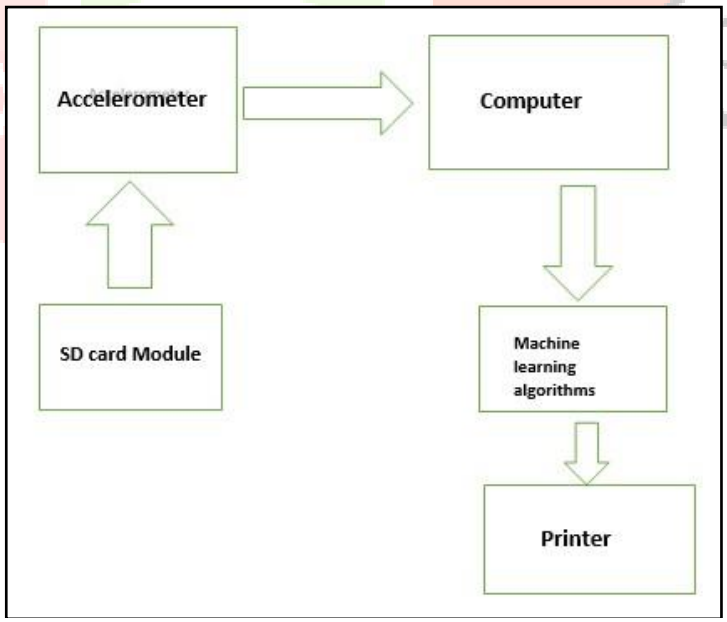
5.1 HARDWARE REQUIREMENT

Arduino Uno Microcontroller
Accelerometer sensor
SD module
Node MCU

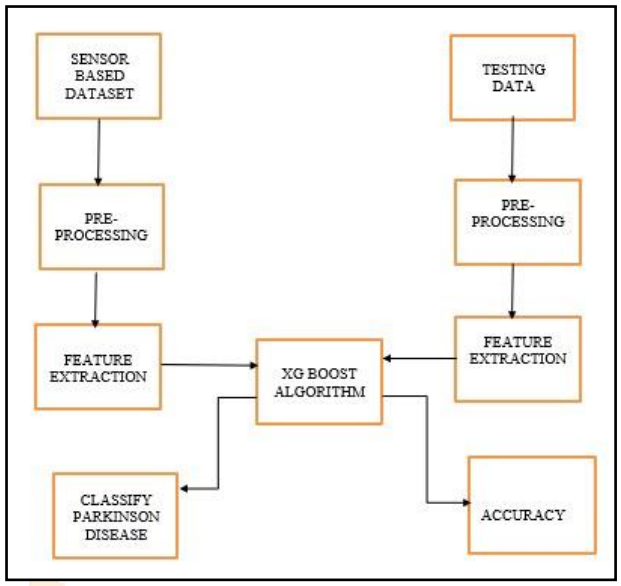
5.2 SOFTWARE REQUIREMENT

PCB Designing
Arduino Ide
Python

6. BLOCK DIAGRAM



6.1 ARCHITECTURE FOR MACHINE LEARNING



7. IMPLEMENTATION

DATA COLLECTION: In this collection, 31 patients with Parkinson's illness provided biological voice measures (PD). Each column in the table represents a voice measure, and each row corresponds to one of 195 voice recordings from these individuals ("name" column). "status" column, which is set to 0 for health and 1, is the primary way to separate healthy persons from those with Parkinson's disease (PD) in the data. ASCII CSV format is used for storing the data in this project. One voice recording is represented in each row of the CSV file, it is estimated that there are between six and eight recordings per subject.

DATA LOADING: Gathering and analyzing information from many different sources is known as data collection. This means that the data we collect must be acquired and kept in a way that makes sense for the business challenge at hand. The reference process of data mapping divides the collected dataset into 80 percent training data and 20 percent testing data. The data is split for the modeling dataset into training and testing sets is to assign data points to the former and the remaining to the latter. A model is therefore trained using a training set, then applied to a test set. Our application may then be evaluated based on its performance.

MODEL CREATION: In this module, XG BOOST the cluster based on transaction and geolocations are done to identify the fraudulent activity. This is a machine learning approach that divides unlabeled data into categories. A definition of it would be that it is "Data clustering is the process of arranging related data points into separate clusters.

TRAINING AND TESTING: With the use of data mapping, the collected dataset is separated into two parts: 80 percent training data, and 20 percent testing data. In order to allocate data points to the former and the latter in the modelling dataset, the data has been separated into training and testing sets. A model is therefore trained using a training set, then applied to a test set. Our application may be evaluated in this manner.

