Developing a Deep Learning Neural Network with Image Analysis for the Early Diagnosis of Kawasaki Disease

Xu, Ellen (School: Del Norte High School)

Kawasaki disease is the #1 acquired heart disease in children in the U.S. and Japan. Its early diagnosis is extremely crucial, as it can lead to permanent heart disease if not detected within the first 10 days. In this project, deep learning neural networks are applied to test its capabilities in early diagnosing Kawasaki disease, using results from main symptom diagnosis. After an AI environment is created on Anaconda, data is prepared for multiple symptoms by grabbing relevant images from the Internet. Images are then augmented by various transformations to generate a larger set of labeled training data. Different machine learning techniques are implemented with two general approaches: a fully trained network from scratch and transfer learning approach based on a well trained deep learning network, e.g. VGG16. For transfer learning, all previous layers from VGG16 are kept and only the last layer is trained with new data. To improve the model further, one more fully connected layer is added to VGG16 to allow more degrees of freedom in the model to fit new training data. Parameters are then tuned and optimized to produce the best results, including changing the number of epochs, early stopping, different loss functions, and data augmentation. After numerous trials of each optimization, it is determined that the enhanced VGG with an additional 16-node fully connected layer, categorical cross entropy loss, early stopping with 300 epochs and 30 patience, without data augmentation produced best results. The final results are 79%-89% accuracy across the five Kawasaki disease symptoms with the best performing model, which are very promising results for further optimization and usage by Kawasaki disease experts.

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