Parkinsons

Aspects	Paper # 1
Title / Question (What is the problem statement?)	A dataset of multi-contrast population-averaged brain MRI atlases of a Parkinson's disease cohort.
Objectives / Goal (What is looking for?)	
Methodology/Theory (How to find the solution?)	T1–T2* Fusion MRI was created for each patient, and used to drive group-wise registration to create a population-averaged multi-contrast atlas in the MNI ICBM152 space.
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	The dataset is made available in a public repository named NIST
Simulation/Test Data (What parameters are determined?)	25 Parkinson's disease patients' MRI images.
Result / Conclusion (What was the final result?)	The averaged result is the population-average T1–T2* fusion atlas, which combines cortical and subcortical details in one image, avoiding susceptibility artifacts in typical T2*w scans.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	Parkinson's disease, Atlas, Multi-contrast, MRI, Brain, Histology, Basal ganglia, Segmentation. T2*, Registration.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	
Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new methodology for your own research project)	

Important:

- Received 17 February 2017, Accepted 11 April 2017
- 5 image contrasts

- manually segmented eight subcortical structures: caudate nucleus, putamen, globus pallidus internus and externus (GPi & GPe), thalamus, STN, substantia nigra(SN), and the red nucleus (RN).
- three image resolutions available: 1 1 1 mm3, 0.5 0.5 0.5 mm3, and 0.3 0.3 0.3 mm3

Aspects	Paper # 2
Title / Question (What is the problem statement?)	DIAGNOSIS OF THE PARKINSON DISEASE BY USING DEEP NEURAL NETWORK CLASSIFIER
Objectives / Goal (What is looking for?)	The objective of this work is to diagnose PD which is realized by using speech impairments, which is one of the earliest indicators for Parkinson's disease.
Methodology/Theory (How to find the solution?)	A deep neural network classifier, which contains a stacked autoencoder and a softmax classifier, is proposed.
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	Experiments are conducted using "The Oxford Parkinson's Disease Detection (OPD)" and "Parkinson Speech Dataset with Multiple Types of Sound Recordings (PSD)" datasets. These datasets are obtained from the Data Mining Repository of the University of California, Irvine (UCI).
Simulation/Test Data (What parameters are determined?)	The simulations are realized with two different setups. ➢ The first setup is performed with 10-fold cross-validation to compare the state art methods and to validate the performance of the DNN with statistical analyses. ➢ The other setup is also run with a %70 training set and a %30 testing set of the used dataset to compare the performances of the DNN. **Both runs are performed 30 times with different initializing.**
Result / Conclusion (What was the final result?)	The result shows that the DNN has superior classification performance, compared with the previous study, which handled the classification problem of the PD over OPD and PSD data sets.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	Although the proposed DNN produces better accuracy results than the others, these results should be supported with statistical analyses.
Terminology (List the common basic words frequently used in this research field)	Parkinson's disease, deep learning, deep neural network, and stacked autoencoder.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	This paper showed that the deep neural network classifier is a very efficient classifier for Parkinson's disease diagnosis.

Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new methodology for your own research project)	The summarization is that the proposed DNN classifier has the ability to extract hidden features, which considerably increases the performance of the classifier and also can be used as a reliable classifier for the PD thanks to its efficient specificity and sensitivity accuracy rates. We can use this knowledge for our own work.

Important:

- Received on: 01.03.2017; Accepted on: 14.03.2017
- Intro 1 - 3rd passage.
- Intro 1 - 5th passage starting from the 2nd line.
- Deep 2 - last 2 lines.
- All runs were performed on a computer with a 3.4 GHz Intel i7 2600 CPU and 12 GB RAM.
- Datasets 3.1 - 2nd & 3rd passage.
- The structure diagram of the proposed DNN is illustrated in Figure 4.

Aspects	Paper # 3
Title / Question (What is the problem statement?)	Early Detection of Parkinson's Disease Using Deep Learning and Machine Learning
Objectives / Goal (What is looking for?)	This study proposed a deep learning model to automatically discriminate between normal individuals and patients affected by PD based on premotor features. It also provides a comparative study and throws light on the performance of these advanced prediction methods when applied to small PD data sets.
Methodology/Theory (How to find the solution?)	PD detection is done into two main stages: training and testing. ➢ In the first stage, the raw data is preprocessed and standardized, and then it is used to construct the deep learning model. ➢ In the testing stage, the previously constructed model with the selected parameters is used for PD detection.
Software Tools (What program/software is used for design, coding, and simulation?)	Matlab, R, Keras package with the Tensorflow
Test / Experiment How to test and characterize the design/prototype?	The data was prepared from the Parkinson's Progression Markers Initiative (PPMI) database.
Simulation/Test Data (What parameters are determined?)	A total of 584 individuals (183 healthy and 401 early PD) data were used. To evaluate the accuracy randomly split the data and use 70% as training data and the rest as testing data.
Result / Conclusion (What was the final result?)	The proposed model shows the superior detection performance of the designed model, which achieves the highest accuracy, 96.45% on average.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	Very small dataset.

Terminology (List the common basic words frequently used in this research field)	Parkinson's disease, Deep learning, Ensemble learning, Early detection, Premotor features, Features importance.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	To make the comparisons as fair as possible, this paper tunes all other methods to achieve their best performance. For example, The number of trees in the boosting methods, the SVM method, and the number of neighbors in the KNN.
Review Outcome (Make a decision on how to use/refer to the obtained the knowledge to prepare a separate and new methodology for your own research project)	Results showed that the designed deep learning offers superior detection performance compared to the twelve considered machine learning models in discriminating between normal people with patients who have Parkinson's disease. According to this work's deep learning method is a promising first step toward the application of cutting-edge research for early disease detection.

Important:

- Generally, two
- types of symptoms of PD can be distinguished: movement-related and unrelated to movement.
- Intro 1 - 4th passage starting from the 3rd line.
- The splitting is repeated 100 times.
- Page 10 - E. COMPUTING TIME
- The deep learning methods take 11 seconds to train on average.
- The parameters $\gamma > 0$ and $\lambda > 0$ are determined by cross-validation.

Aspects	Paper # 4
Title / Question (What is the problem statement?)	Magnetic resonance imaging for the diagnosis of Parkinson's disease
Objectives / Goal (What is looking for?)	Aims to summarize research findings regarding the value of the different MRI techniques, including advanced sequences at high- and ultra-high-field MRI and modern image analysis algorithms, in the diagnostic work-up of Parkinson's disease.
Methodology/Theory (How to find the solution?)	
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	
Simulation/Test Data (What parameters are determined?)	
Result / Conclusion (What was the final result?)	

Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	Parkinson's disease MRT Atypical parkinsonism Multiple system atrophy Progressive supranuclear palsy
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	
Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new methodology for your own research project)	

Important:

- Received: 2 February 2017; Accepted: 22 March 2017

Aspects	Paper # 5
Title / Question (What is the problem statement?)	Classification of PPMI MRI scans with voxel-based morphometry and machine learning to assist in the diagnosis of Parkinson's disease.
Objectives / Goal (What is looking for?)	The purpose of this research is the introduction of a new method to classify the 3-D magnetic resonance scans of an individual, as an assisting tool for diagnosis of Parkinson's disease by using the largest MRI dataset from a population of patients with Parkinson's disease and control individuals.
Methodology/Theory (How to find the solution?)	In general, the proposed method consists of two main parts: ➢ Identification of regions of interest by using VBM and ➢ analysis of these regions for PD detection. A total of Seven classifiers are used and conducting separate experiments for men and women.
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	To conduct experiments, images were accessed from the Parkinson's Progression Makers Initiative (PPMI) dataset.
Simulation/Test Data (What parameters are determined?)	PPMI's T1-weighted MR images were selected for this study. The MR images were extracted from 226 male patients with PD, 86 male controls, 104 female patients with PD, and 64 female patients with PD.

