ANKARA UNIVERSITY

ENGINEERING FACULTY

DEPARTMENT OF COMPUTER ENGINEERING

ARTIFICIAL NEURAL NETWORK PROJECT PROPOSAL

DEEP LEARNING BASED BRAIN TUMOR DETECTION

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Introduction & Description of the Problem

It's crucial to detect brain tumors in their early stages, as their classification usually involves invasive brain surgery for biopsy. Using computational intelligence techniques, we will try several deep learning models and machine learning approaches to diagnose three types of brain tumors (glioma, meningioma, and pituitary gland tumors) and to identify healthy brains without tumors through magnetic resonance brain images. This enables physicians to achieve highly accurate early-stage tumor detection.

In medical terms, tumors are known as malignant or benign neoplasms, of which there are more than 200 diverse varieties that may affect humans . According to the American Cancer Society, a brain tumor is a severe disease in which irregular brain tissue growth impairs brain function. The National Brain Tumor Foundation (NBTF) reported that the number of people who have lost their lives due to brain tumors has increased by 300% in the last three decades . Every year, many people die due to brain tumors; based on "brain tumor" website estimation in the U.S., about 700,000 people have primary brain tumors, and about 85,000 people are added to this estimation every year. To solve this problem, artificial intelligence has come to the aid of medicine and humans. One of the branches of deep learning that has been very successful in processing medical images is CNN. Therefore, in this project we will use CNN network architecture to overcome that problem. The aim of the project is contribution to misdiagnosis prevention and improving early diagnosis.

Design

Firstly we preprocess and identify our dataset. We will use several image processing methods to enhance image quality. To give an example, CLAHE, Beasfy filters are very successful image processing methods for this problem since they enhance contrast of the image which has a very crucial role to identify grayscale images. After we preprocess the dataset we design a deep learning model to predict the tumor type. Deep learning (DL) models learn high-level abstractions from input photographs using a hierarchical framework. Because large-scale labelled datasets are available, and CNN has shown to be the most successful DL technique for analyzing medical images. ImageNet, MobileNet, VGG16, and ResNet101 are examples of prominent CNN models that have achieved substantial advances in image recognition. These CNN models consist of many convulsions which are the basement of the CNN architecture.

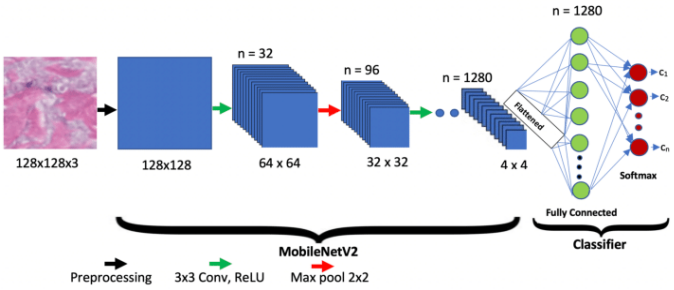

Figure 1. Deep Learning model MobilenetV2

Data & Metrics

We will select a brain tumor data set which contains 3096 grayscale images with 256x256. Our main goal is to detect and identify brain tumors with respect to 4 classes. These classes are glioma_tumor, meningioma_tumor, pituitary_tum and normal. We use F1, precision, recall and accuracy score techniques to measure the model's success. Moreover, we will use a confusion matrix to analyze the model.We will insert binary cross-entropy loss type which is generally used in image classification.Below we give 2 images in our dataset. Our dataset located at: https://www.kaggle.com/datasets/thomasdubail/brain-tumors-256x256/data

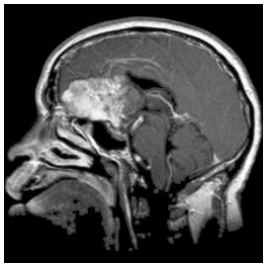

Figure 2. Example of glioma tumor

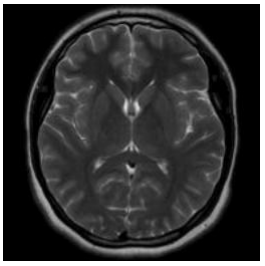

Figure 3. Example of healthy brain

Timeline

1-Exploratory data analysis: Where we will obtain a general insight into the data (4th week)
2-Model building: Where we will build the model (4-6th weeks)
3-Model trial and preliminary analysis: Where we will try the model and gain a general idea about the results (7th week)
4-Progress report(7th week)
5-Detailed analysis of Results: Where the results are evaluated thoroughly (8th week)
6-Model update if required: Where the model is readjusted according to needs (9-10th weeks)
7- Presentation and Report (11th week)

References

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2-Tiwari, P., Pant, B., Elarabawy, M. M., Abd-Elnaby, M., Mohd, N., Dhiman, G., & Sharma, S. (2022). Cnn based multiclass brain tumor detection using medical imaging. *Computational Intelligence and Neuroscience*, *2022*.

3-Saeedi, S., Rezayi, S., Keshavarz, H., & R. Niakan Kalhori, S. (2023). MRI-based brain tumor detection using convolutional deep learning methods and chosen machine learning techniques. *BMC Medical Informatics and Decision Making*, *23*(1), 16.

4-Komori, T. (2022). The 2021 WHO classification of tumors, central nervous system tumors: the 10 basic principles. *Brain Tumor Pathology*, *39*(2), 47-50.

5-*https://radiologyassistant.nl/neuroradiology/brain-tumor/systematic-approach*