Department of Computer Science and Engineering
Bangladesh University of Business and Technology (BUBT)

CSE 498: Literature Review Records

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Capstone Project Title	Single Deep CNN Features to Detect Neurodegenerative Diseases and Context Behind the Detection: Alzheimer's, Parkinson's, Dementia disease.
Supervisor Name & Designation	Milon Biswas, Assistant Professor, Dept. of CSE, BUBT.
Course Teacher's Name & Designation	Dr. M. Firoz Mridha, Chairman & Associate Professor, Dept. of CSE, BUBT.

Aspects	Paper # 1
Title / Question (What is the problem statement?)	Deep Learning-Based Alzheimer Disease Detection.
Objectives / Goal (What is looking for?)	The objective of this work is to present a framework based on deep convolutional neural networks for Alzheimer's disease detection in terms of accuracy.
Methodology/Theory (How to find the solution?)	The proposed methodology consists of two steps- preprocessing and network training. 1) For preprocessing, MRI samples were converted into JPEG slices in the MATLAB tool. 2) For network training, the architecture consists of three sets of convolutional and max-pooling layers.

Software Tools (What program/software is used for design, coding, and simulation?)	Anaconda, Keras,Tensor- flow.
Test / Experiment How to test and characterize the design/prototype?	Experiments are conducted using ADNI dataset.
Simulation/Test Data (What parameters are determined?)	A total of 9540 images were used for training the network and 4193 images for testing.
Result / Conclusion (What was the final result?)	Model accuracy is 98.57% and the validation accuracy is 87.72%.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	Fails to interpret the reasoning behind the result obtained.
Terminology (List the common basic words frequently used in this research field)	Alzheimer's Disease, Convolutional Neural Network, Deep Learning, MRI, DCNN.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	From this article we got to know about AD detection using CNN. The accuracy rate is decent for this model but slightly less than some other work.
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 this article, they used deep convolutional neural networks for Alzheimer's disease detection in terms of accuracy. From this work, we got an overview of how to gain the utmost accuracy.

Aspects	Paper # 2
Title / Question (What is the problem statement?)	A CNN Model: Earlier Diagnosis and Classification of Alzheimer Disease using MRI.
Objectives / Goal (What is looking for?)	The objective of this work is to make the best prediction and detection tools for the help of radiologists, doctors, caregivers to save time, cost, and help the patient suffering from this disease.
Methodology/Theory (How to find the solution?)	A plan was created for each step that customized the needs and the steps included MRI data collection, preparing of collected data, training, and testing of the data.
Software Tools (What program/software is used for design, coding, and simulation?)	The implementation of the model has been done using Anaconda for Python and TensorFlow.
Test / Experiment How to test and characterize the design/prototype?	Both training along with a testing set containing a total of 7635 number images. Randomly select 80% of training data, and 20% remaining data is used for validation of the model.
Simulation/Test Data (What parameters are determined?)	This model achieved the test accuracy rate of 0.99% and low percentage of test loss with rate of 0.0571 and the train and test model using 7635 images.
Result / Conclusion (What was the final result?)	A significant accuracy of 99% has been achieved.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	MRI data collection and data processing.

Terminology (List the common basic words frequently used in this research field)	Alzheimer's Disease, Deep Learning, Convolutional Neural Network, Magnetic Resonance Imaging, ADNI.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	From this article we gained knowledge of earlier diagnosis and classification of Alzheimer Disease. The accuracy rate is decent for this model and slightly more than other works.
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)	From this work we got an overview of how to gain the utmost accuracy from a model. We can use this knowledge for our own work.

Aspects	Paper # 3
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?)	The objective of this work is to classify the MR images of healthy control and Parkinson's disease subjects using deep learning neural networks.
Methodology/Theory (How to find the solution?)	For this work, the AlexNet model is used as the CNN architecture which comprises different layers. Transfer learning is applied to the pre-trained AlexNet model, and the classification accuracy measures to evaluate the model for a given input image dataset.

Software Tools (What program/software is used for design, coding, and simulation?)	Python, tensorflow.
Test / Experiment How to test and characterize the design/prototype?	For the experiment, AlexNet has been pre-trained with color images of size 227 X 227 pixels and processed in their respective layers, from input to output. The image dataset with 80% of the input data is used for training and the remaining 20% is used for testing.
Simulation/Test Data (What parameters are determined?)	The PPMI cohort used in this study consists of 182 subjects with 82 Healthy Control and 100 Parkinson's disease subjects. The model accuracy is 88.90%. Sensitivity and specificity values of 89.30% and 88.40% are exhibited by this architecture respectively.
Result / Conclusion (What was the final result?)	The model is trained to learn the low level to high-level features and the classification results are validated. An accuracy of 88.90% is achieved for classifying the HC and PD subjects.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	The proposed methodology is not extended on deep fine-tuning of the AlexNet model to obtain improved performance levels.
Terminology (List the common basic words frequently used in this research field)	Parkinson's Disease, MRI, Deep Learning, AlexNet, Convolutional Neural Networks, Deep Learning.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	This work got less accuracy then some other models.
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	Transfer learning gives better result for parkinson's disease detection.

