Artificial Neural Network to prescient the severity of Parkinson's Disease

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Objective

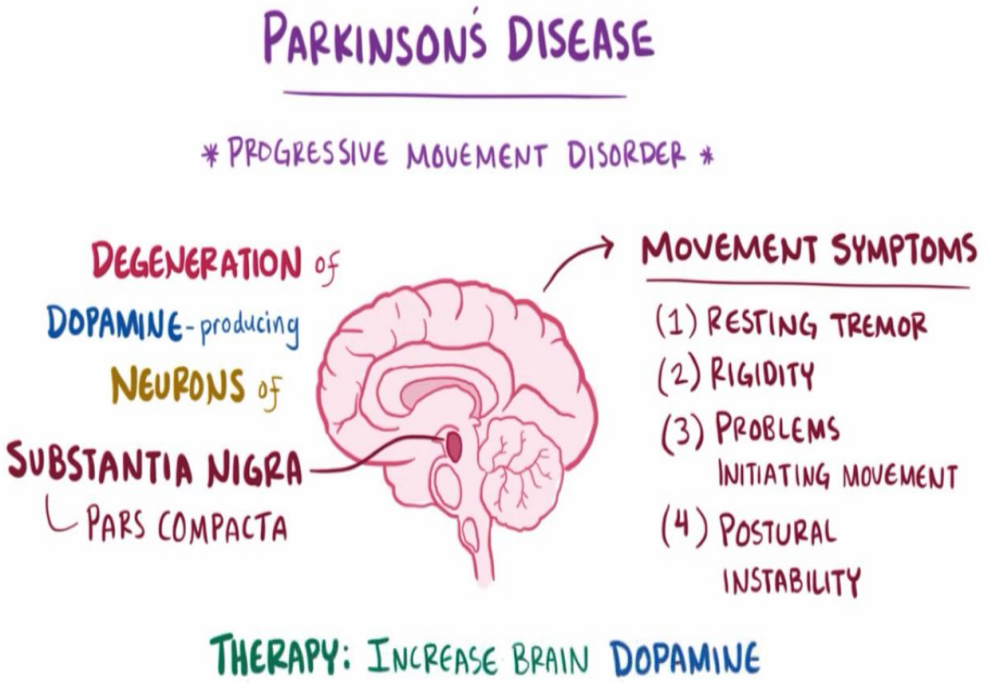
1) To Predict Severity Of Parkinson's Disease Using Deep Learning.

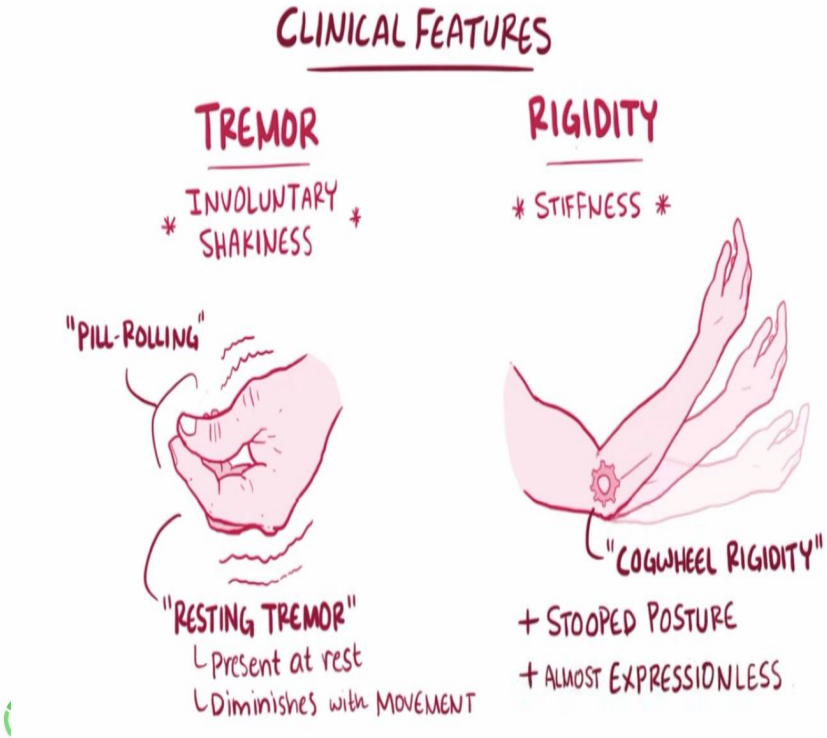
2) To Introduce simpler way to predict Parkinson's disease.

