Name(s)
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Project Number
J1503

Project Title
Detecting Cancer with Neural Networks

Abstract

Objectives/Goals
With the advent and availability of large quantities of data, powerful artificial intelligence models are becoming increasingly more popular for use by the general public. The goal of this project was to develop a tool that could be used in the medical field to identify malignant and benign cells. Currently, scientists look at cells under a slide and use their training to identify a cell. This process could be mimicked with an artificial neural network (ANN). An ANN, similar to a human brain, takes an input and multiplies it by a random value to produce a prediction. Depending upon how far off that prediction is, the network adjusts those values to better suit the situation. This process is considered "learning." The objective was to see if an ANN could correctly differentiate between malignant and benign cells, and create a mobile app containing the neural network that people could download onto their phones.

Methods/Materials
After conducting research, it was discovered that it would take too much computing power to create a custom image recognition ANN. Instead, an open-source ANN made by Google called Inception was used. Dr. Megan Smith-Zagone, a pathologist at St. Joseph's Hospital, provided pictures of malignant and benign cells for use in the project. The Inception model was trained on 50 pictures each of malignant and benign cells and was tested on new pictures, with each experiment increasing the number of times the network trained itself.

Results
After being trained 4200 times, the network achieved 96% training accuracy and 100% testing accuracy. Training accuracy is the accuracy determined by the network testing itself and calculating its accuracy on its own. Testing accuracy is the accuracy determined by a human training it on new images. The reason the network achieved "100%" testing accuracy is because there were only 10 images to test the network. If more testing images had been used, the testing accuracy would likely have been closer to 96%.

Conclusions/Discussion
A program was created that could correctly identify malignant and benign cells. Sometimes, scientists are unsure whether cells are malignant or benign, so this program could help make this task easier. In addition, the Inception model was successfully deployed onto an Android phone, so this app could potentially be used to identify malignant and benign cells easily in a lab.

Summary Statement
In this study, I was able to teach a neural network how to identify malignant and benign cells using pre-acquired images.

Help Received
I adapted a pre-made neural network made by Google. Dr. Megan Smith-Zagone provided pictures of malignant and benign cells for use in training the neural network.