Result / Conclusion (What was the final result?)	The best detection performance achieved in men is 99.01% of accuracy, 99.35% of sensitivity, 100% of specificity, and 100% of precision. The best detection performance achieved in women is 96.97% of accuracy, 100% of sensitivity, 96.15% of specificity, and 97.22% of precision.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	During the classification of magnetic resonance images, the corresponding computational complexity is reduced since few features are selected. The accuracy has not reached 100% and has not tried deep learning as a tool for PD detection so far.
Terminology (List the common basic words frequently used in this research field)	Parkinson's disease, Magnetic resonance imaging, Voxel-based morphometry, Machine learning, Feature selection
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	The proposed method provides high performance as an assisting tool in the diagnosis of Parkinson's disease, by conducting separate experiments in men and women. While most of the works have focused their analysis to the striatum region of the brain.
Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new methodology for your own research project)	This paper demonstrated the fact that men are more prone to Parkinson's disease than women. The results show that different regions are useful to classify PPMI MR images depending on gender. we got an overview of how voxel-based morphometry and machine learning assist in the diagnosis of Parkinson's disease.

Important:

- Received 21 August 2020; Accepted 6 October 2020
- Page 3 - fig 1 (Stages for voxel-based morphometry PD detection.)
- Dataset 2.1 - 2nd passage.
- The model parameters are obtained by solving argmax p ξ .
- Page 5 - fig 5 (An original MR image and the corresponding result after alignment and segmentation of the gray matter.)
- Classifiers - 2.5
- Page 14 - A comparison with different PD detection methods (Table)
- Four sets of experiments were conducted. At each experiment, seven classifiers were used, Logistic Classifier, Naive Bayes (NB), Bayesian Network (BN), Random, Forest (RF), k-Nearest Neighbors (kNN), Multi-Layer Perceptron (MLP), Support Vector Machine (SVM).
- Feature extraction was implemented in JULIA 1.4. Feature selection, classification, and performance assessment were implemented in WEKA.

Aspects	Paper # 6
Title / Question (What is the problem statement?)	Detection of Parkinson's Disease in Brain MRI using Convolutional Neural Network
Objectives / Goal (What is looking for?)	This paper present a Convolutional Neural Network (CNN) based automatic diagnosis system which accurately classifies PD and healthy control (HC).
Methodology/Theory (How to find the solution?)	The proposed system receives MR images as input, which is eventually labeled as PD or HC. The model contains a total number of 8 major layers.

	The kernel size of all convolutional layers and Max-pooling layers is 3x3 which generates 32 feature maps.
Software Tools (What program/software is used for design, coding, and simulation?)	MATLAB, Keras, Theano.
Test / Experiment How to test and characterize the design/prototype?	The dataset used in this research is obtained from PPMI.
Simulation/Test Data (What parameters are determined?)	A total of 500, T2 weighted MRI scans were 250 MRI scans of PD while 250 for HC. Furthermore, data is divided into training, validation, and testing sets with a ratio of 70%, 10%, and 20% respectively.
Result / Conclusion (What was the final result?)	During the training of the model, validation and training accuracies are recorded after each epoch. Each time after training the model is tested on the test set. The proposed model shows better accuracy when compared to SVM, RVM, Decision tree, ANN, GA-ELM, and other machine learning techniques on the same dataset.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	During the experimentation, the limited dataset was a major issue, leading the CNN model towards overfitting.
Terminology (List the common basic words frequently used in this research field)	Parkinson's Disease, MRI, Deep Learning, Convolutional Neural Network, CNN
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	The results demonstrate that the proposed network is capable of learning accurate features of Parkinson disease automatically.
Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new methodology for your own research project)	Due to the complex manifestation of PD, we have to select the most appropriate features related to the disease because the CNN does not require the handcrafted features.

Important:

- Proceedings of the 24th International Conference on Automation & Computing, Newcastle University, Newcastle upon Tyne, UK, 6-7 September 2018
- 25% of diagnoses are incorrect.
- For classification, 6 different techniques such as Decision Tree, Bagging, Boosted Tree, Random Forest, RBF Neural Network, Multi-layer Perceptron, and Neural Network were used.
- Page 4 - Comparison table
- Used CNN as a sequential model with the Theano library.
- The classification accuracy fluctuates between 94 to 98%.

Aspects	**Paper # 7**

Title / Question (What is the problem statement?)	Predicting Severity Of Parkinson's Disease Using Deep Learning
Objectives / Goal (What is looking for?)	This study proposed a methodology for the prediction of Parkinson's disease severity using deep neural networks on UCI's Parkinson's Telemonitoring Voice Data Set of patients.
Methodology/Theory (How to find the solution?)	the methodology was conducted in a two-step. ➢ In the first step consists the voice data collection, analyzation & normalization. ➢ In the next step deep neural network is designed with three layers.
Software Tools (What program/software is used for design, coding, and simulation?)	'TensorFlow', Keras
Test / Experiment How to test and characterize the design/prototype?	The ParkinsonsTelemonitoring Voice Data Set from UCI Machine Learning Repository.
Simulation/Test Data (What parameters are determined?)	The dataset comprises biomedical voice measurements of 42 patients which contain 5,875 voice recordings of these patients. On average, there are approximately 200 recordings collected from each patient.
Result / Conclusion (What was the final result?)	The classification accuracy obtained is 83.367% and 81.6667% for the train and test datasets respectively.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	The dataset has not had enough instances or combined features.
Terminology (List the common basic words frequently used in this research field)	Parkinson's Disease, Deep Neural Networks, TensorFlow, UPDRS
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	The proposed DNN model found that the classification based on motor UPDRS score is better than the classification based on total UPDRS score.
Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new methodology for your own research project)	The accuracy of our approach can be further improved by implementing it on a larger dataset. So to gain the utmost accuracy we should collect a large dataset.

Important:

- International Conference on Computational Intelligence and Data Science (ICCIDS 2018)
- Page 3 - fig 1
- The normalization was done column-wise.
- 80% (for train dataset) and 20%(for test dataset).
- The output classes are 'non-severe' and 'severe'.

- respectively. The network was trained with 1000 and 2000 steps respectively.

Aspects	Paper # 8
Title / Question (What is the problem statement?)	Towards the Identification of Parkinson's Disease Using only T1 MR Images
Objectives / Goal (What is looking for?)	This paper investigates the plausibility of using MRIs for automatically diagnosing PD.
Methodology/Theory (How to find the solution?)	The framework of the proposed method presented three main steps. ➢ Preprocessing, ➢ Feature Extraction, ➢ Classification.
Software Tools (What program/software is used for design, coding, and simulation?)	FreeSurfer
Test / Experiment How to test and characterize the design/prototype?	The data used in the preparation is the T1-weighted brain MR images obtained from the PPMI database
Simulation/Test Data (What parameters are determined?)	T1 MR image of 598 samples with 411 Parkinson's disease (PD) and 187 healthy control (HC).
Result / Conclusion (What was the final result?)	The best result is for RF either with the age/sex feature or without it. if the comparison is based on the training accuracy showing the ability of the classifier to learn a feature from the data then SVM-linear is the best one.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	the efficiency of the proposed method could be improved by adding high-level features to the current ones.
Terminology (List the common basic words frequently used in this research field)	Parkinson's Disease, MRI, (LR), Random Forest (RF) and Support Vector Machine (SVM),
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	The proposed system proves to be promising in assisting the diagnosis of PD. At the same time, most of the other works prefer to classify this disease.
Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new methodology for your own research project)	This paper extracts the volume-based features from the MR T1 images using FreeSurfer. So we can implement this easy way to fulfill our requirement for the features.