3) To detect parkinson's disease by processing the voice recordings of Patient using Machine learning.

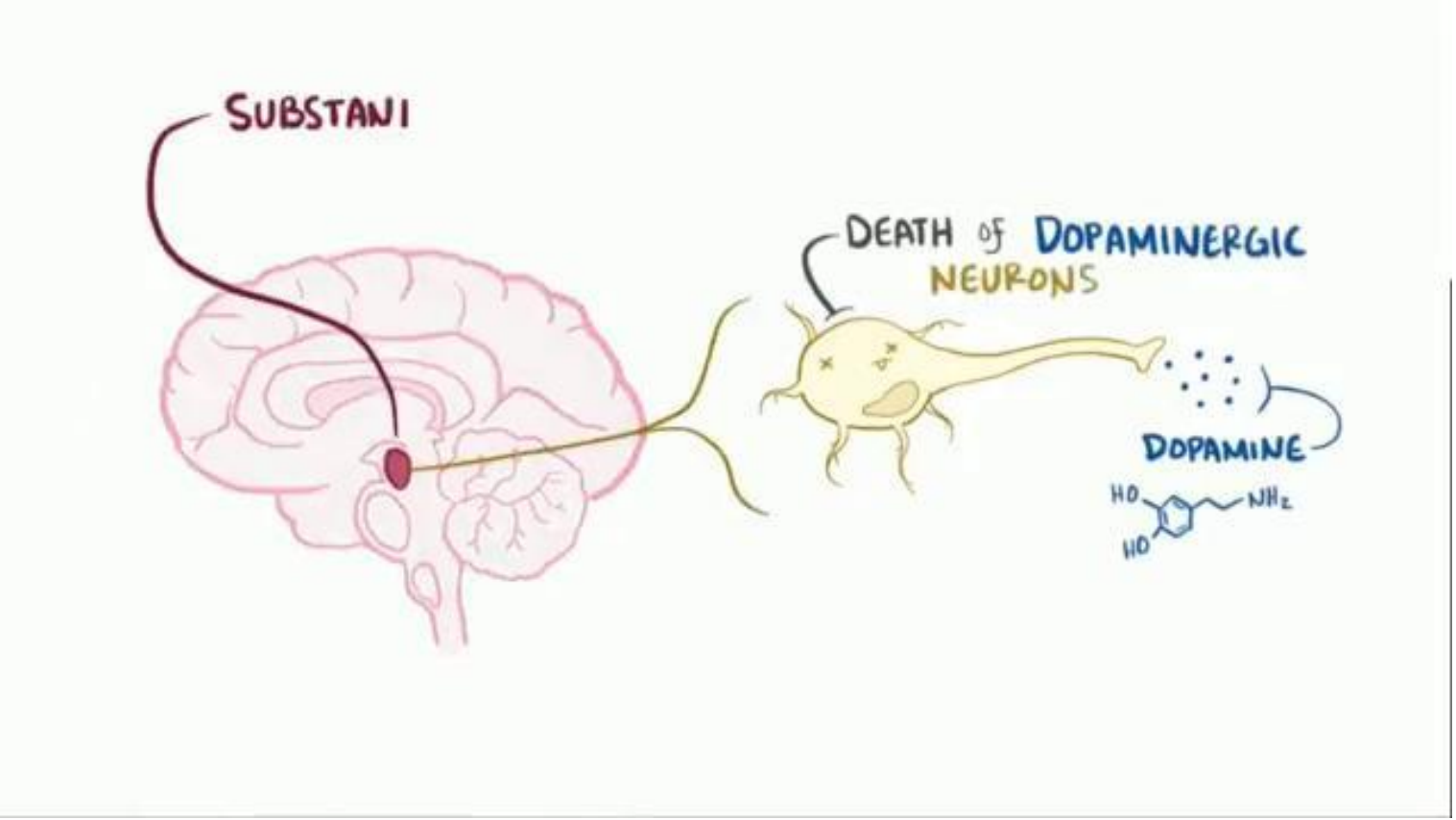
... Before that let's understand what is Parkinson's disease.

What is Parkinson's disease?





How does it happen and why ? (Cause)



Role of Machine Learning in prognosis

1. Research shows that vocal changes can be watched around five years before the real finding of this disease, this significant indication is used to anticipate PD.
2. Execution of different machine learning models like various direct relapse, polynomial relapse, arbitrary woodland, choice trees, SVR and ANN is done.
3. A relative investigation of the consequences of the execution of these models is done and we have come up with various analysis.

