

Fuzzy integrated Neural Network Classification of Body Surface Potential Contour Map to Detect Myocardial Infarction Location

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Abstract:

Because of the absence of comprehensive understanding of fundamental basic science of the ischemic heart disease, there are still some mismatches between the diagnostic methods and the therapeutic interventions. This paper addressed this issue by presenting an automatic Neuro-fuzzy method for characterizing the location of MI applied to the standard 17-segment model of the heart.

This work is relying on the idea that already has presented by the same authors¹ in CinC/PhysioNet Challenge 2007 and has ranked second². The data that is used here is 352-electrode BSPM data for four cases (two training cases and two test cases). First, some horizontal/vertical lines are considered on torso surfaces. Then the ECG contour map on torso surface is plotted and the behavior of some ECG features on these lines is calculated. These ECG features includes maximum positive QRS peak, maximum negative QRS peak and QRS integral. In this paper, a method of fuzzy decision-making applied for characterization of infarcted elements. The proposed method in the first level uses a neural network classifier to characterize a region on torso surface. Next, the method of dealing with the uncertainties present in the data using the fuzzy approach to map these regions to the heart surface.

The results of two test subjects are the estimated infarcted elements. These results are compared to a gold standard that consists of expert analysis of gadolinium-enhanced MRI data. Given the estimated and gold standard sets of infarct segments, "overlap" (SO) can be defined as the number of segments in both sets divided by the number of segments in either set (a value between 0 and 1, where 1 is a perfect match and 0 indicates that the sets are completely disjoint). The proposed method reached SO=0.44 and SO=0.26 for two test subjects so far. This method can estimate the location of both cases medially and need more adjustments in the parameters. By implementing other ECG features one can detect the location of infarcted area more precisely.

Table 1: Comparison between the results of the proposed method and our previous method

| Test subjects | Overlapped Segments (SO) | |
|---------------|--------------------------|---------------------------------|
| | The proposed method | Previous Semi –Automatic method |
| #3 | 0.44 | 0.50 |
| #4 | 0.26 | 0.444 |

¹ SadAbadi, H., et. al., "Variation of ECG features on torso plane: An innovative approach to myocardial infarction detection", In proceeding of Computers in Cardiology, 2007; pp. 629 - 632.

² <http://www.cinc.org/challenge.shtml>