Important:

- Springer Nature Switzerland AG 2018
- two types of classes which are PD and HC.

- Page 4 - fig 2

Aspects	Paper # 9
Title / Question (What is the problem statement?)	Data Driven Intelligent Diagnostics for Parkinson's Disease
Objectives / Goal (What is looking for?)	This paper applies several preprocessing methods to image data such as gray level transformation, histogram equalization, improved wavelet soft-threshold denoising, and image enhancement, and proposes a deep learning model based on U-Net architecture with deformable convolution kernels.
Methodology/Theory (How to find the solution?)	In this study, gray level transformation, histogram equalization, improved wavelet soft-threshold denoising, and image enhancement was used for image preprocessing, then the convolutional neural network was trained and tested.
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	Experiments are conducted using PPMI, ADNI, HCP & MNIST databases.
Simulation/Test Data (What parameters are determined?)	214 PET images with Parkinson's disease and 127 PET images of the control group. 60000 handwritten digital image set to verify the performance of the constructed network.
Result / Conclusion (What was the final result?)	After training and testing, the diagnostic accuracy of the U-Net was 84.17%, the CNN network was 76.19%, and the reserved PET images got correct diagnostic results.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	Cost of error function occurred. To minimize this a SoftMax classifier was trained.
Terminology (List the common basic words frequently used in this research field)	Parkinson's disease, PET, U-Net, VGG-Net, CNN, data analytics.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	This project attempts to extract the feature map used to determine whether a patient is PD from the network model layer by layer and make the feature map visible.
Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new	The applied model is robust to the task of PET image data processing. We can use this as our data is also image related.

methodology for your own research project)	

Important:

- Received July 20, 2019, accepted July 25, 2019, date of publication July 29, 2019
- Using the hold-out method, 253 images were used as training sets, and 88 images were the test set.
- According to the test results of neural network models, it can be concluded that U-Net performs better than CNN in the task of PD diagnosis using PET images.
- Epoch is set 10000, learning rate 0.01.

Aspects	Paper # 10*
Title / Question (What is the problem statement?)	Deep learning to differentiate parkinsonian disorders separately using single midsagittal MR imaging: a proof of concept study.
Objectives / Goal (What is looking for?)	To evaluate the diagnostic performance of deep learning with the convolutional neural networks (CNN) to distinguish each representative parkinsonian disorder using MRI.
Methodology/Theory (How to find the solution?)	At first, trained the CNN to distinguish each parkinsonian disorder using a single midsagittal T1-weighted MRI with a training group to minimize the differences between predicted output probabilities and the clinical diagnoses; then, adopted the trained CNN to the validation data set.
Software Tools (What program/software is used for design, coding, and simulation?)	Keras
Test / Experiment How to test and characterize the design/prototype?	The experiment dataset was collected from a hospital.
Simulation/Test Data (What parameters are determined?)	372 were diagnosed by neurologists as PD, PSP, or MSA-P. In the study. all subjects were randomly divided into training (85%) and validation (15%) data sets with the same proportions of each disease and normal subjects.
Result / Conclusion (What was the final result?)	The accuracies of diagnostic performances regarding PD, PSP, MSA-P, and normal subjects were 96.8, 93.7, 95.2, and 98.4%, respectively.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	This work was a retrospective study, and therefore had intrinsic selection bias. The number of cases of each disease was not balanced. Including some advanced cases in the dataset after disease onset was also a limitation of this study.
Terminology (List the common basic words frequently used in this research field)	Artificial intelligence, Parkinson's disease, Magnetic resonance imaging. ROC curve, Deep learning
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	This work assessed the diagnostic performance of deep learning for distinguishing among PD, PSP, MSA-P, and normal status using single midsagittal MRI.

Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new methodology for your own research project)	It was a single-institution study, and these results required confirmation at other institutes. So in our work, we will collect more cases in collaboration with other institutions.

Important:

- Received: 26 April 2019, Revised: 4 June 2019, Accepted: 13 June 2019
- MRI examinations at a single hospital from January 2012 to April 2016,
- Training took 30 min and validation took 2 min.
- a total of 32 images were generated from each original image.

Aspects	Paper # 11
Title / Question (What is the problem statement?)	Deep learning-based diagnosis of Parkinson's disease using convolutional neural network
Objectives / Goal (What is looking for?)	This work is an attempt to classify the MR images of healthy control and Parkinson's disease subjects using deep learning neural network.
Methodology/Theory (How to find the solution?)	The proposed system consists of several steps like MR image database, pre-processing of the MR images, CNN AlexNet architecture, Transfer learning applied to the pre-trained AlexNet model and the classification accuracy measures
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	The axial T2 weighted MR images are obtained from the Parkinson's Progression Markers Initiative (PPMI).
Simulation/Test Data (What parameters are determined?)	T2 MR image of 182 subjects with 82 Healthy controls and 100 Parkinson's disease subjects.
Result / Conclusion (What was the final result?)	An accuracy of 88.9% is achieved with the proposed system.
Obstacles/Challenges (List the methodological obstacles authors mentioned in the article)	This approach could suffer from loss of information. Also, are intrinsically biased by segmentation errors and would affect the discrimination power.
Terminology (List the common basic words frequently used in this research field)	Parkinson's disease, MRI, Deep learning, Convolutional neural networks, AlexNet
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	The model is trained to learn the low-level to high-level features, and the classification results are validated while previous studies have reported comparable performance levels on different Parkinson's disease datasets,

	utilizing various dimensionality reduction techniques [30] and machine learning algorithms
Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new methodology for your own research project)	The proposed CNN model is based on whole brain analysis that exploits the spatial structure without relying on hand-crafted features and hence considered to be robust. We can use deep fine-tuning of the AlexNet model to obtain improved performance levels.

Important:

- Received: 1 October 2018, Revised: 6 February 2019, Accepted: 7 March 2019, published online: 21 March 2019
- Page 3 - table 1
- A 2D Gaussian filter with a smoothening kernel of size 5 X 5 and an optimised standard deviation σ of 0.8 is used to smoothen and thus reduce the intensity inhomogeneities from the images.
- Normalisation is applied to the first two convolution layers in the network.
- The dropout probability is set to be 0.5
- The image dataset with 80% of the input data is used for training and the remaining 20% is used for testing.
- The network is trained for 30 epochs
- Accuracy is calculated by the proportion of the true positive and true negative to obtain the total number of predictions that are correct.
- Alex-Net

Aspects	**Paper # 12**
Title / Question (What is the problem statement?)	Parkinson Disease Detection Using Deep Neural Networks
Objectives / Goal (What is looking for?)	This study aims to develop a deep learning model containing 2 modules namely VGFR Spectrogram Detector and Voice Impairment Classifier implementing CNN (Convolutional Neural Networks) and ANN (Artificial Neural Network) respectively, for a cheaper and more accurate objective diagnosis of Parkinson's Disease in its early stages.
Methodology/Theory (How to find the solution?)	It is based on two unique decisive features. ➢ walking patterns in the form of recorded signals are depicted as spectrograms. ➢ voice impairment.
Software Tools (What program/software is used for design, coding, and simulation?)	Tensor flow and Keras.
Test / Experiment How to test and characterize the design/prototype?	The dataset featured in this project has been taken from the PhysioNet Database bank and UCI Machine Repository.
Simulation/Test Data	Biomedical voice measurements of 91 subjects,

(What parameters are determined?)	
Result / Conclusion (What was the final result?)	The classification accuracy on VGFR Spectrogram Detector is recorded as 88.1% while Voice Impairment Classifier has shown 89.15% accuracy.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	CNN, Neural, ANN, Parkinson, Gait, PPMI, Neurodegenerative, UCI
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	The experimental results indicate that the proposed models outperformed the existing state of the arts in terms of accuracy.
Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new methodology for your own research project)	it is stated that both the datasets are balanced and have an adequate proportion of all the classes, and the proposed modules give better accuracy as compared to other machine learning algorithms. Hence the model proposed is practically effective and efficient as compared to all other algorithms.