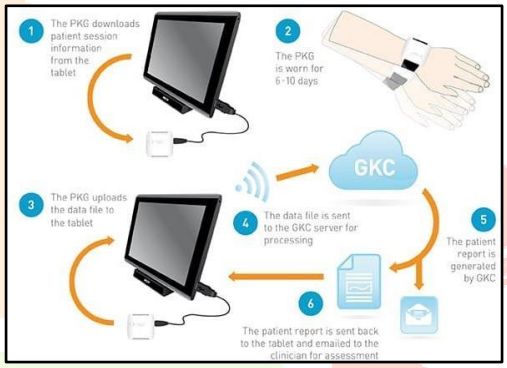
XG-BOOST: Xgboost is short for Extreme Gradient Boosting. XgBoost is an ensemble method based on decision trees that build out a strong learner from several weak learners. XgBoost algorithm is used to boost the performance of the model and is used to provide better accuracy. In this, decision trees are built sequentially. Weights are randomly assigned to all the features which are independent of each other and fed to the decision tree which predicts the results. The weights of wrongly predicted features by the decision trees are increased and these features are sent to the next decision tree. The correctly predicted weights of features by the decision trees are reduced. This process continues sequentially until correct results are predicted. These individual classifiers then combine to produce a strong and more precise model. Xgboost is used for solving both regression and classification problems. The popular supervised machine learning algorithm known as Random Forest (RF) is utilized for both classification and regression. However, the majority of problems involving classification make use of it. The idea of ensemble learning is the foundation of the RF algorithm. Multiple learning algorithms can benefit from ensemble learning, which is a general machine learning technique [2, 19] that aims to improve predictive performance. As a result, the RF method constructs multiple

decision trees based on the data samples, gathers predictions from each tree, and finally determines the best solution by taking into account majority voting. The ensemble method outperforms a single decision tree because it reduces over-fitting by averaging results. We are able to attain accuracy and prevent problems from being over-fitted thanks to the large number of decision trees in RF. The RF algorithm completes the following steps (see also figure 6): Step 1: First, a given dataset is used to select n numbers for the random sample. Step 2: For each person, a decision tree will be constructed. Step 3: An output will be predicted by each decision tree. Step 4: The final outcome was determined by a majority vote or average.

PREDICTION AND COMPARISON: The model ready to detect Parkinson's Disease and predict based on the given dataset. The data features obtained from test is compared. Machine learning algorithms can only be fairly compared if they are assessed on the same data. When testing algorithms, we may force them to be assessed on a uniform test harness.

VISUALIZATION: The graphical visual representation created gives a user friendly way to explore and comprehend data trends, outliers, and patterns in the data.

WORKING MODEL



8.PYTHON

Python is a high-level, interpreted scripting language developed in the late 1980s by Guido van Rossum at the National Research Institute for Mathematics and Computer Science in the Netherlands. The initial version was published at the alt. sources newsgroup in 1991, and version 1.0 was released in 1994. Python 2.0 was released in 2000, and the 2.x versions were the prevalent releases until December 2008. At that time, the development team made the decision to release version 3.0, which contained a few relatively small but significant changes that were not backward compatible with the 2.x versions. Python 2 and 3 are very similar, and some features of Python 3 have been backported to Python 2. But in general, they remain not quite compatible.

Both Python 2 and 3 have continued to be maintained and developed, with periodic release updates for both. As of this writing, the most recent versions available are 2.7.15 and 3.6.5. However, an official End of Life date of January 1, 2020 has been established for Python 2, after which time it will no longer be maintained. If you are a newcomer to Python, it is recommended that you focus on Python 3, as this tutorial will do. Python is still maintained by a core development team at the Institute, and Guido is still in charge, having been given the title of BDFL (Benevolent Dictator for Life) by the Python community. The name Python, by the way, derives not from the snake, but from the British comedy troupe Monty Python's Flying Circus, of which Guido was, and presumably still is, a fan. It is common to find references to Monty Python sketches and movies scattered throughout the Python documentation.

9.RESULT & CONCLUSION

In this project we have used IOT with ML and achieved the data sets from the live values from hardware through wearable sensors nonlinear classifier with decision tree to classify the PD and control group and we found good result by achieving an accuracy of using the PCA based feature sets with random forest classifier. We have compared the performance metrics of different classifiers with two different feature sets such as OFS and PCA feature sets. Overall the PCA based feature sets performed better with random forest classifier in terms of accuracy, sensitivity, specificity, PPV, NPV compared to the original feature sets. This analysis will help the clinicians to shift focus towards the important features while early diagnosis of Parkinson's disease. In the future we will try other feature reduction techniques and as well as other classification technique to compare the performance of all the parameters of the performance metrics.

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