CURATED RESEARCH SO FAR....

*Out of around 15 research papers we will brief about the **3 most critical research** done on this so far.*

1. In a paper by Srishti Grover, Saloni Bhartia, Akshama, Abhilasha Yadav, Seeja K DNN model was implemented on the static dataset and patients were classified in two categories “severe” or “non-severe” in the view of the estimation of motor and total UPDRS values.

2. Elmehdi BENMALEK, Jamal ELMHAMDI, Abdelilah JILBAB have mapped the extracted features to UPDRS using neural network and least square regressions.

3. Meysam Asgari, Izhak Shafran [7] have done a computational approach for computing various features by performing 3 tasks and then calculated UPDRS value for severity prediction of PD. Mehrbakhsh Nilashi, Othman Ibrahim & Ali Ahani

DATA OVERVIEW

Dataset is in ASCII-CSV format which is composed of 5,876 instances as rows and 22 columns including 16 voice parameters.

1.Jitter(%)	2.Jitter(Abs)	3.Jitter:RAP	4.Jitter:PPQ5
4.Jitter:DDP	5.Shimmer	6.Shimmer(dB)	7.Shimmer:APQ3
9.Shimmer:APQ5	10.Shimmer:APQ11	11.Shimmer:DDA	12.NHR
13.HNR	14.RPDE	15.DFA	16.PPE

Table 1: Input Attribute Information

The above table describes 16 parameters that are used for the prediction of the severity of the disease. Among all mentioned parameters, 1-13 are Linear parameters where as14-16 belongs to non-linear parameters. The most important purpose of the statistics is to predict the motor and whole UPDRS rankings('MOTOR_UPDRS' and 'TOTAL_UPDRS') from the 16 voice measures.

Metric	Severe	Non-Severe	Scaling Range
Total-UPDRS	Above 25	0-25	0-176
Motor-UPDRS	Above 20	0-20	0-108

Table 2: Severity and Scale Range of Output Classes

SUITABLE MODELS

- Multiple Linear Regression
- Polynomial Regression
- Support Vector Regression
- Decision Tree
- Random Forest
- Feed forward neural Network