Important:

- The proposed CNN model comprises 2 convolution layers (layer 1 with 32 units and layer 2 with 16 units),
- Three popular machine learning algorithms were applied i.e. XG Boost, Support Vector Machine, and MLP

Aspects	Paper # 13
Title / Question (What is the problem statement?)	Detection of Parkinson's Disease from 3T T1 Weighted MRI Scans Using 3D Convolutional Neural Network
Objectives / Goal (What is looking for?)	The main premise of the study focuses on the detection of Parkinson's Disease and the classification of MRI scans as a healthy control for Parkinson's Disease using 3D convolutional neural networks.
Methodology/Theory (How to find the solution?)	The methodology was primarily divided into four stages. ➢ Data preprocessing ➢ Registration, and transformation ➢ 3D convolutional neural network architecture ➢ The results and performance evaluation of the CNN architecture based on some metrics.
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment	The data for the study was collected from the PPMI database

How to test and characterize the design/prototype?	
Simulation/Test Data (What parameters are determined?)	406 subjects from baseline visit, where 203 were healthy and 203 were suffering from Parkinson's Disease.
Result / Conclusion (What was the final result?)	The model developed in the study plotted an overall accuracy of 95.29%, average recall of 0.943, average precision of 0.927, and f1-score of 0.936 for both classes.
Obstacles/Challenges (List the methodological obstacles authors mentioned in the article)	The challenge that is faced in the process is that the hyperparameters much be chosen in a particular way that it should be model-specific rather than a training set to increase the generalizability of the model over unseen data.
Terminology (List the common basic words frequently used in this research field)	Parkinson's Disease, neurodegeneration, magnetic resonance imaging (MRI), convolutional neural network (CNN), deep learning
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	Until now no therapeutic method has been discovered for completely eradicating the disease from a person's body after it's onset.
Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new methodology for your own research project)	In the future, it is highly recommended to perform such research by considering specific subcortical structures and the development of more efficient architectures for the detection of Parkinson's Disease.

Important:

- Received: 14 May 2020, Accepted: 10 June 2020, Published: 12 June 2020
- Page 5 - table 3
- Time range of 20–30 min field of view (FoV).
- Determining the generalizability of the model over unseen data a 5-split cross-validation was performed.
- The loss function used in the present study was binary cross-entropy,

Aspects	**Paper # 14**
Title / Question (What is the problem statement?)	Diagnosis of Parkinson's disease using deep CNN with transfer learning and data augmentation.
Objectives / Goal (What is looking for?)	This paper proposed and employed a framework to categorize MR images of healthy people and people with Parkinson's disease using a combination of data augmentation and transfer learned Alex-Net.
Methodology/Theory (How to find the solution?)	The model was conducted in four stages. ➢ Preprocessing of images. ➢ Data augmentation ➢ Transfer learning ➢ Evaluation.

Software Tools (What program/software is used for design, coding, and simulation?)	Keras, Theano
Test / Experiment How to test and characterize the design/prototype?	The MR images of healthy people and patients with Parkinson's disease were collected from the PPMI database
Simulation/Test Data (What parameters are determined?)	The MR images used in this study consist of 162 participants, including 67 healthy individuals and 85 subjects with Parkinson's disease
Result / Conclusion (What was the final result?)	The proposed approach demonstrates accuracy, sensitivity, and specificity values of 89.23%, 90.27%, and 89.03%, respectively.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	The limitation is that these strategies are potentially skewed by segmentation errors, which may affect the efficiency of classification
Terminology (List the common basic words frequently used in this research field)	Parkinson's disease, Generative Adversarial Network, Alex-Net, Transfer learning, Overfitting
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	The main focus of this paper to construct and validate a deep transfer learned Alex-Net with a data augmentation approach that can forecast PD diagnosis depending on a given cross-sectional brain skeletal MRI scan.
Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new methodology for your own research project)	The scope of the proposed model is it can be further expanded to bring the AlexNet model's fine-tuning within its ambit for obtaining superior working results.

Important:

- Received: 9 May 2020, Revised: 25 September 2020, Accepted: 19 October 2020
- A total of 504 images are collected, and 360 images are used to augment data. The increased data set of this model is as many as 4200 images.
- Generative Adversarial Networks (GANs) based data augmentation technique
- Alex-Net architecture.
- Page 7 - fig 1
- The image dataset with 60% of the input data is used for training, 20% for validation, and the remaining 20% is used for testing.
- The network's mean training period was 1 h, for 200 epochs.
- The approach proposed is finally analyzed using seventy-two MR images of HC and PD patients with a proportion of 1:1.

Aspects	**Paper # 15**

Title / Question (What is the problem statement?)	Modern Brainstem MRI Techniques for the Diagnosis of Parkinson's Disease and Parkinsonisms.
Objectives / Goal (What is looking for?)	A brief overview of recent advances in brainstem-related MRI markers in Parkinson's disease and Parkinsonism.
Methodology/Theory (How to find the solution?)	
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	
Simulation/Test Data (What parameters are determined?)	
Result / Conclusion (What was the final result?)	
Obstacles/Challenges (List the methodological obstacles authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	iron, neuromelanin (NM), multiple system atrophy (MSA), NODDI, diffusion kurtosis imaging (DKI), nigrosome
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	

Important:

- Received: 06 March 2020, Accepted: 25 June 2020, Published: 04 August 2020

Aspects	**Paper # 16**
Title / Question (What is the problem statement?)	Parkinson's Disease Detection Using Ensemble Architecture from MR Images

Objectives / Goal (What is looking for?)	Exploring various approaches to identify Parkinson's using Magnetic Resonance (MR) T1 images of the brain.
Methodology/Theory (How to find the solution?)	This work proposed two ensemble architectures to identify PD from MR images of the brain, one of which achieves comparable accuracy to existing state-of-the-art models. Conducting three steps this model was completed. ➢ Data ➢ Preprocessing ➢ Model
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	The dataset was collected from Parkinson Progression Markers Initiative (PPMI)
Simulation/Test Data (What parameters are determined?)	The final dataset has is class balanced with 598 subjects.
Result / Conclusion (What was the final result?)	94.7% of average accuracy was achieved using smoothed GM and WM extracts and one of our proposed architectures.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	Parkinson's Disease Detection, Ensemble Learning, Deep Learning, Magnetic Resonance Imaging.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	Using ensemble architectures for PD detection and the detection accuracy using sMRI was lacking in other works. Conducting the proposed method this study got better results than before.
Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new methodology for your own research project)	Two versions were constructed for each of our ensemble architectures; one with all untrained constituent models and another with all pretrained constituent models. We can use this architecture in our work.

