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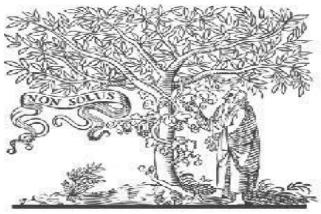

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Using A Convolutional Neural Network To Detect Parkinson's Illness

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ABSTRACT— Motor impairment is a hallmark of Parkinson's disease (PD), which is caused by the death of neurons in the brain that produce dopamine. The degeneration of nerve cells characterises Parkinson's disease. Symptoms of Parkinson's disease include tremors, stiffness, slowness of movement, shaking, and inability to maintain balance. For this research, we developed two neural network-based models—the VGFR Spectrogram Detector and the Voice Impairment Classifier—to assist both medical professionals and the general public in the early diagnosis of sickness. In order to foretell illness, we used deep dense ANNs (Artificial Neural Networks) on audio recordings and Convolutional Neural Networks (CNNs) on massive images of gait signals converted to spectrogram images. According to the results of the experiments, the proposed models outperformed the state-of-the-art methods in terms of accuracy. In comparison to the Voice Impairment Classifier's success rate of 89.15%, the VGFR Spectrogram Detector only manages an accuracy of 88.16%.

INTRODUCTION

Every day, hospitals throughout the world treat a slew of new patients with Parkinson's who are experiencing a wide variety of different symptoms. The complexity of Parkinson's disease prevents the development of a valid severity index. It is a neurodegenerative disorder that causes motor function impairment due to falling dopamine levels in the brain, and its effects may be seen in the patient's outward appearance. This is the main reason why neurons don't recover from Parkinson's disease. As a person becomes older, their neurons start to die off and are permanently lost. Only the neurotransmitter dopamine,

which is produced by neurons, can get the body moving and enable neurons to talk to each other. Age-related declines in brain dopamine production dampen the numerous communication routes in the brain and dampen our overall neurological state. Patients may not experience any symptoms until after prolonged exposure to the drug's cumulative negative effects. A few of the symptoms include difficulty communicating, stuttering, rigidity, lethargy, tiredness, and a blank countenance. According to WHO data, PD affects almost 10 million individuals worldwide. An irreversible neurological disorder that cannot be cured if not caught early on in patients. The disease becomes terminal and untreatable in the majority of its sufferers as it develops. The global death toll from PD grew to an estimated 117,400 in 2015 from the previous year's estimate of 6.2 million. Disease testing is both costly and incorrect. PD is a significant financial burden for society; in the United States, the cost per patient per year is above $10,000, and the overall cost is $23 billion; in the United Kingdom, the cost per patient per year is usually expected to be between £49 million and £3.3 billion. Because of these factors, scientists have worked to perfect a quick, reliable, and painless method of detecting PD in its earliest stages, before it can do any permanent damage. The focus of this study is on creating a deep learning model for early Parkinson's disease detection that makes use of both Convolutional Neural Networks (CNNs) and Artificial Neural Networks (ANNs) to maximise diagnostic precision while keeping costs to a minimum. The model will include two parts: a Spectrogram Detector for Voice Quality Loss (VGFR) and a Voice Impairment Classifier. Both the incapacity to speak orally and the utilisation of recorded signals expressing kinetic patterns in spectrograms are crucial to its operation. The UCI Machine Repository and the PhysioNet Data Bank provided the data for this study. The paper describes all relevant aspects, including symptoms, and how they might be used as input to the suggested neural networks for disease prediction. Support Vector Machine, Multi Layer Perceptron, and XG Boost are three well-known machine learning algorithms that are put up against the outcomes of the two modules. In addition, it offers an in-depth evaluation of current tools that might be utilised to realise the objective of automatic Parkinson's disease diagnosis.

RELATED WORK

" Using a deep learning network classifier to identify Parkinson's illness."

Dopamine is a neurotransmitter essential for the control of a wide variety of human motor and non-motor actions, and the loss of its production by certain brain cell populations leads to the onset of Parkinson's disease. One's ability to talk, see, walk, and even urinate may be significantly impacted by Parkinson's disease, in addition to raising the chance of sadness, anxiety, panic attacks, and sleep disturbances. Correctly interpreting voice and speech data for the purpose of diagnosing Parkinson disease is a substantial classification issue. This article uses difficulty communicating as an early sign of Parkinson's disease. By integrating a stacked autoencoder with a softmax classifier, a deep neural network classifier might aid with this. To demonstrate the effectiveness of the deep learning network classifier, we perform many simulations on two datasets. The performance of the proposed classifier is compared to that of the reference classification method. Research and testing demonstrate that a deep neural network-based classifier can accurately detect Parkinson's disease.