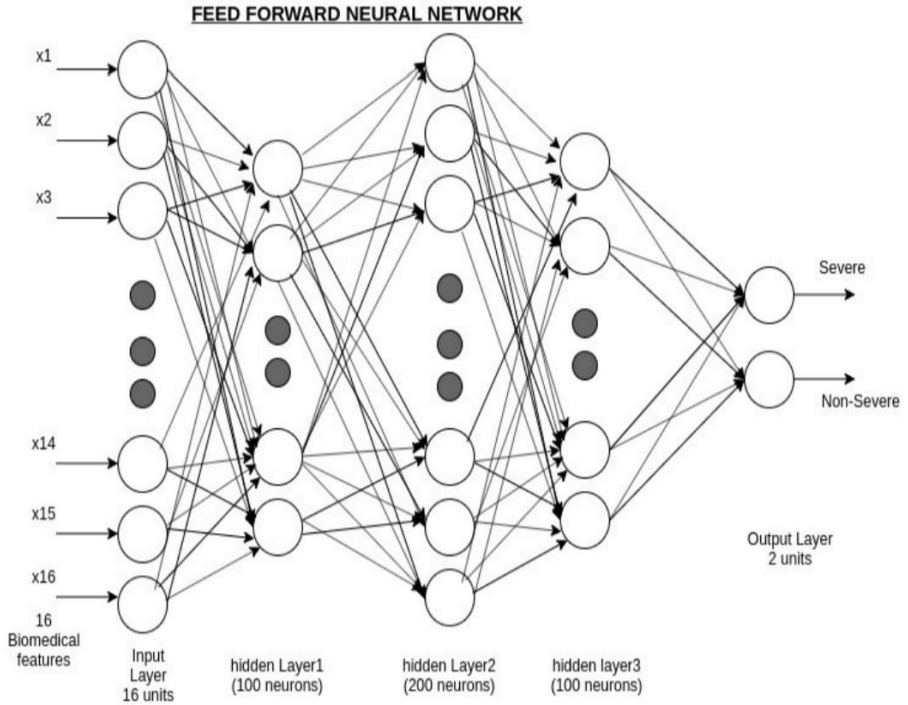
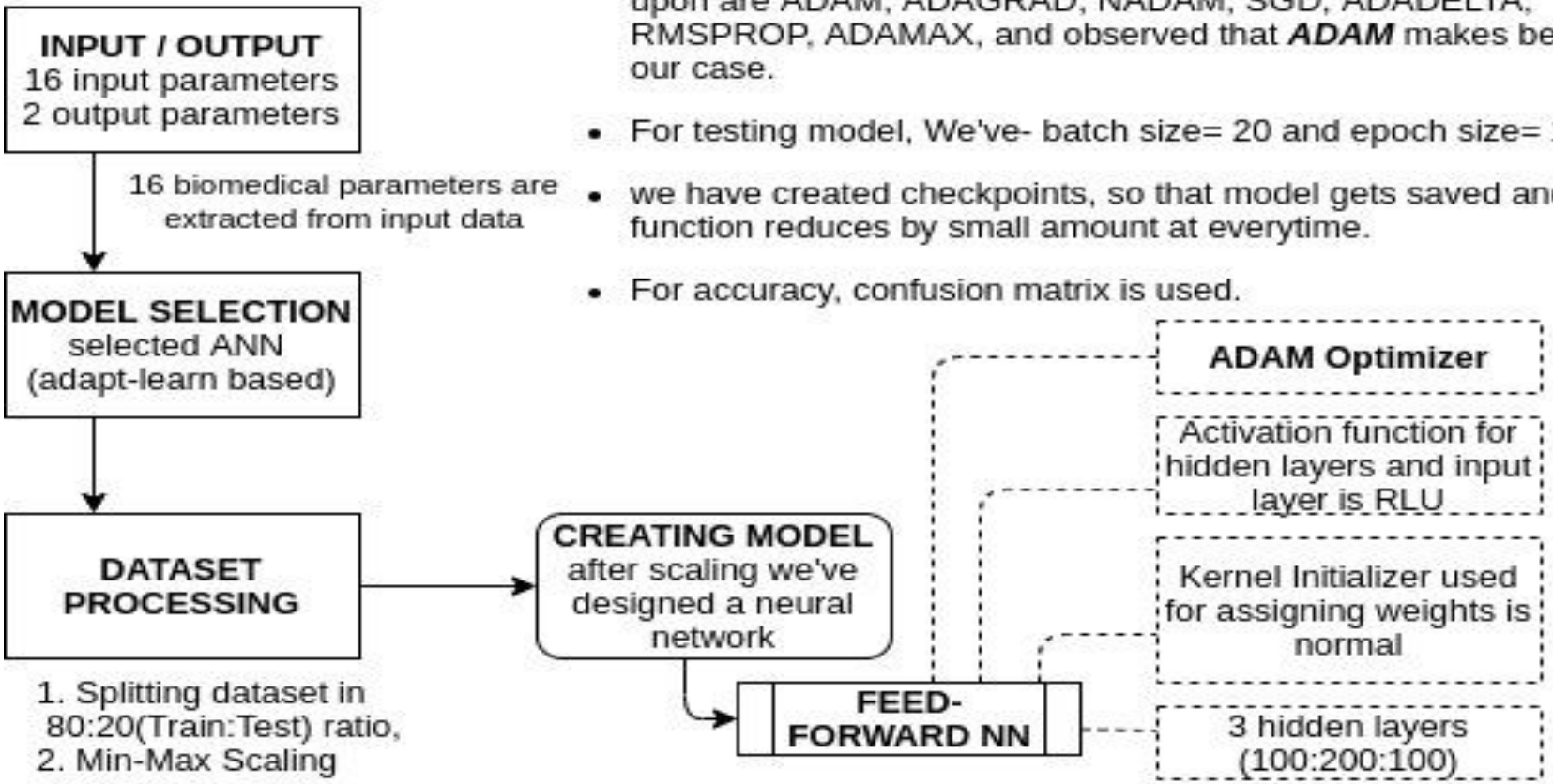