Important:

- 2020 IEEE 20th International Conference on BioInformatics and BioEngineering (BIBE)
- T1-weighted sMRI scans for 568 PD and Healthy Control (HC) subjects from which we choose 445 subjects. The resulting data has a class imbalance with 299 PD and 146 HC subjects.
- The models are designed for the ImageNet dataset,
- Each model was trained for 25 epochs with an Adam Optimizer and Cross Entropy Loss function.

Aspects	Paper # 17
Title / Question (What is the problem statement?)	Unified deep learning approach for prediction of Parkinson's disease
Objectives / Goal (What is looking for?)	The study presents a novel approach, based on deep learning, for the diagnosis of Parkinson's disease through medical imaging.
Methodology/Theory (How to find the solution?)	The study method starts by training a deep neural architecture, such as a convolutional, or convolutional-recurrent network to predict the status (PD, or NPD) of subjects. This is based on an analysis of medical images, MRI images, collected in a specific medical center, or hospital.
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	The data for the study was collected from the PPMI database.
Simulation/Test Data (What parameters are determined?)	In total, the dataset includes 925 DaTscans, 595 of which come from subjects with PD and 330 from controls; and 41528 MRIs, 31147 of which represent PD and 10381 NPD.
Result / Conclusion (What was the final result?)	Predictions of very high accuracy.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	It is presented illustrating the ability of the proposed approach to effectively predict Parkinson's, using different medical image sets from real environments.
Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new methodology for your own research project)	It is a new approach for deriving a unified prediction model for PD. we can use this model for better results.

Important:

- Received on 18th November 2019, Revised 11th March 2020, Accepted on 29th April 2020

Aspects	Paper # 18
Title / Question (What is the problem statement?)	Application of Deep Learning Models for Automated Identification of Parkinson's Disease: A Review (2011–2021)
Objectives / Goal (What is looking for?)	The purpose of this systematic review is to provide a comprehensive review of automated Parkinson's disease (PD) detection using deep learning models, and to further promote deep learning models as a potential computer-aided diagnostic (CAD)-based tool for clinical decision support systems.
Methodology/Theory (How to find the solution?)	This systematic review applied the PRISMA model [36] to analyze the most relevant studies on PD detection using deep learning models.
Software Tools (What program/software is used for design, coding, and simulation?)	CAD
Test / Experiment How to test and characterize the design/prototype?	
Simulation/Test Data (What parameters are determined?)	A total number of 794 studies
Result / Conclusion (What was the final result?)	The overall model performance achieved by deep learning studies in each modality is favorable, especially for common modalities like MRI, PET, SPECT, EEG, gait, handwriting, and speech, in which overall model accuracy had all exceeded 80%.
Obstacles/Challenges (List the methodological obstacles authors mentioned in the article)	There is a potential lack of studies for ultrasound imaging, small movement-related tests, and multi-model analysis which involves more than one modality. This makes it difficult to determine the best-performing model for these three categories.
Terminology (List the common basic words frequently used in this research field)	Parkinson's disease (PD); deep learning; computer-aided diagnosis (CAD); SPECT; PET; MRI; EEG; gait; handwriting; speech
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	identify the best performing deep learning model reported for each modality and highlight the current limitations that are hindering the adoption of such CAD tools in healthcare.
Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a the separate and new methodology for your own research project)	The authors have only demonstrated that deep learning models are promising CAD tools for PD diagnosis. Using this system we can develop deep learning models into a clinically trusted CAD tool for clinical decision support.

Important:

- Received: 20 September 2021, Accepted: 19 October 2021, Published: 23 October 2021

- Between 1990 and 2016, the number of people diagnosed with PD doubled from 2.5 million to 6.1 million.
- 178 studies from PubMed, 248 studies from Google Scholar, 135 studies from IEEE, and 233 studies from Science Direct.
- A majority of the studies that focused on image analysis proposed CNN models for automated detection of PD.

Aspects	Paper # 19
Title / Question (What is the problem statement?)	Machine Learning for the Diagnosis of Parkinson's Disease- A Review of Literature.
Objectives / Goal (What is looking for?)	This study, conducted a literature review of studies published until February 14, 2020, using the PubMed and IEEE Xplore databases.
Methodology/Theory (How to find the solution?)	Boolean search strings were used. No additional filters were applied in the literature search. All retrieved studies were systematically identified, screened, and extracted for relevant information following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	
Simulation/Test Data (What parameters are determined?)	In 93 out of 209 studies (43.1%), original data were collected from human participants. In 108 studies (51.7%), data used were from public repositories and databases,
Result / Conclusion (What was the final result?)	The average accuracy of 92.6 (6.1) % was obtained, and the lowest and highest accuracy among the 15 studies was 82.0% and 100.0%, respectively.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	The present study, excluded research articles in languages other than English, and the results were published in the form of conference abstracts, posters, and talks. Due to the high inter-study variance in the data source and presentation of results, it was challenging to directly compare outcomes associated with each type of model across studies, as some studies failed to indicate whether the model performance was evaluated using a test set, and/or results given by models that did not yield the best per-study performance.
Terminology (List the common basic words frequently used in this research field)	Parkinson's disease, machine learning, deep learning, diagnosis, differential diagnosis.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	A high-level summary, providing access to information including machine learning methods, types of clinical behavior, biometric data, potential biomarkers, and other highly relevant information

Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	These studies demonstrate a high potential for adaptation of machine learning methods and novel biomarkers in clinical decision making, leading to increasingly systematic, informed diagnosis of PD. So we can choose those methods which got the best performance.

Important:

- Received: 26 November 2020, Accepted: 22 March 2021, Published: 06 May 2021
- A total of 209 studies were included
- the most commonly used data modalities were voice recordings (n = 51, 38.6%), movement (n = 35,26.5%), and MRI data (n = 15, 11.4%).

Aspects	Paper # 20
Title / Question (What is the problem statement?)	The Role of Neural Network for the Detection of Parkinson's Disease: A Scoping Review
Objectives / Goal (What is looking for?)	The study aimed to explore and summarize the applications of neural networks to diagnose PD.
Methodology/Theory (How to find the solution?)	PRISMA Extension for Scoping Reviews (PRISMA-ScR) was followed to conduct this scoping review.
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	Medical databases (e.g., PubMed) and technical databases (IEEE) were searched.
Simulation/Test Data (What parameters are determined?)	Out of 1061 studies, 91 studies satisfied the eligibility criteria.
Result / Conclusion (What was the final result?)	In total, 91(8.67%) studies were included in this review.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	Authors limited the search to the period between 2018 to 2021. Due to that, it may have missed some significant studies.
Terminology (List the common basic words frequently used in this research field)	Parkinson's disease; neural network; deep learning; classification.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	This scoping review summarized studies by investigating the use of neural networks, specifically deep learning algorithms, for early diagnosis of PD based on various data collected from different public and private sources

Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new methodology for your own research project)	Many possible applications of neural networks were identified in this review, however, most of them are limited up to research purposes. In that case, we should review the papers as much as we can.

