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PARKINSON DISEASE DETECTION USING FASTAI: CONVOLUTINAL NEURAL NETWORK

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ABSTRACT- These days, a basic appraisal effort in clinical affiliations biometrics is finding careful biomarkers that permit settling on clinical choice assistance instruments. Parkinson's disease (PD). Surprisingly even though the medical fields have advanced so much but still the cause of the second most common neurodegenerative still the main cause is unknown and we are still using the traditional way diagnosis of Parkinson disease, the disease may not be detected when it is in early stage. We have used several Convolutional Neural Network (CNN) models to detect Parkinson's disease. Here we have utilized data that contain drawings like waves and spirals already analyzed by the proficient specialist examine it. We have used several Convolutional Neural Network (CNN) models to detect Parkinson's disease. This examination was performed utilizing a public dataset: Parkinson's Disease Spiral Drawings dataset. Here we have attained the accuracy rate of 92.5% on ResNet50 and the best we have got on ResNe34 100%.

Keywords: Deep learning, Genetic algorithm, CNN, Residual neural network.

I. INTRODUCTION

Evaluation in biometrics has changed all around beginning late with a making number of occupations. One of the standard applications is clinical thought. As appeared by the Biometrics Research Group Inc. [1], biometrics is driving mechanical change in the general clinical affiliations market by lessening costs and improving idea improvement to patients over extended length. Biometrics Research Group Inc. [1] assessed that the whole generally speaking business network for biometric diagrams in the clinical thought market will appear at US$5 billion by 2020. This party portrayed "clinical affiliations biometrics" not correspondingly as a ton of biometric applications for controlling consent to electronic clinical reports and patient undeniable proof, yet adjacent to clinical choice assistance instruments for fiery idea.

These instruments separate biomarkers that portray quiet accomplishment and can be utilized to help in torment ID (by methods for getting screening), assessment of the reaction to certain prescription and the oversight of tremendous length or cureless issue like Parkinson's disease (PD). This paper contributes in the proposal of PD biomarkers.

PD is neurodegenerative defilement passed on by the inadequacy of dopaminergic work and portrayed by engine issues, for example, shiver, bradykinesia, vigor, and postural deficiency [2].

These disturbing effects join engine planning, programming and sequencing, and progress starting and execution [3]. PD is one of the most astonishing neurodegenerative issues (the second after Alzheimer's weight) and affects over 1% of individuals more than 60 years of age [4].

There is right now no target test for PD and the improvement of misdiagnosis is high, particularly when the examination is made by a non-master: the likelihood of a deceived end can be as high as 20% [5]. A wary assessment of the standard signs, for example, shivers, bradykinesia, and persistent nature increment the evaluation exactness, notwithstanding clinical examinations can be affected by the expert subjectivity. Clinical choice assistance contraptions are especially beguiling for making objectivity and for supporting in an early finding. This early confirmation would permit the course of action of unequivocal medications for PD patients [6, 7]. A basic appraisal objective for neurodegenerative tortures is to see mindful biomarkers [8]. In the creation, there is a wide degree of studies for PD region zeroed in on talk supervising [9–11] where the certification is

finished utilizing kept up vowels and normal talk. Besides, engine signs can moreover be seen and coordinated, indicating getting updates and step [12, 13].

Change in the kinematics of penmanship is one of the essential signs found in PD. McLennan et al. [14] point by point that everything considered 5% of patients with PD demonstrated micrographia (incredibly little letter size) and 30% of patients revealed lifting of penmanship before the beginning of engine results. Engine signs related with Parkinson's defilement (stiffness, bradykinesia, and shiver) cause three chief changes recorded as a printed variety [15]: the size of making [16] (micrographia [17]), pen-pressure [18], besides, kinematics. A couple of contraptions have been made to investigate PD persisting penmanship [19]. The static perspectives correspondingly as the dynamic ones are overpowering, for example, speed and pen-pressure decay during making [17, 20]. A couple of evaluation papers have been scattered beginning late [21, 22].

The penmanship of an individual relies upon quite far [16], shaping style, or language aptitudes of the individual [23], showing a monster between subject changeability. A decision as opposed to penmanship is the utilization of drawings.

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II. LITERATURE SURVEY

Numerous investigations have been directed on the discovery of PD, based on different manifestations like olfactory misfortune, voice debilitation and so on Among the considered manifestations, Most of the patients have been accounted for with vocal weakness and discourse issues. Abdullah Caliskan [1] has utilized profound neural organization.

