Dissertation Proposal:

Programme: MSc in Computer Science (2022-2023)

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Intake: September, 2022.

Term: 3

Title: Acquiring Alzheimer's Syndrome Detection through the Application of Machine Learning.

1. Project Summary:

This paper aims to develop an advanced system for the early identification of neurological condition of Alzheimer's disease using machine learning algorithms with a specific focus on deep learning models. Alzheimer's disease (AD) is a progressive in order neurological ailment that causes concerns with memory, thinking, and behaviours. And, with time frame, the symptoms cultivate sufficiently intense to interfere with routine duties. Unfortunately, there is no cure for the condition, a comprehensive management approach implemented early on can assist optimise quality of life and perhaps delay disease progression. A deep learning model will be trained using neuroimaging data (MRI scans) and clinical data for precisely identifying Alzheimer's disease. CNNs will extract informative features, capturing disease progression patterns. A robust dataset encompassing a wide range of neuroimaging images and accompanying the clinical data will be gathered and pre-processed. The data will be separated into training and testing sets for formulating models and evaluations. The trained predictive model's efficacy will be attentively assessed leveraging appropriate metrics such as precision, responsiveness and specificity. The system's ability to detect initial signs of Alzheimer's will be compared with existing diagnostic methods. This paper intends to advance AD's research by developing an accurate, efficient, and simple method for early diagnosis. The findings will be released in the form of visualisations and reports, offering significant perspectives into the possibility of using machine learning in AD's detection and helping to current research efforts to battle this horrific disorder.

2. Research Area:

In this research, first and foremost initializing with the data collection and image pre-processing one of the most important aspects is the gathering and organising of an extensive dataset that includes clinically relevant neuroimaging data such as MRI scans of brain. Different kinds of details about patients and complications of the disease stages would be represented in the dataset, which will be heterogeneous. In order to assure the accuracy and

efficacy of the dataset for subsequent study, adequate data processing methods will be used. These include feature scaling, normalisation, and tackling missing values.

Then developing the machine learning model, Convolutional Neural Networks (CNNs), in specifically, will be used to extract valuable features from the neuroimaging data using deep learning methods. CNNs are effective in detecting minute patterns and irregularities that point to the advancement of Alzheimer's disease. To create a powerful Alzheimer's detection system, the models will be trained on the cleaned dataset using both neuroimaging and clinical evidence. To improve the accuracy of their predictions and assurance generalisation to untested data, the models will go through intensive training, validation, and testing procedures.

For the performance evaluation, many assessment indicators will be used to assess the effectiveness of the proposed models. Accuracy, sensitivity, specificity, and the area under the Receiver Operating Characteristic (ROC) curve are some of these measurements. The two factors sensitivity and specificity assess the ability of the approach to accurately recognise positive and negative occurrences, respectively, while accuracy quantifies the overall reliability of the classification findings. The AUC-ROC score offers an in-depth analysis of the model's discriminating power, and the ROC curve shows the ratio between sensitivity and specificity at various categorised thresholds.

By comparing the performance of the created Alzheimer's detection system to that of current techniques for diagnosis, its efficacy as well as productivity will be examined. The positive aspects and transformations that machine learning-based techniques may bring will be highlighted in this analogy. Furthermore, to help medical professionals make highly accurate and swift diagnoses, the research will focus on how to incorporate the current approach with systems that provide clinical decision support. By incorporating accurateness (being able to correctly determine positive instances) and recall (the capacity of remembering all positive instances), the F1 score provides an in-depth review of a model's performance. This balanced measure considers every aspect of classification accuracy, providing a comprehensive evaluation of the model's effectiveness.

Keeping in mind the ethical considerations, this study would follow extremely strict ethical norms, guarding patient data protection and confidentiality. To avoid disclosing the identity of those occupied and data anonymization tactics will be used. The study's goal is to advance the science of Alzheimer's detection and enhance patient outcomes while abiding to ethical standards and data protection requirements not revealing any personal information.

Concluding, this study will suggest the use of machine learning, especially deep learning models, to diagnose Alzheimer's disease. The creation of a highly precise and effective detection method will have the potential to allow for early strategies, personalised plan of treatment, and enhanced results for patients. It is meant to contribute to continuing efforts to treat Alzheimer's disease and advance the area of neurodegenerative sickness research by determining the effectiveness of machine learning models and comparing them to existing diagnostic methods.

3. Tools to be used and Expected Implementation:

From an open source (online community platform), a data set of numerous photos was obtained. The data consists of four picture classes in both the Training and Testing sets.

A number of tools will be used to achieve the goal of this project. Some of them are as under:

- Hardware Resources:
  - A proper computing infrastructure
  - Sufficient CPUs/GPUs
  - Sufficient memory (RAM)
- Software Resources:
  - Programming Language: Python
  - Machine Learning Libraries: TensorFlow or PyTorch
  - Image Processing Libraries: OpenCV and PIL
  - Development Environment: Jupyter Notebook or PyCharm
  - Data Visualization Library: Matplotlib or Seaborn
    or
  - Visualization Tool: Microsoft Power BI

The images from the dataset would be processed using the image processing libraries as it is very crucial to prepare the data for machine learning model. OpenCV and PIL (Python Imaging Library) can be utilized to handle the image data and perform tasks like resizing, cropping and normalization. The development environments like Jupyter Notebook or PyCharm can be used to run and debugging of the code. Then the Data Visualization will be achieved with the use of libraries; Matplotlib or Seaborn or a visualization tool; Power BI to determine the prediction results.

4. Required Resources:

The dataset needs to serve as the primary resource for the research considering the image processing procedures cannot be carried out without it. Aside from that, there are publications, instances, research papers, articles, and, of course, the internet, where everything is readily accessible. Scientific databases such as PubMed, IEEE Xplore or Google Scholar and relevant journals should be available. In addition to research papers and publications, it is crucial to also have the Reference materials covering neuroimaging techniques, Alzheimer's disease pathology, clinical assessment tools and related medical knowledge. They are useful resources for comprehending domain-specific theories and employing them into the research framework.

5. Prerequisite Knowledge/skills Required:

Following are the list of skills required to achieve the end goal for this project.

- Fundamentals of Machine Learning
- Basic Knowledge of Deep Learning
- Python Programming
- Data & Image Processing
- Evaluation Metrics
- Data Visualization Techniques
- Some Domain Knowledge

6. Project Plan:

Task	Status	Start Date	End Date
FINDING RESEARCH DEFINATION	Done	Jun 8	Jun 15
ANALYSING PREVIOUS RESEARCH PAPERS	Done	Jun 15	Jun 22
FINDING AND ANALYZING DATASET	Done	Jun 15	Jun 22
FINAL DRAFTING OF PROPOSAL	Working on it	Jun 19	Jun 26
REQUIREMENT GATHERING FOR SIMULATION	Yet to be Started	Jun 27	Jun 29
INITIALIZING SIMULATION	Yet to be Started	Jun 29	Jul 27
LITERATURE REVIEW	Yet to be Started	Jul 27	Jul 31
MANAGING RESEARCH METHODOLOGY	Yet to be Started	Aug 1	Aug 3
FINALIZED ANALYSIS AND SYNTHESIS	Yet to be Started	Aug 3	Aug 17
CONCLUSIONS AND RECOMMENDATIONS	Yet to be Started	Aug 17	Aug 24
ROUGH DRAFT OF DISSERTATION REPORT	Yet to be Started	Aug 17	Sep 1
FINAL DRAFTING OF RESEARCH REPORT	Yet to be Started	Sep 1	Sep 11

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