Important:

- Received: 25 April 2021, Accepted: 26 May 2021, Published: 16 June 2021.
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Aspects	Paper # 21
Title / Question (What is the problem statement?)	The role of neuroimaging in Parkinson's disease.
Objectives / Goal (What is looking for?)	This paper provides an overview of established and emerging targets and agents used for molecular imaging in PD patients and discusses the advances in the understanding of PD achieved through molecular imaging.
Methodology/Theory (How to find the solution?)	
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	
Simulation/Test Data (What parameters are determined?)	
Result / Conclusion (What was the final result?)	
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	alpha-synuclein, neurodegeneration, neuroimaging, Parkinson's disease, PET, SPECT.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	
Review Outcome (Make a decision on how to use/refer to the obtained	

knowledge to prepare a separate and new methodology for your own research project)	

Important:

- Received: 12 May 2021, Revised: 9 September 2021, Accepted: 10 September 2021

Aspects	Paper # 22
Title / Question (What is the problem statement?)	Visualizing correlations among Parkinson biomedical data through information retrieval and machine learning techniques
Objectives / Goal (What is looking for?)	This paper analyzes the data available in the Parkinson's Progression Markers Initiative (PPMI), a comprehensive observational, multi-center study designed to identify progression biomarkers important for better treatments for Parkinson's disease.
Methodology/Theory (How to find the solution?)	IR and ML techniques are used to identify eventual correlations between documents in order to recognize the different classes of patients based on specific medical reports.
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	The activity was conducted by the PPMI dataset.
Simulation/Test Data (What parameters are determined?)	The complete dataset consists of 145 files.
Result / Conclusion (What was the final result?)	The results of the clustering algorithms are analyzed, by computing Precision, Recall, and F-measure for each cluster.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	Biomedical data analysis, Health information visualization, Information retrieval, Machine learning
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	This paper focused on correlations among Parkinson biomedical while other works focused on detecting the disease.
Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new	This paper represents 3 outcomes. ➢ correlate the information of each patient's medical report, Information Retrieval, and Machine Learning techniques. ➢ patients are classified as affected or not. ➢ a data visualization system to support diagnosis for doctors.

methodology for your own research project)	

Important:

- Received: 30 August 2020, Revised: 3 December 2020, Accepted: 5 January 2021
- reference study started in 2010.
- PD is a neurodegenerative disease, belonging to the “Movement Disorders” category.
- dataset consists of 145 files in CSV format,
- Page 13 - fig 3
- Page 14 - fig 4

Aspects	Paper # 23
Title / Question (What is the problem statement?)	A Comparative Study of Existing Machine Learning Approaches for Parkinson's Disease Detection
Objectives / Goal (What is looking for?)	To present a comprehensive survey including the most recent research papers up to the year 2017 and recommend the potential opportunity for automatic diagnosis of PD.
Methodology/Theory (How to find the solution?)	The Levenberg–Marquardt algorithm is efficient and strongly recommended for neural network training which has been implemented here.
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	This database is freely available and can be easily downloaded from the UCI repository.
Simulation/Test Data (What parameters are determined?)	A Dataset of PD patients regarding general voice disorders has been used.
Result / Conclusion (What was the final result?)	It is observed that Artificial Neural Networks with Levenberg–Marquardt algorithm gives the highest classification accuracy of 95.89% for voice dataset.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	Two biggest challenges that still exist in MIP are the dataset and computational power to develop the meta-cognitive algorithm for the identification of the brain regions responsible for PD using the RFE approach and 87.21% accuracy was achieved but the computational cost was high.
Terminology (List the common basic words frequently used in this research field)	Artificial neural networks (ANN). K-nearest neighbors (KNN), Parkinson’s disease (PD), support vector machine (SVM)
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	The paper summarized that the performance of ANN, KNN, and SVM classifiers have been evaluated using sensitivity, specificity, total classification accuracy and geometric mean on voice database.

Review Outcome (Make a decision on how to use/refer to the obtained knowledge to prepare a separate and new methodology for your own research project)	The existing knowledge review indicates that many classification algorithms have been used to achieve better results, but the problem is to identify the most efficient classifier for PD detection. We can compare our results with those obtained result.

Important:

- Published online: 22 Oct 2018.
- Page 3 - table 1
- Page 5 - fig 2

Dementia

Aspects	Paper # 01
Title / Question (What is the problem statement?)	Open Access Series of Imaging Studies (OASIS): Longitudinal MRI Data in Nondemented and Demented Older Adults.
Objectives / Goal (What is looking for?)	This study describe a longitudinal sample of MRI data from older adults, with and without Alzheimer‘s disease (AD).
Methodology/Theory (How to find the solution?)	The process was conducted using some steps.
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	The dataset was obtained from OASIS.
Simulation/Test Data (What parameters are determined?)	The present data set includes longitudinally acquired T1-weighted MRI data from 150 individuals.
Result / Conclusion (What was the final result?)	72 & 64 of the subjects were characterized as nondemented & demented throughout the study respectively.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	data sharing, Alzheimer’s Disease, aging, MRI, morphometry, open access, ADNI
Review Judgment	

(Briefly compare the objectives and results of all the articles you reviewed)	
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	

Important:

- Published in final edited form as: J Cogn Neurosci. 2010 December
- 150 subjects (88 female) aged 60–96
- Dementia status was established and staged using the CDR scale.
- Overall, 25 imaging sessions were excluded.

Aspects	Paper # 02
Title / Question (What is the problem stateNetworks)	Computer-Aided Classification of Multi-Types of Dementia via Convolutional Neural Networks.
Objectives / Goal (What is looking for?)	This paper offers a novel computer aided diagnosis (CAD) system for early detection of multi-types of dementia.
Methodology/Theory (How to find the solution?)	A new two- stage convolutional computer- aided approach has been proposed in order to detect and track the progression of dementia.
Software Tools (What program/software is used for design, coding, and simulation?)	Tensorflow
Test / Experiment How to test and characterize the design/prototype?	The dataset that has been chosen from OASIS.
Simulation/Test Data (What parameters are determined?)	A classification of dementia was tested on MR images collected from 74 different subjects.
Result / Conclusion (What was the final result?)	The proposed algorithm yields a 74.93% accuracy in early diagnosis of multi-type of dementi
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	Alzheimer's disease, Brain imaging, Computer-Aided Diagnosis, Convolutional Neural Networks, Dementia, Early diagnosis, Magnetic Resonance Imaging.
Review Judgment	This method indicates that merging the CNN with regression, achieves better accuracy than linear support vector machine, logistic regression, and CNN with softmax layer by training them on images.

(Briefly compare the objectives and results of all the articles you reviewed)	
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	Using this CAD method we can create comparison among three diseases which we selected for our project.

Important:

- Peer-reviewed at the direction of IEEE Instrumentation and Measurement Society prior to the acceptance and publication.
- 7- fold cross validation is performed on 734 MRI images.
- 60% training & 40 % testing
- Page 4 - fig 4
- Page 5 - table 1

Aspects	Paper # 03
Title / Question (What is the problem statement?)	Dementia Detection and Classification From MRI Images Using Deep Neural Networks and Transfer Learning
Objectives / Goal (What is looking for?)	Provide a technique which aims to classify those MRI scans that display the most potential for the diagnosis of this neurodegenerative disease.
Methodology/Theory (How to find the solution?)	A Deep Machine-Learning model which includes the following steps: ➢ Image pre-processing ➢ Feature extraction ➢ Learning classification model
Software Tools (What program/software is used for design, coding, and simulation?)	MATLAB
Test / Experiment How to test and characterize the design/prototype?	MRI images from the OASIS 1 dataset are being used.
Simulation/Test Data (What parameters are determined?)	Total 416 subjects. Each class contains 14 subjects for training.
Result / Conclusion (What was the final result?)	Using DCNN model produced an important classification accuracy of 81.94%
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology	Dementia,MRI, Bag of feature, K-means,Deep Machine Learning, DCNN, Transfer Learning

(List the common basic words frequently used in this research field)	
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	It's a new approach in the field of Deep Machine Learning, that comprises both DCNN (Deep Convolutional Neural Network) model and Transfer Learning model to detect and classify the dementia disease.
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	Results showed that the DCNN model achieved significant accuracy for better Dementia diagnosis. We can use this model if needed.