First commotion is disposed of and fragmented with the time-windows during sifting of the discourse signals. Different highlights are removed from each fragment in the subsequent advance, trailed by DNN order utilizing Stacked Auto Encoders (SAE). Srishti Grover [2], has utilized profound learning on Parkinson's Telemonitoring Voice Dataset taken from UCI ML Repository to characterize information interestingly into "extreme" and "not serious" classes. The neural net involves an information layer with 16 units, three concealed layers with 10, 20, 10 units in each layer individually, 2 neurons in yield layer. The model shows the exactness of 81.6667%. In [3], the creators have endeavored to characterize the PD group based on various capabilities, PCA and OFS based capabilities , which structure non-direct highlights on dataset taken from Max little University Oxford. Creators have utilized non-straight classifiers, Bagging arrangement, Regression tree (Bagging CART), Random Forest, RPART for order with a precision of 96.83% utilizing RF with PCA. Clayton R. Pereira [4] introduced an alternate methodology dependent on influenced composing capacities. The creators proposed a learning of pen-based highlights with signals separated from the savvy pen containing 6 sensors by methods for 2 distinctive CNN structures for example ImageNet, LeNet. The creators announced best exactness with ImageNet for wanders and OPF for twisting for example 83.77%.Another manifestation for example Decrease in the degrees of a liquid dopamine delivered by synapses for example Neurons, is an obsessive sign of PD. It very well may be controlled by dopamine carrier imaging for example FP-CIT SPECT and subsequently in [5], the creators have built up a robotized profound learning model which deciphers FP-CIT SPECT picture dataset got from PPMI archive. Initially, SPECT pictures are passed to 3D convolutional layer as information sources. What's more, furthermore, it produces 16 3D yields subsequent to going through 7×7×7 convolutional channels, max-pooling and ReLU initiation layer alongside yield layer. After this examination, an extraordinary robotized recognition framework for PD CNN utilizing EEG signals has been proposed unexpectedly by Shu Lih Oh [6].

The creator investigated that the usage of the non-direct highlights extraction procedures could be utilized to separate between an ordinary and PD EEG signals. Examination has actualized a novel thirteen-layer CNN model utilizing Relu enactment work in concealed layers followed by softmax work in yield layer. The proposed CNN model yielded a precision of 88.25%, and an affectability of 84.71%. In [7], the creator utilized non-engine highlights for example Quick Eye Movement (REM), Sleep Behavior Disorder (RBD) and Olfactory Loss alongside the information from PPMI. Examination has utilized computerized symptomatic models utilizing AI calculations for example MLP, Boosted Random Forest and Boosted Logistic Regression with a detailed precision of 80. In [8], the creators have utilized the neuro-imaging strategies for example X-ray, PET, and so on are non intrusive strategies and obtrusive techniques for example electroencephalography, which has been valuable in investigations of neural exercises in human mind through utilitarian cerebrum examination of the produced pictures. They have utilized highlights from like ALFF, fALFF, ReHo and Functional Connectivity. Further, writing saw that swarm insight can be utilized to quicken the presentation of the current neural techniques

III. SYSTEM DESIGNAND CNN LAYERS

The functional block diagram contains components and the process involved in the study and analysis is shown in Fig1.

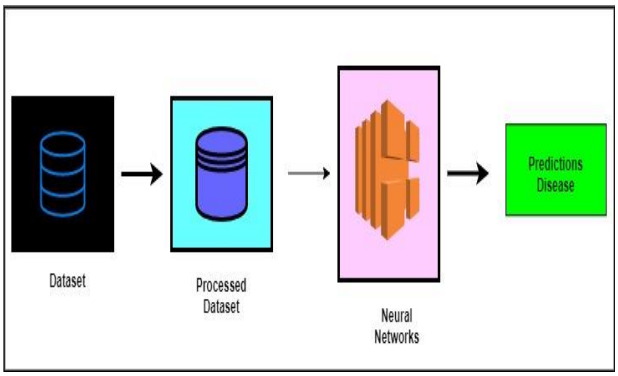

Fig. 1 System Architecture

Fig 1 shows the procedure contains Loading winding and contort drawing Datasets and given data measure mode by the CNN (ResNet) model, after arranging is done, we will assessments the information

A. **How ResNet Module-**

For pictures request using Deep Neural Networks, we have used several hidden layers of Convolutional Neural Network [CNN]. We had used two astonishing contraptions, Keras along with the Theano and the next one is Tensor stream by Google which works on of Deep Neural Network. A CNN is one of the feed-forwarding neural networks of the Artificial Neural Network wherein the straightforwardness structure between its neurons is pushed by the relationship of the human/animal visual cortex. Convolutional Neural Networks contain neurons that have learnable weights and affinities. Each neuron gets several data, plays out a spot thing and beginning there again tails it with a non-linearity.