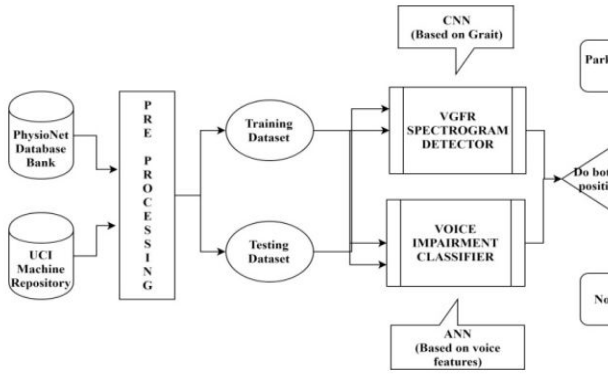
" Predicting Parkinson's Disease Severity using Deep Learning"

Parkinson's disease is a progressive and debilitating neurological disorder. Damage to the loss of dopamine-producing neurons may have far-reaching consequences for basic skills including communication, motor control, and movement. Consequences for patients include the aggravation of these symptoms over time. We provide a strategy for using deep neural networks to forecast the progression of Parkinson's disease, and we evaluate it using the Parkinson's Telemonitoring Voice Data Set generated at the University of California, Irvine. Our neural network was developed using the deep learning library TensorFlow in Python to make intensity predictions. The precision estimates obtained with our method outperform those obtained in previous research.

METHODOLOGY

In this research, a deep learning neural network is utilised to identify Parkinson's disease based on the disorder's two hallmark symptoms: gait and speech impairment. This paradigm consists of an essential core and an ancillary extension. A Voice Impairment Classifier is trained with data from PD patients with speech issues, and a VGFR Spectrogram Detector is trained with data from PD patients with abnormal gait

patterns. The proposed module is shown in Fig.



RESULT AND DISCUSSION

The first section, "VGFR Gait Analysis using CNN," is dedicated to the analysis of gait data, while the second section, "Voice Impairment classifier," is concerned with the analysis of speech impairments. The programme begins with a spectrogram showing the signals from the dataset that characterise the Vertical ground force response via 19 parameters. These 2D Spectrogram pictures are then sent into a neural network, where they are transformed and reduced by means of two Convolution 3-Dimensional layers and two max-pool layers. Finally, two Dense layers are used to impart nonlinearity into the predictions. The Convolutional Neural Network is developed using the TensorFlow backend framework and the Keras library, which is constructed on top of TensorFlow. Vocalizations from both healthy and PD subjects have been segmented to provide signal values for use in Module 2's dataset. This model is used to foretell the result of the next section, and it is based on ANN, a subset of deep learning models. Within its four layers are 256 neurons (16x64x32). A CSV file containing the dataset is read as input, and the algorithm is trained to spot non-linear patterns in the values of the signals it analyses. It was also developed using Tensor flow and Keras. Median Age: 52–74 (66.3 years) 70 55 23 18 M/F Ratio: 0.99 Duration of Tests (Minutes) Sensor Count: 2 (per foot) Amount of samples taken per second, in tens 100/s A DATABASE ON VOICE DEFECTS (UCI MACHINE REPOSITORY) Age (Mean), the VGFR Spectrogram Detector's precision with respect to resulting spectrogram pictures, and the Voice Impairment Scale Three popular machine learning techniques, including the one just stated, were put to the test. Our trials with XG Boost, Support Vector Machine, and Multilayer Perceptron (MLP) on both datasets are compared to the

suggested modules and their results are shown in Table

TABLE III. TRAINING & TESTING RESULTS

S. No.	Module Name	Data Splitting (Training-Testing)	Training Epochs	Accuracy	Comparisons		
					SVM	XG Boost	MLP
1.	VGFR Spectrogram Detector	244-62	23	88.17%	86.12%	78.66%	87.79%
2.	Voice Impairment Classifier	157-39	35	89.15%	81.16%	77%	85.60%

The results show that the recommended modules outperform the state-of-the-art machine learning approaches and that both datasets are balanced and include a representative group of all classes. Therefore, the proposed model represents the most effective and efficient of all current methods.

CONCLUSION

We looked at studies published on Parkinson Detection, a topic that combines Machine Learning and Deep Learning algorithms to determine if a person's mix of symptoms makes them a normal or abnormal suspect. The results of the experiments were compared using a variety of approaches, and it was concluded that Deep Learning would be most beneficial for examining the two most indicative symptoms: irregular gait and trouble speaking. The information was collected from the PhysioNet Data Bank and the UCI Machine Learning Repository. Currently, the state-of-the-art includes two modules: the VGFR Spectrogram Detector using CNN and the Voice Impairment using ANN. These two modules outperformed three major algorithms on the testing dataset, achieving an accuracy of 88.17% and 89.15%, respectively, in distinguishing between PD patients based on their gait and speech impairment symptoms. When compared to the regular support vector machine, XG Boost, and the multilayer perceptron, the suggested model is superior in speed and accuracy. In It is proposed to combine the findings from these 2 modules in the future to improve the detection's efficacy and accuracy. This will be achieved by the application of Deep Learning methods to this data, which will allow for the incorporation of other critical elements like the loss of olfactory sound and the distortion of handwriting. In addition, untried approaches will be taken into account in the hopes that they may lighten the strain on the system's processing resources and make it more transportable.

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