Important:

- 416 subjects, who are aged between 18 to 96 years and in total of 436 imaging sessions.
- The size of the MRI images is reduced from 176 * 208 * 176 to 227 * 227 * 1 to facilitate our work.
- Page 7 - Table 3

Aspects	Paper # 04
Title / Question (What is the problem statement?)	Technology and Dementia: The Future is Now
Objectives / Goal (What is looking for?)	To summarise key areas of technology development in dementia and identify future directions and implications.
Methodology/Theory (How to find the solution?)	Members of the US Alzheimer's Association Technology Professional Interest Area involved in delivering the annual pre-conference summarised existing knowledge on current and future technology developments in dementia.
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	
Simulation/Test Data (What parameters are determined?)	
Result / Conclusion (What was the final result?)	The main domains of technology development are as follows: ➢ diagnosis, assessment and monitoring, ➢ maintenance of functioning, ➢ leisure and activity, ➢ caregiving and management.
Obstacles/Challenges	

(List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	Technology, Dementia, Aging, Big data, Policy
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	An overview of between Technology and Dementia
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	

Aspects	**Paper # 05**
Title / Question (What is the problem statement?)	Deep learning based-classification of dementia in magnetic resonance imaging scans.
Objectives / Goal (What is looking for?)	The objective of this research is to develop an open source software for deep learning based-classification of dementia in magnetic resonance imaging scans.
Methodology/Theory (How to find the solution?)	Fllowing Deep Learning Framework this project was conducted.
Software Tools (What program/software is used for design, coding, and simulation?)	Keras, TensorFlow, Lasagne, MXNet, Caffe, Torch.
Test / Experiment How to test and characterize the design/prototype?	In this research, OASIS-2 was used.
Simulation/Test Data (What parameters are determined?)	The image dataset encapsulates 1592 MRI scans for demented and 2032 MRI scans for non-demented subjects, respectively
Result / Conclusion (What was the final result?)	The calculated performance metrics demonstrate that the proposed Keras deep learning model can be used to successfully separate dementia patients and healthy individuals based on the T1-weighted MRI scans.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology	Classification, deep-learning, dementia, Keras, magnetic resonance imaging.

(List the common basic words frequently used in this research field)	
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	The current research intends to develop an open source software for deep learning based-classification of dementia in magnetic resonance imaging scans.
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	The proposed system can be used to detect individuals with suspected dementia disease.

Important:

- 72 of the individuals were defined as non-demented during the study. 64 of the subjects were defined as demented

Aspects	Paper # 06
Title / Question (What is the problem statement?)	Computational Modeling of Dementia Prediction Using Deep Neural Network: Analysis on OASIS Dataset
Objectives / Goal (What is looking for?)	This paper intends to develop the novel algorithm by proposing changes in the designing of capsule network for best prediction results and making the modelmcomputationally efficient.
Methodology/Theory (How to find the solution?)	This paper highlights the utilization of classification methods by application of query through feeding images in a type of image retrieval system, using the CNN method and the proposed technique of using CapNet.
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	The data used for preparation of the paper is taken from OASIS database
Simulation/Test Data (What parameters are determined?)	OASIS dataset consists of a longitudinal collection of 150 subjects aging from 60 to 96 years old. Each subject was scanned on two or more visits, separated by at least one year for a total of 373 imaging sessions.
Result / Conclusion (What was the final result?)	The correlation accuracy at several iterations and layers with an admissible accuracy of 92.39%.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	when implemented on other datasets with heterogeneity factor involved in the data.
Terminology	Dementia, Alzheimer's disease, neural network models, machine learning, deep learning, convolutional neural networks, capsule networks.

(List the common basic words frequently used in this research field)	
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	This study, investigated the longitudinal MRI images consisting of neuroimaging test images in the OASIS dataset and handle hierarchical modeling problems and is computationally more efficient with better accuracy as compared with the other models that used deep neural networks, CNN and original capsule network.
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	The model is compared with state-of-art deep learning classifiers taken as benchmarks using different performance metrics. If needed we can use this for better accuracy.

Important:

- Received March 3, 2021, accepted March 10, 2021, publication March 17, 2021,
- dataset with dimensions (373 X 15) to diagnose the labels into two groups
- Page 6 - fig 1
- Page 8 - table 2

Aspects	Paper # 07
Title / Question (What is the problem statement?)	The Detection of Dementia in the Primary Care Setting
Objectives / Goal (What is looking for?)	To determine the rate of unrecognized and undocumented dementia in a primary care internal medicine private practice.
Methodology/Theory (How to find the solution?)	Methods: This was a cross-sectional study of 297 ambulatory persons aged 65 years and older attending an internal medicine private group practice within an Asian American community of Honolulu, Hawaii.
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	
Simulation/Test Data (What parameters are determined?)	
Result / Conclusion (What was the final result?)	Twenty-six cases of dementia were identified. Of these 26, 17 (65%) (95% confidence interval, 44.3-82.8) were not documented in outpatient medical records of 18 patients, 12 (67%) (95% confidence interval, 40.9-86.7) were not thought to have dementia by their physicians at the time of the office visit.
Obstacles/Challenges	

(List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	Identified recognition rates by the primary care physician at the time of a patient visit and documentation rates in the outpatient medical record.
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	

Aspects	Paper # 08
Title / Question (What is the problem statement?)	DEMNET: A Deep Learning Model for Early Diagnosis of Alzheimer Diseases and Dementia From MR Images
Objectives / Goal (What is looking for?)	This paper proposes a model that uses the convolutional neural network to extract the discriminative features.
Methodology/Theory (How to find the solution?)	This proposed methodology CNN method is employed to extract the discriminative features by effectively improving accuracy in AD classification.
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	The dataset was obtained from Kaggel & ADNI
Simulation/Test Data (What parameters are determined?)	The dataset is divided into 80% training, 10% validation, and 10% testing set from 12800.
Result / Conclusion (What was the final result?)	The DEMNET achieves an accuracy of 95.23%, Area Under Curve (AUC) of 97% and Cohen's Kappa value of 0.93.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology	Deep learning, Alzheimer's Disease, MRI image, convolutional neural network, Cohen's kappa.

(List the common basic words frequently used in this research field)	
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	By considering four stages of dementia and conducting a particular diagnosis, the proposed model generates high-resolution disease probability maps from the local brain structure to a multilayer perceptron and provides accurate, intuitive visualizations of individual Alzheimer's disease risk.
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	This study presented a new convolutional neural network architecture that relatively small parameters to detect the types of dementia which is suitable for training a smaller dataset and named DEMNET.