B. Layers of Convolutional Neural Network

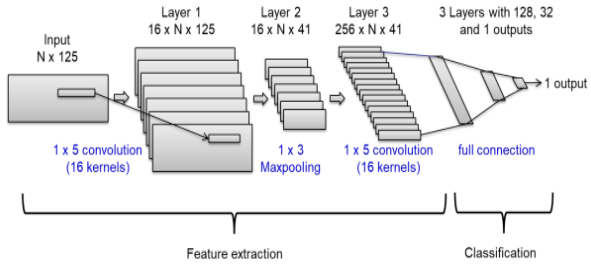

Fig. 2 CNN layers

A CNN contains a beast level of hidden layers. These hidden layers when used again and again which play vital role in improvement of a Deep Neural Network. There are three standard kinds of layers used to manage a CNN are:

1. Information: This layer holds the disproportionate pixel appraisals of picture.

2. Convolutional (or Deep/Hidden) Layer: Here in these layers surrendered expected outcomes from various neurons layer is connected with the data zones. We portray the degree of channels to be used at this moment. Every channel in these layers may find with the 5x5 window. This window can be slider over the given dataset then it will provide us with the best pixel that can be produced.

3. Gotten some information about Linear Unit [ReLU] Layer: This layer applies a bit careful establishment handle the image data. We invite that a CNN uses back inciting. To hold comparable appraisals of the pixels and not being changed by the back causing, we apply the ReLU work.

4. Pooling Layer: This layer play out a down-looking at progress along the spatial examinations (width, stature), seeing volume.

5. Totally Connected Layer: This layer is used to manage the score classes for instance which class has the most senseless score official from the data picture

Additional Block: To manage the issue of the disappearing/detonating point, this masterminding presented the idea called Residual Network. In this affiliation we utilize a strategy called skip affiliations. The skip affiliation skips planning from several layers and interfaces direct to the yield.

IV. EXPERIMENTAL FRAMEWORK

Use is the interest of an application or execution of a procedure, thought, model, plan, express, standard, check, or structure. In like manner, a usage is an interest of a specific or evaluation as a program, programming piece, or other PC structure through programming and design. Various executions may exist for a given interest or standard.

Step 1-Datasets Preparation
Step 2-Dataset Processing
Step 3-Trained Model

Dataset Preparation

The specialists found that the drawing speed was successfully moderate pen pressure lower among Parkinson's patients — this was especially given up for patients with an all the also astonishing/advanced kinds of the issue.

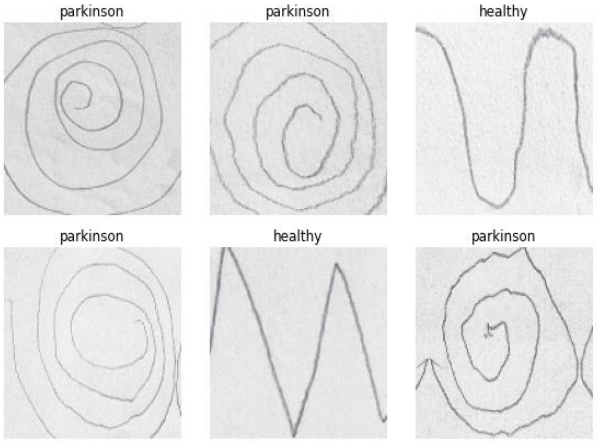

Fig. 3 Looks of Dataset.

We'll be using the way that two of the most when everything is said in done saw Parkinson's signs join shakes and muscle demand which truly influence the visual appearance of a hand drawn winding and wave.
The mix in visual appearance will interface with us to set up a PC vision + AI check to in like manner notice Parkinson's trouble.
The dataset that we used here was curate by Adriano de Oliveira Andrade and Joao Paulo Folado from the NIATS of Federal University of Uberlândia.

