Single Deep CNN Features to Detect Neurodegenerative Diseases and Context Behind the Detection: Alzheimer's, Parkinson's, Dementia

Project proposal by

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Approval

We do hereby acknowledge that the research works presented in this thesis entitled "Single Deep CNN Features to Detect Neurodegenerative Diseases and Context Behind the Detection: Alzheimer's, Parkinson's, Dementia" result from the original works carried out by Mohammad Sabbir Ahmed, Syeda Nowshin Ibnat, Rakibul Ahasan, Nusrat Jahan Anka and Sk. Abu Hanif ID No: 17183103004, 17183103020, 17183103022, 17183103008 and 17183103043 Department of CSE, Bangladesh University of Business and Technology (BUBT) under the supervision of Milon Biswas, Assistant Professor, Department of Computer Science and Engineering (CSE). We declare that no part of this thesis has been submitted elsewhere for the requirements of any degree, award or diploma, or any other purposes except for publications.

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Motivation:

Deep Learning (DL) is an emerging field that attracts researchers, specifically in the field of engineering and medical sciences. Deep learning techniques have opened up possibilities for enhanced analysis of neuroimaging data during the last decade. In this, we will provide deep learning architectures, applications, and the role of deep learning in the detection of neurodegenerative diseases like Alzheimer’s, Parkinson’s, Dementia disease. In general, we all know that using MRI to detect any of these three disorders is time-consuming and expensive. However, with our work, we can get results in a short period of time. As a result, we believe that detecting these three neurodegenerative diseases is essential in order to treat patients at an early stage. As a result, detection of neurodegenerative diseases is crucial in our society, as we have a significant number of elderly people who are suffering. So, in this work, we'll create a single model architecture that can detect Alzheimer's, Parkinson's, and Dementia diseases, including the context behind the detection.

Objective:

We are aiming to build a DL model that should be able to:

1. Identifying present difficulty to work with neuroimaging data.
2. Build a new DL model to detect three Neurodegenerative Diseases named Alzheimer's, Parkinson's, and Dementia.
3. Get decent accuracy using a suitable MRI dataset.
4. Use XAI to know the context behind the detection.
5. Comparing the existing architectures with the proposed one for neurodegenerative diseases detection.

Research Methodology:

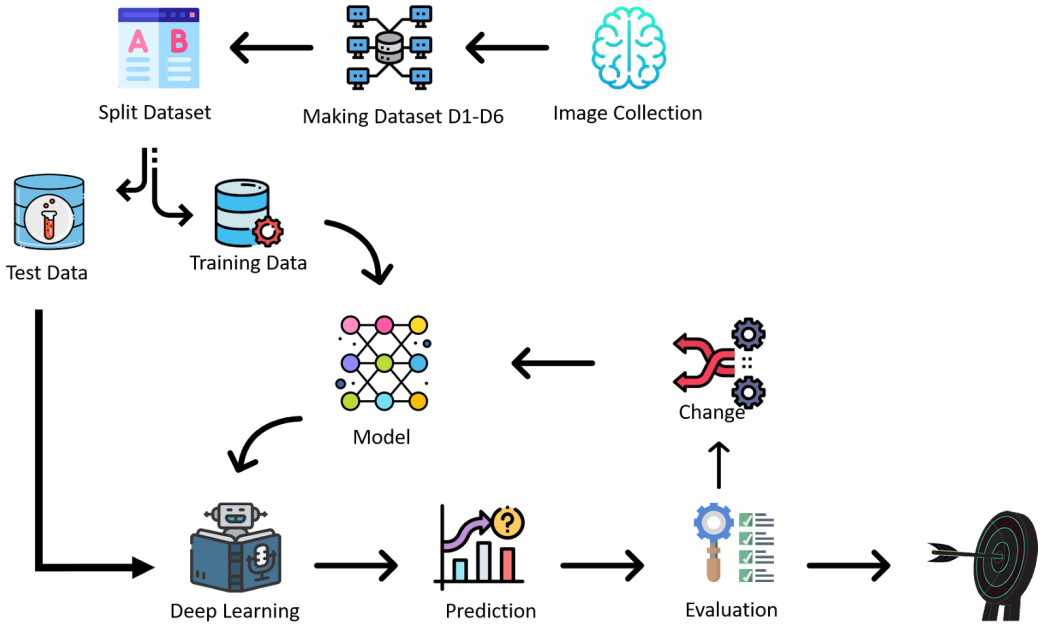

Figure 1: Research methodology of our work

Critical Challenges:

Finding a suitable dataset is one of the most difficult parts of this project. Due to the similarities in disease phenotypes, accurate detection of such disorders from neuroimaging data is very challenging. Also, the scarcity of MRI data set on the internet in this regard made the task even more difficult.

Conflicting Requirements:

Real-life commercial use of this DL model will create a lot of conflicts. Patients may not agree to go through the new system but when it comes to modern technology in the medical field it will be really helpful.

Addressing Complex Engineering Problems (Ps) through this Project:

Ps	Attribute	How Ps are addressed through the project
P1	Depth of Knowledge Requirement	• The project requires the study of research on Deep Learning systems, mainly Deep Convolutional neural networks (DNN) **(K8).** • Data collection from different sources **(K3, K4).** • Knowledge of design of deep-learning-based models **(K3, K4).** • Integration of different components **(K5, K6).** • Data collection from different sources like Kaggle, UCI, PPMI, OASIS, Data world, etc. **(K7).**
P2	Range of Conflicting Requirement	• Real-life commercial feasibility is low. • Effectively reduce the cost.
P3	Depth of Analysis Required	• Not only making a model that can detect the diseases but also explaining why that disease occurs.
P4	Familiarity of Issues	• The project produces explainable models while maintaining a high level of learning performance.
P5	Extent of applicable codes	• Generates proper solutions of deep learning models based on Deep Convolutional Neural Network (DCNN).
P6	Diverse Groups	• People of all ages and classes are involved, especially middle-aged and elderly people. • But we are not collecting users any personal information such as name, gender, etc.
P7	Interdependence	• The project involves a number of interdependent subsystems (components), such as data collection, training, module, a detection module, development, etc.

Addressing Complex Engineering Activities (As) through this Project:

As	Attribute	How As are addressed through the project
A1	Range of resources	● The project needs to engage diverse resources including people, information, and technologies.
A2	Level of interaction	● The level of interaction between the group members has been very high when it comes to finding the suitable dataset for our model.
A3	Innovation	● A degree of innovation is needed to develop the deep-learning-based diseases detection model using the collected data.
A4	Consequences	● Help the elderly people with our system. ● Overall leaving a positive impact on our society by doing this work. ● Medical professionals will get an advantage because our work will make their system faster.
A5	Familiarity	● The project deals with the medical area when it comes to the same type of case to detect the problem with several tests.