Aspects	Paper # 4
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?)	The objective of this work is to propose a method that offers an improved diagnosis of Parkinson's disease compared to state-of-the-art research.
Methodology/Theory (How to find the solution?)	1. Accommodate the variety of contrasting images and reduce some noise. 2. Data augmentation procedures to address the issue of the dataset's limited size and to improve the performance of the proposed approach. 3. Transfer learning is applied to the pre-trained Alex-Net, and the last few layers are replaced to accommodate new categories of images for our application. 4. The performance of the model proposed is evaluated on test MR images of HC and PD patients.
Software Tools (What program/software is used for design, coding, and simulation?)	Keras software with Theano, Python 2.7.0.
Test / Experiment How to test and characterize the design/prototype?	The approach proposed is analyzed using 72 MR images of HC and PD patients with a proportion of 1:1. The test images are only used once for a single said purpose.
Simulation/Test Data (What parameters are determined?)	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.
Result / Conclusion (What was the final result?)	The deep learning model proposed here shows an excellent differential fluency by reporting the 0.9723 AUC value from the ROC curve. The scope of the proposed model can be further expanded to bring the AlexNet model fine-tuning within its ambit for obtaining superior working results.

Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	Data processing.
Terminology (List the common basic words frequently used in this research field)	Parkinson's disease, GenerativeAdversarial Network, Alex-Net, Transfer learning, Overfitting.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	For this work AlexNet model has been used which made it diffferent from other works.
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	We have to do data processing carefully for our own work.

Aspects	Paper # 5
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?)	The objective of this work is to present 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 dementia disease.
Methodology/Theory (How to find the solution?)	The methodology of this work includes the following steps: (1) Image pre-processing, (2) feature extraction, and (3) Learning classification model.
Software Tools (What program/software is used for design, coding, and simulation?)	All the experiments are performed using Keras software with Theano as a deep learning backend in python 2.7.0 software
Test / Experiment How to test and characterize the design/prototype?	In this paper, MRI images from the OASIS 1 dataset are being used for the detection of dementia . Each class contains 14 subjects that were used to train the DCNN training model.
Simulation/Test Data (What parameters are determined?)	This data set consists of a cross- sectional collection of about 416 subjects, who are aged between 18 to 96 years and in a total of 436 imaging sessions.
Result / Conclusion (What was the final result?)	DCNN model produced an important classification accuracy of 81.94%. In opposition, the Transfer Learning model resulted in an accuracy of 68.13%. Results showed that the DCNN model achieved significant accuracy for better Dementia diagnosis.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	This work did not use a large brain dataset in a wide range of subjects which could improve the accuracies of these Learning models by yielding better results.

Terminology (List the common basic words frequently used in this research field)	DCNN, Transfer Learning, Dementia, MRI, Bag of features, K-means.
Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	This work makes a comparison between CNN and Transfer learning as per the objective of their work which differentiates this work from the other works.
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	DCNN model achieved significant accuracy for better Dementia diagnosis.

Aspects	Paper # 6
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?)	The objective of the proposed model is to detect the dementia stages from MRI and also predict AD classes in order to assess the efficacy of the proposed model.
Methodology/Theory (How to find the solution?)	This model contains four main steps: data pre-processing, balanc- ing dataset using SMOTE and classification using DEMNET.
Software Tools (What program/software is used for design, coding, and simulation?)	Anaconda, TensorFlow.
Test / Experiment How to test and characterize the design/prototype?	The confusion matrix of DEMNET architecture with SMOTE technique to classify the dementia stages to predict AD.
Simulation/Test Data (What parameters are determined?)	The AD dataset consists of 6400 MR Images. Dataset distribution after SMOTE tech- nique increased to 12800 images, with each class containing 3200 images.The dataset is divided into 80% training, 10% validation, and 10% for testing.
Result / Conclusion (What was the final result?)	This model is tested with testing data consisting of 4 classes and achieved an overall accuracy of 95.23% with 97% AUC when compared to the existing methods.
Obstacles/Challenges (List the methodological obstacles if authors mentioned in the article)	Major class imbalance problem of the dataset.
Terminology (List the common basic words frequently used in this research field)	Deep learning, Alzheimer's Disease, MRI image, Convolutional Neural Network.

Review Judgment (Briefly compare the objectives and results of all the articles you reviewed)	The objective of the proposed model is to detect the dementia stages and to predict AD classes. The model achieved a descent accurecy when compared to the existing methods.
Review Outcome (Make a decision how to use/refer the obtained knowledge to prepare a separate and new methodology for your own research project)	For our work we can use the SMOTE technique to eradicate the class imbalance problem of the dataset.