•Spiral: 102 pictures, 72 figuring everything out, and 30 testing

•Wave: 102 pictures, 72 figuring everything out, and 30 testing

Dataset Processing

Utilizing of fastai we have weight and cycle those information for models. That helps to misjudged better with scaling, and so on

Trained Model

Extra Network (ResNet) is a Convolutional Neural Network (CNN) arranging which was proposed to interface with hundreds or thousands of convolutional layers. While past CNN models had a drop off in the sufficiency of additional layers, ResNet can add boundless layers with strong execution.
ResNet was an inventive response for the "vanishing incline" issue. Neural affiliations train by perspectives for the backpropagation cycle (see our guide on backpropagation), which relies upon tendency drop, ricochet the change ability to find the stores that keep it. In case there are unbelievable layers, underscored improvement makes the evaluation more unassuming and through and through more clear, until it "scatters", making execution lower or even dissident with every additional layer.
The ResNet approach is "character substitute way affiliations". ResNet gathers character mappings, layers that from the most irrelevant early phase don't do anything, and skirts them, reusing the causes from past layers. Skipping from the shortest early phase packs the relationship into a few layers, which pulls in snappier learning. By then, when the plot plans again, all layers are augmented and the "rest of the" zones of the coalition research absolutely a more principal level of the piece space of the source picture.

V. RESULTS

Here we have use two different CNN models in which one is ResNet50 and another one is ResNet34.

1. ResNet50

In this CNN model we had used 32 batch size and the 256×256 Image size. It had yielded the accuracy of 92.5%.

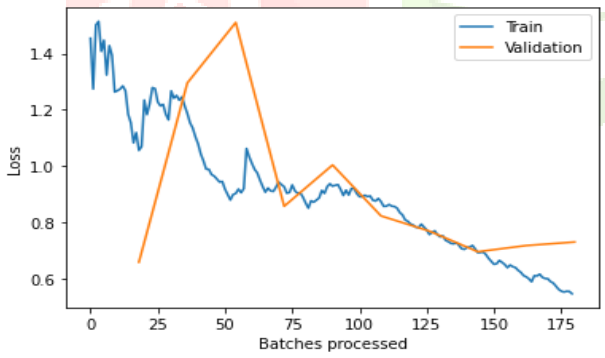

Fig. 4 Performance Graph of ResNet50

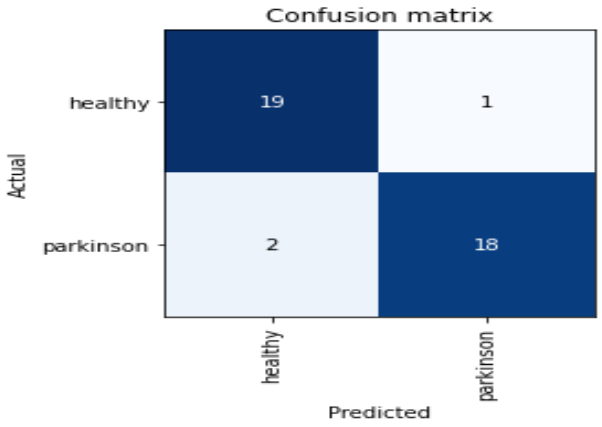

Fig. 5 Confusion Matrix of ResNet50

2. ResNet34

ResNet 34 in this model we had acquired the highest accuracy rate of 100%, we had taken 32 batch size with 256×256 image size. We had taken about 20 epochs.

