

CORONARY ARTERY DISEASE DIAGNOSIS USING MYOCARDIAL PERFUSION IMAGING POLAR MAPS AND DEEP LEARNING METHODS

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Introduction:

SPECT Myocardial Perfusion Imaging (MPI) is widely used for the diagnosis of Coronary Artery Disease (CAD), since it is the most trustworthy non-invasive diagnostic test. Despite its advances, MPI still performs poorly in the prediction of CAD, obliging the doctors to take into consideration not only MPI's results, but also any other patient data provided. Convolutional Neural Networks (CNN) are considered to be a promising method for automatic medical image analyzation and classification.

Purpose:

In this study, we proposed a technique for the classification of MPI Polar Map images between CAD and Normal class, utilizing 216 subjects.

Methodology:

A state-of-the-art CNN (called VGG16) for the classification of MPI images, is employed. Polar maps sets from the Department of Nuclear Medicine of University Hospital of Patras are processed to train the CNN. Those polar maps include non-attenuation corrected and attenuation corrected polar maps in stress and in rest condition. Moreover, our data includes the doctor's characterization of the images, and the true labels confirmed by Surgical Coronary Angiography. As our initial dataset is small for training deep networks, we use data augmentation to generate new images for the training sets. Evaluation is performed using 10-fold cross-validation.

Results:

VGG16 achieves an accuracy of 74%, sensitivity of 87.5%, and specificity of 51.25% in the classification of the Polar Maps. Moreover, we compare the predictions of VGG16, the doctors' diagnosis on the same images, and the actual classes. The results demonstrate that the proposed model is matching the doctor's expertise on this set of images (Kappa Statistic of 0.71).

Conclusions:

The results suggest that Deep Learning in MPI images could be useful as an assisting tool. We are aware of the fact that the dataset is too small to constitute a trustworthy conclusion, which is why we only recognize that the results are just promising for future research.