Capstone Three Project Proposal
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Speedy and accurate diagnosis is key to treating cancer, especially brain cancer. For this project I will be developing a neural network that can correctly diagnose brain cancer when given an MRI image of the brain. I will be acting as an employee for a hospital or a diagnostic imaging center and will present a report about my neural network to the head of the cancer unit. As an example, I may work at the local hospital network ChristianaCare in the imaging department https://christianacare.org/services/imaging/.

According to Gao and Jiang: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3864167/, brain cancer is in the top ten for causes of cancer deaths, and early and accurate diagnosis is essential for disease management. We can increase the speed and accuracy of the diagnosis with the help of an artificial neural network trained to spot tumors in the brain.

For the development of this artificial neural network I will make use of the dataset found here: https://www.kaggle.com/datasets/preetviradiya/brian-tumor-dataset. This is a dataset of 4600 MRI images of the brain separated into labeled folders. There are slightly more images of brains with tumors than brains without. That should be of sufficient size to develop a neural network with quite good accuracy.

First I will process the images and use data augmentation and create a training and test set of images. Then I will create a convolutional neural network making use of multiple convolutional layers before heading into dense layers with some dropout. The final layer will make a diagnosis between ‘Brain Tumor’ and ‘Healthy’.

Modern convolutional neural networks that make diagnosis of brain cancer often have hundreds of thousands if not millions of input images and achieve remarkable accuracy, even managing to correctly distinguish between different type of brain cancers: https://labblog.uofmhealth.org/health-tech/artificial-intelligence-improves-brain-tumor-diagnosis. My neural network, being much smaller, will not be able to achieve that kind of accuracy, nor will it distinguish between types of cancers, but I will consider it successful if it can correctly diagnose a brain tumor with at least 95% accuracy.