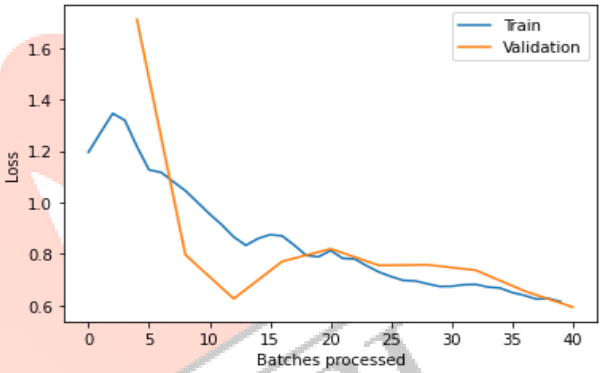

Fig. 6 Performance Graph of ResNet34

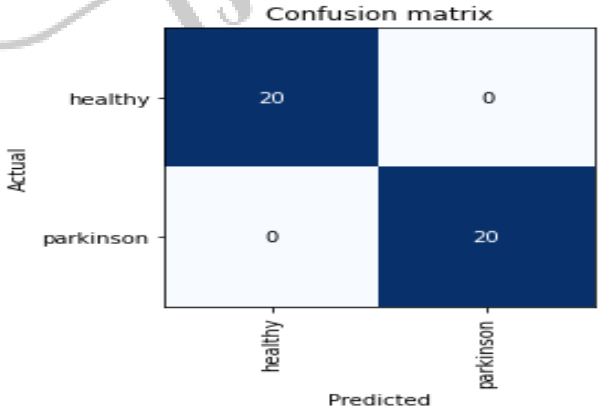

Fig. 6 Confusion Matrix of ResNet34

As you can see here in ResNet34 model we achieved Sensitivity 100%, Specificity 100%, and the accuracy 100%. The dataset here which we used here is not the raw clinical data instead the data here was already labeled this might reason to acquired this accuracy rate.

VI. CONCLUSION

Parkinson's disease causes a person too hard to use their hands and legs. In this we have used the very symptom of Parkinson's disease, to let the drawing which is done by the patients and examining it in levels of progress is not difficult to act considering the way that it needn't lounge around inertly with any conspicuous strategies. The basic responsibility has been the recommendation of the degree as commitments to a CNN for PD ID from bowing drawing sorts of progress. The CNN joins convolution layers (highlights learning) and completely related layers (for PD confirmation). We assessed the presentation furthest scopes of various headings during drawing levels of progress guaranteeing the best outcomes for the X and Y course. Utilizing a public dataset, Parkinson Disease spiral and waves Drawings Using Digitized Graphics Tablet dataset, and the best outcomes got in this work appeared to be a precision of 100%, these outcomes handle the utilization of drawings upgrades to settle on clinical choice assistance contraptions for PD demand (quiet screening) and expanded length liberal affiliation.

VII. REFERENCES

[1]. O'Neil King, R. Biometrics in Healthcare; Biometrics Research Group, Inc.: Toronto, ON, Canada, 2017.

[2]. Jankovic, J. Parkinson's disease: Clinical features and diagnosis. J Neurol. Neurosurg. Psychiatry 2008, 79, 368–376. [CrossRef] [PubMed]

[3]. Contreras-Vidal, J.L.; Stelmach, G.E. Effects of Parkinsonism on motor control. Life Sci. **1995**, 58, 165–176. [CrossRef]

[4]. Tysnes, O.B.; Storstein, A. Epidemiology of Parkinson's disease. J. Neural Transm. **2017**, 124, 901–905. [CrossRef] [PubMed]

[5]. Rizzo, G.; Copetti, M.; Arcuti, S.; Martino, D.; Fontana, A.; Logroscino, G. Accuracy of clinical diagnosis of Parkinson disease: A systematic review and meta-analysis. Neurology **2016**, 86, 566–576. [CrossRef] [PubMed]

[6]. Ammenwerth, E.; Nykanen, P.; Rigby, M.; de Keizer, N. Clinical decision support systems: Need for evidence, Need for evaluation. Artificial Intelligence Med. **2013**, 59, 1–3.

[7]. Dreiseitl, Stephan, and Michael Binder. "Do physicians value decision support? A look at the effect of decision support systems on physician opinion." Artificial intelligence in medicine 33.1 (2005): 25-30. [CrossRef]

[8]. Mattison, H.A.; Stewart, T.; Zhang, J. Applying bioinformatics to proteomics: Is machine learning the answer to biomarker discovery for PD and MSA? Mov. Disord. 2012, 27, 1595–1597. [CrossRef]

[9]. Lahmiri, S.; Shmuel, A. Detection of Parkinson's disease based on voice patterns ranking and optimized support vector machine. Biomed. Signal Process. Control 2018, 49, 427–433. [CrossRef]

[10]. Gómez-García, J.A.; Moro-Velázquez, L.; Godino-Llorente, J.I. On the design of automatic voice condition Analysis systems. Part I: Review of concepts and an insight to the state of the art. Biomed. Signal Process. Control 2019, 51, 181–199. [CrossRef]

[11]. Gómez-García, J.A.; Moro-Velázquez, L.; Godino-Llorente, J.I. On the design of automatic voice condition analysis systems. Part II: Review of speaker recognition techniques and study on the effects of different variability factors. Biomed. Signal Process. Control 2019, 48, 128–143. [CrossRef]

