Name(s)	Project Number
Jason Z. Dong	**S1509**

Project Title

A Novel Algorithm to Diagnose Medical Issues: Identifying Facial Paralysis via Convolutional Neural Networks

Abstract

Objectives/Goals
To (1) compress the existing VGG-16 Convolutional Neural Network into a smaller neural network specifically tailored to a reduced number of categories of images to decrease training times and (2) to accurately identify the presence of facial paralysis in new images.

Methods/Materials
First, open-source images were collected containing faces with and without facial paralysis. Images consisted of faces spanning a variety of ages, in different lightings and angles. These images had different degrees of facial paralysis present, ranging from slight signs of drooping to easily distinguishable deviations from normal faces. After collecting these images, JPEG files were then converted into an LMDB database using a portable MacBook. These databases were then processed through the convolutional neural network, where unsupervised learning was able to take place. Final results with this algorithm were attained using a desktop computer with an Intel Core i7-6700K Processor.

Results
After training this network on only a small set of images, results consistently achieved higher than a 95% accuracy rate with rates often exceeding 98%. These results were able to be achieved in small amounts of time, not exceeding 100 milliseconds with a reduced training time of under four hours.

Conclusions/Discussion
Focused on faces with and without facial paralysis, my algorithm was able to effectively determine whether or not new faces had any signs of facial drooping while also minimizing the training time necessary to learn key features in trained images. As impending strokes only provide a few key features, with facial paralysis being one of these identifiable signs, the immediate identification of facial drooping is imperative to avoid the neuronal death associated with strokes. Satisfying the two main objectives of this project, the algorithm I developed provides an effective way to classify images and diagnose medical issues, particularly facial paralysis for impending strokes, in a timely manner with low training times. This artificial neural network is capable of learning and identifying any type of image, being able to attain an accuracy rate consistently higher than 95%. Able to effectively classify images, this algorithm can accurately diagnose other medical issues by iteratively learning through known symptoms.

Summary Statement

I developed a deep convolutional neural network able to efficiently and precisely diagnose medical issues such as the presence of facial paralysis to identify impending strokes.

Help Received

Mr. Jason Lee helped to facilitate the application process of this project and conducted meetings through regular check-ups.