Examining the Effectiveness of Convolutional Neural Networks for Determining Visual Fixation Using fMRI

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When conducting a study using fMRI, it is often beneficial to be able to track the eyes of participants, especially for experiments that require visual fixation. One method of achieving this is with the use of support vector regression (SVR) to analyze fMRI data of the eyes and predict where a participant is fixing their gaze. However, SVR suffers from several drawbacks, one of which is the requirement of two separate models to determine horizontal and vertical coordinates. The purpose of this project was to examine the effectiveness of convolutional neural networks (CNN) for eye tracking with fMRI images and compare its accuracy to SVR. The CNN was written in Python using TensorFlow and trained with the same data as the SVR model, and its accuracy was computed using mean squared error (MSE). Eight different configurations of CNNs were tested. It was found the most effective configuration of the CNN had an average MSE of 0.00439 on testing data. The MSE of the SVR models was larger at 0.00628. Therefore, on the dataset used for this project, the CNN appeared to be more effective than SVR. However, due to a small amount of samples, the CNN appeared to overfit the training data to a certain degree. As more data are collected, overfitting should be reduced.

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