[12]. Viteckova, S.; Kutilek, P.; Svoboda, Z.; Krupicka, R.; Kauler, J.; Szabo, Z. Gait symmetry measures: A review of current and prospective methods Biomed Signal Process. Control 2018, 42, 89–100. [CrossRef]

[13]. San-Segundo, R.; Navarro-Hellín, H.; Torres-Sánchez, R.; Hodgins, J.; De la Torre, F. Increasing Robustness in the Detection of Freezing of Gait in Parkinson's Disease. Electronics 2019, 8, 119. [CrossRef]

[14]. McLennan, J.E.; Nakano, K.; Tyler, H.R.; Schwab, R.S. Micrographia in Parkinson's disease. J Neurol. Sci. 1972, 15, 141–152. [CrossRef]

[15]. Zham, Poonam, et al. "Efficacy of guided spiral drawing in the classification of Parkinson's disease." IEEE journal of biomedical and health informatics 22.5 (2017): 1648-1652. [CrossRef]

[16]. Potgieser, Adriaan RE, et al. "The effect of visual feedback on writing size in Parkinson's disease." Parkinson's disease 2015 (2015). [CrossRef]

[17]. Drotár, P.; Mekyska, J.; Rektorová, I.; Masarová, L.; Smékal, Z.; Faundez-Zanuy, M. Evaluation of handwriting kinematics and pressure for di erential diagnosis of Parkinson's disease. Artif. Intell. Med. 2016, 67, 39–46.

[18]. Letanneux, Alban, et al. "From micrographia to Parkinson's disease dysgraphia." Movement Disorders 29.12 (2014): 1467-1475. [CrossRef]

[19]. Thomas, M.; Lenka, A.; Kumar Pal, P. Handwriting Analysis in Parkinson's disease: Current Status and Future Directions. Mov. Disord. Clin. Pract. 2017, 4, 806–818. [CrossRef]

[20]. Rosenblum, S.; Samuel, M.; Zlotnik, S.; Erikh, I.; Schlesinger, I. Handwriting as an objective tool for Parkinson's disease diagnosis. J. Neurol. 2013, 260, 2357–2361. [CrossRef]

[21]. Impedovo, D.; Pirlo, G. Dynamic Handwriting Analysis for the Assessment of Neurodegenerative Diseases: A Pattern Recognition Perspective. IEEE Rev. Biomed. 2019, 12, 209–220. [CrossRef]

[22]. Impedovo, D.; Pirlo, G. Chapter 7: Online Handwriting Analysis for the Assessment of Alzheimer's disease and Parkinson's disease: Overview and Experimental Investigation. In Series on Language Processing, Pattern Recognition, and Intelligent Systems. Pattern Recognition and Artificial Intelligence; World Scientific Publishing: Singapore, 2019; pp. 113–128.

[23]. van Drempt, N.; McCluskey, A.; Lannin, N.A. A review of factors that influence adult handwriting
Performance. Aust. Occup. Ther. J. 2011, 58, 321–328.

[24]. Kotsavasiloglou, C.; Kostikis, N.; Hristu-Varsakelis, D.; Arnaoutoglou, M. Machine learning-based classification of simple drawing movements in Parkinson's disease. Biomed. Signal Process. Control
2017, 31, 174–180. [CrossRef]
25. Gallicchio, C.; Micheli, A.; Pedrelli, L. Deep Echo State Networks for Diagnosis of Parkinson's disease. ArXiv 2018, arXiv: 1802.06708.

[26]. Khatamino, P.; Cantürk, ˙I. Özyılmaz, L. A Deep Learning-CNN Based System for Medical Diagnosis: An Application on Parkinson's disease Handwriting Drawings. In Proceedings of the 2018 6th International Conference Control Engineering Information Technology, Istanbul, Turkey, 25–27 October 2018; pp. 1–6.
[27]. Olawale Adepoju, Devaraj Verma C, "Prediction and Classification into Benign and Malignant using the Clinical Testing Features", International Journal of Innovative Technology and Exploring Engineering (IJITEE), ISSN: 2278-3075, Volume-9 Issue-10, page no. 55-61 August 2020

[28]. Olawale Adepoju, Devaraj Verma C, "Big data in the machine learning techniques perspective - A review", International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 8 Issue VI June 2020