ANALYSIS OF GATED MYOCARDIAL PERFUSION SPECT IMAGES BASED ON COMPUTATIONAL IMAGE REGISTRATION

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ABSTRACT: Myocardial perfusion is commonly studied based on the evaluation of the left ventricular function using stress-rest gated myocardial perfusion single photon emission computed tomography (GSPECT), which provides a suitable identification of the myocardial region, facilitating the localization and characterization of perfusion abnormalities. The prevalence and clinical predictors of myocardial ischemia and infarct can be assessed from GSPECT images.

Here, techniques of image analysis, namely image segmentation and registration, are integrated to automatically extract a set of features from myocardial perfusion SPECT images that are automatically classified as related to myocardial perfusion disorders or not. The solution implemented can be divided into two main parts: 1) building of a template image, segmentation of the template image and computation of its dimensions; 2) registration of the image under study with the template image previously built, extraction of the image features, statistical analysis and classification. It should be noted that the first step just needs to be performed once for a particular population. Hence, algorithms of image segmentation, registration and classification were used, specifically of k-means clustering, rigid and deformable registration and classification.

The computational solution developed was tested using 180 3D images from 48 patients with healthy cardiac condition and 72 3D images from 12 patients with cardiac diseases, which were reconstructed using the filtered back projection algorithm and a low pass Butterworth filter or iterative algorithms. The images were classified into two classes: “abnormality present” and “abnormality not present”. The classification was assessed using five parameters: sensitivity, specificity, precision, accuracy and mean error rate.

The results obtained shown that the solution is effective, both for female and male cardiac SPECT images that can have very different structural dimensions. Particularly, the solution demonstrated reasonable robustness against the two major difficulties in SPECT image analysis: image noise and low resolution. Furthermore, the classifier used demonstrated good specificity and accuracy, Table 1.

Table 1. Performance achieved by the solution developed.

Measure	Performance value
Sensitivity	0.698
Specificity	0.945
Precision	0.833
Accuracy	0.876
Mean error rate	0.124

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