PROJECT PROPOSAL

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Project title:

Enhancing Alzheimer's disease classification using Image Processing techniques and CNN model.

Introduction:

Artificial intelligence (AI) has involved in many fields, among these many fields, the AI has become of great importance in the medical field, this is possible for AI due to his ability to analyze images, extract important features from them, and compare them with his database to diagnose and classify the medical condition.

The most serious problem that causes a real challenge for AI in the medical field is the quality of the images, the images may usually be fairly poor and have many external effects, which makes it difficult for AI to extract important features from it and therefore it is difficult to diagnose the condition accurately.

So we will take advantage of the field of Digital Image Processing (DIP) to enhancement the image before inserting it into the AI model, which improves the accuracy of the diagnosis.

What calls for obtaining the most accurate possible from the artificial intelligence model in the medical field, is that a wrong diagnosis should never be a possibility, it may be acceptable if a completely healthy person is diagnosed with Corona, he will be isolated and treated until it turns out otherwise, But if a person infected with Corona is diagnosed as healthy, this will cause a serious problem, so in this project we are not only looking for the AI model with huge accuracy only!, but we are looking for the most accurate model that an infected person is not diagnosed as a healthy person.

We will search different ways to improve image quality and the accuracy of the AI model, and we will apply and compare the results before and after enhancing the images, we will apply our work on the database of Alzheimer's peoples to see and discuss the results.

Research Problem and Objectives:

We discussed previously that the biggest problem facing AI in the medical field is images that contain noise. Another important problem is the lack of existing medical data, which makes the learning process difficult for AI, as the more diverse and varied the number of cases, the better the learning.

The aim of the project is to improve the quality of images and the ability of the AI model to extract distinctive features so that the problem of lack of medical data sets can be compensated for and at the same time we obtain the best possible accuracy so that AI can be used to greatly assist in diagnosing cases so that it is easier for the treating physician and the diagnosis is under his supervision.

Literature Review:

There are many studies that have dealt with the same problem and tried to contribute to increasing the accuracy of diagnosis for similar or different diseases. We will study the methods used in the following references and then try to reach the highest possible accuracy. The studies that we relied on to create the project are in the references. [1][2][3][4][5][6]

Methodology:

A) For DIP section:

Most of the problems facing brain images to detect Alzheimer's disease contain noise. The noise may be an increase in the light rate of the image or it becomes darker or tends to gray or contains many black and white dots due to lack of accuracy during imaging or a problem in the medical device. So we will initially try to solve this problem during the DIP stage by using:

1- Negative function.
2- Histogram Equalizer.
3- Bilateral filtering.
4- Average & Sharpen filters.

We will search for others filters that helps to enhance the image accuracy for better classification.

B) For AI classification section:

One of the best models used for image recognition is the Convolution Neural Network (CNN), we will discuss the reasons for its superiority later.

The goal is to reach a suitable number of convolution layers & pooling layers to obtain the highest possible accuracy and also we have to try different hyper parameters and compare between their results to choose the best hyper parameters for this dataset.

Data Collection and Preprocessing:

We will collect our data set from kaggle, then we will import some noisy image from different places.

We will enhance the noisy images then test them on the model that’s trained by the collected data set, and then compare between the results after and before image enhancement section.

Experimental Design:

There are a lot of metrics to measure the performance of the AI model as:

1- Histogram to check the distribution of the image.

2- Accuracy in AI (that comparing the predicted results to actuals).

3- Classification report and charts (to learn more about accuracy, such as how many people were incorrectly diagnosed as healthy or unhealthy).

Classification report includes (Recall, Precision, and F1 score) and others...

Expected Results and Analysis:

We will use classification report and plots from Seaborn & Matplotlib libraries to evaluate the performance of the model before and after we processed the image using DIP techniques. We expect to increase the classification accuracy of Alzheimer's disease.

Timeline:

We have a timeline from **25/10/2024** until **03/01/2025** (**10** weeks).

Subject	Duration
Collecting Alzheimer’s data set for training and testing phase.	1 week
Searching for different Image enhancement & CNN techniques.	1 week
Practicing the different Image enhancement & CNN techniques.	2 weeks
Preparing a report for different techniques (DIP & AI models) and which is the best for our case (Midterm report)	1 week
Applying the best technique, on the Alzheimer's data set.	1 week
Preparing the final project.	1 week
Prepare a presentation & report for final project that includes what we have done.	1 week
Testing stage, checking bugs and errors.	2 weeks

Potential Contributions:

Increasing the efficiency of the artificial intelligence model for diagnosing Alzheimer's cases, taking into account that the input images may contain some undesirable effects.

References:

1- https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0302358

2- https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8886493

3- https://onlinelibrary.wiley.com/doi/full/10.1155/2021/6621607

4- https://link.springer.com/article/10.1186/s40537-019-0276-2

5- https://journals.ekb.eg/article_259887_6a845476900a610fcdfda6b0b0120a08.pdf

6- https://pmc.ncbi.nlm.nih.gov/articles/PMC7406801/