Important:

- Received June 3, 2021, accepted June 14, 2021, publication June 18, 2021
- Page 4 - fig 1

Alzheimer's

Aspects	Paper # 01
Title / Question (What is the problem statement?)	Multi-Method Analysis of Medical Records and MRI Images for Early Diagnosis of Dementia and Alzheimer's Disease Based on Deep Learning and Hybrid Methods.
Objectives / Goal (What is looking for?)	In this study, efficient machine learning algorithms were assessed to evaluate the Open Access Series of Imaging Studies (OASIS) dataset for dementia diagnosis.
Methodology/Theory (How to find the solution?)	The methodology used to evaluate the proposed systems on the two datasets. ➢ OASIS dataset ➢ MRI dataset
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	The MRI dataset for AD was obtained from the open source Kaggle website & for DD the dataset was obtained from OASIS.
Simulation/Test Data (What parameters are determined?)	The oasis_longitudinal dataset contains 15 features of 374 patients & The MRI dataset contains 6400 images separated into four classes, namely, mild dementia disease
Result / Conclusion (What was the final result?)	The random forest algorithm achieved an overall accuracy of 94% and precision, recall and F1 scores of 93%, 98% and 96%, respectively while The AlexNet+SVM hybrid model achieved accuracy, sensitivity, specificity and AUC scores of 94.8%, 93%, 97.75% and 99.70%, respectively.

Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	Alzheimer; dementia; t-SNE algorithm; machine learning; deep learning; hybrid techniques
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	In this paper, the two transfer models of CNN algorithms are AlexNet and ResNet50, which are applied to classify AD. All models contain the three most important layers: convolutional layers, pooling layers and fully connected layers.
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	All models achieved high performance, but the performance of the hybrid methods between deep learning and machine learning was better than that of the deep learning models.

Important:

- Received: 11 October 2021, Accepted: 18 November 2021, Published: 20 November 2021
- Page 4 - fig 1
- Page 10 - fig 4

Aspects	Paper # 02
Title / Question (What is the problem statement?)	Classification of MRI images for Alzheimer's disease detection
Objectives / Goal (What is looking for?)	This paper presents a new methodology for classification of Alzheimer's disease from MR images for medical support.
Methodology/Theory (How to find the solution?)	This paper used some mejor steps like normalization, Feature extraction, Feature selection, SVM classification, result.
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	To perform this work ADNI dataset was being used.
Simulation/Test Data (What parameters are determined?)	

Result / Conclusion (What was the final result?)	Results show a very high performance in classification results in the NAD problem, higher than 95% for both types of wavelets transformations without the use of PCA feature reduction.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	Support Vector Machine (SVM), Alzheimer's Disease, Mild Cognitive Impairment (MCI), PCA, Wavelets, MRI
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	This paper deals with the important challenge of identification of Alzheimer's disease and the condition prior to dementia which is Mild Cognitive Impairment (MCI),
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	SVM has been used as classification technique and results obtained have shown to be promising.

Aspects	**Paper # 03**
Title / Question (What is the problem statement?)	EARLY DIAGNOSIS OF ALZHEIMER'S DISEASE WITH DEEP LEARNING
Objectives / Goal (What is looking for?)	This paper proposed a novel early diagnosis method for AD based on a deep learning architecture, consisting of stacked sparse auto-encoders and a softmax regression layer.
Methodology/Theory (How to find the solution?)	The proposed method is semi-supervised that can be extended to use unlabeled training samples, which are easier and cheaper to obtain. This learning structure can be demonstrated by two primary components: stacked sparse auto-encoders and a softmax regression layer.
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	The neuroimaging data obtained from Alzheimer's disease Neuroimaging Initiative (ADNI) database
Simulation/Test Data (What parameters are determined?)	The MRI images of 311 subjects from the ADNI baseline cohort, including 65 AD subjects, 67 cMCI subjects, 102 ncMCI subjects and 77 normal control subjects.
Result / Conclusion (What was the final result?)	A performance gain has been obtained on the overall accuracy and the overall specificity (47.42% and 83.75%) comparing to SVMs.

Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	Alzheimer's disease, neuroimaging, classification
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	This method conducts AD diagnosis as a multi-class classification task, with minimal prior knowledge dependency in the model optimization.
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	A performance gain was achieved in both binary and four-class classifications.

Important:

- BMIT Research Group, School of IT, University of Sydney, Australia
- Surgical Planning Lab, Brigham & Women's Hospital, Harvard Medical School, Boston, USA
- In 2006, the worldwide prevalence of AD was 26.6 million, and this number is expected to double in every 20 years.
- Gaussian filter used to exaggerate the distinctions between each ROI.
- Better precisions were observed on three classes (55.43% on NC, 32.02% on ncMCI and 51.96% on AD), except cMCI which contains much fewer subjects than its sibling class ncMCI.

Aspects	**Paper # 04**
Title / Question (What is the problem statement?)	A Segmentation Technique To Detect The Alzheimer's Disease Using Image Processing
Objectives / Goal (What is looking for?)	In this paper a modified approach based on the watershed aLgorithm is used for segmenting the hippocampus region.
Methodology/Theory (How to find the solution?)	
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	

Simulation/Test Data (What parameters are determined?)	
Result / Conclusion (What was the final result?)	
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	Hippocampus, Segmentation, bLock meanALzheimer's diseases.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	The outcome of this watershed algorithm of the brain scan is analyzed and the diseased area is analyzed using the Shape analysis techniques.
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	This process a water shed algorithm was used which is highly sophisticated to find the diseased area in the scanned image.

Important:

- International Conference on Electrial. Electronics. and Optimization Techniques (ICEEOT)-2016

Aspects	Paper # 05
Title / Question (What is the problem statement?)	Differential diagnosis of neurodegenerative diseases using structural MRI data
Objectives / Goal (What is looking for?)	The objective of this paper is to perform an extensive study on differential diagnostics of dementias utilizing only structural MRI data.
Methodology/Theory (How to find the solution?)	Patients with subjective cognitive decline (SCD) were regarded as the control subjects. Patients were diagnosed as having SCD when cognitive complaints could not be confirmed by cognitive testing and criteria for MCI, dementia or other neurological or psychiatric disorder known to cause cognitive complaints were not met.
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	
Simulation/Test Data	

(What parameters are determined?)	
Result / Conclusion (What was the final result?)	
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	MRI, Neurodegenerative diseases, Classification, Volumetry, TBM, VBM, Alzheimer's disease, Frontotemporal lobar degeneration, Vascular dementia, Dementia with Lewy bodies
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	

Aspects	**Paper # 00**
Title / Question (What is the problem statement?)	
Objectives / Goal (What is looking for?)	
Methodology/Theory (How to find the solution?)	
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	
Simulation/Test Data (What parameters are determined?)	
Result / Conclusion (What was the final result?)	
Obstacles/Challenges	

(List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	

Aspects	**Paper # 00**
Title / Question (What is the problem statement?)	
Objectives / Goal (What is looking for?)	
Methodology/Theory (How to find the solution?)	
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	
Simulation/Test Data (What parameters are determined?)	
Result / Conclusion (What was the final result?)	
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology	

(List the common basic words frequently used in this research field)	
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	

Aspects	**Paper # 00**
Title / Question (What is the problem statement?)	
Objectives / Goal (What is looking for?)	
Methodology/Theory (How to find the solution?)	
Software Tools (What program/software is used for design, coding, and simulation?)	
Test / Experiment How to test and characterize the design/prototype?	
Simulation/Test Data (What parameters are determined?)	
Result / Conclusion (What was the final result?)	
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	
Terminology (List the common basic words frequently used in this research field)	
Review Judgment	

(Briefly compare the objectives and results of all the articles you reviewed)	
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	