Figure 2: Proposed Neural Network

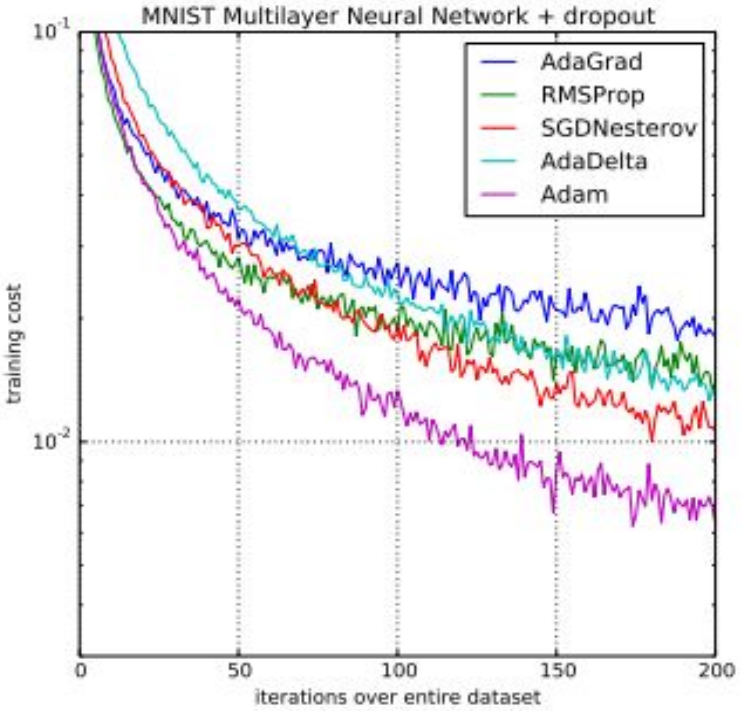
Algorithm and workflow



- The different types of optimizers that we have tested the model upon are ADAM, ADAGRAD, NADAM, SGD, ADADELTA, RMSPROP, ADAMAX, and observed that ***ADAM*** makes better in our case.
- For testing model, We've- batch size= 20 and epoch size= 1000.
- we have created checkpoints, so that model gets saved and loss function reduces by small amount at everytime.
- For accuracy, confusion matrix is used.

Function of ADAM Optimizer

Adam optimizer is an algorithm that we have used for the iterative setting of weights of the neurons in the network as per the epochs. We have chosen this particular optimizer over other optimizers as it requires less tuning and also it can handle high variability data. the main reason for its choice over others was that it hardly requires any resources to adjust itself with the neural network which in turn gives a huge benefit in terms of accuracy and sensitivity achieved. Also, Adam optimizer takes into account various benefits of other optimizers and work accordingly.



Future Scope

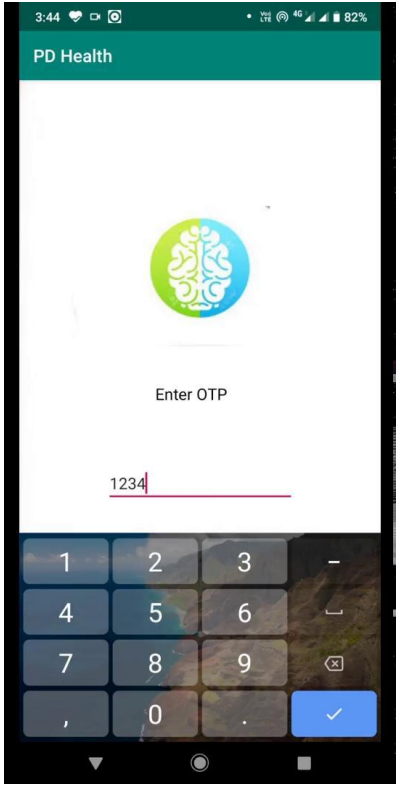
What we can do in another way from this kind of static data processing is that we can put in force dynamic data processing in which we can create some kind of the front end application that will record the voice of the person and do preprocess like extracting all the aspects on the back-end side. This will, in turn, grant dynamic training of mannequin with some tuning modifications in the current model. Also, we can integrate different sources of data of predicting Parkinson's Disease like hand movements, deep brain simulation data, etc. Also, a complete analysis of the data capturing mechanism can be given to increase the trust of the application. we can take the help of the Internet Of Things as nicely to increase the accuracy we can use data from sensors positioned at various positions during testing.

Future Scope in Practice

As per the future scope mentioned previously, the working app is ready powered by firebase, python and machine learning.

Input : Voice Recording

Output : Displaying result on screen with the file.



Conclusion

We have implemented an ANN which is the feed-forward neural network. It is found to be providing exceptional results in predicting the severity of Parkinson's disease when compared with other regression models. The model seems to use its capabilities to adapt and learn to its full potential. It can analyze the nonlinear patterns within the dataset with great ease. With the use of Ann, we have also taken into consideration all the problems that might come in future modifications which other models do not provide very efficiently. It also allows greater flexibility in training and testing phase cases when there is an abundant change in the dataset due to which other models collapse but Ann seems to have a better handling mechanism for this as it provides humans like understanding behavior.

THANK YOU !!!