

## Original Article

### Fuzzy knowledge-intensive case based classification for the detection of abnormal cardiac beats

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#### Abstract:

This paper presents a new automated diagnostic system to classification of electrocardiogram (ECG) cardiac beats. We have developed an intensive-knowledge case based reasoning classifier which uses a distributed case base enriched by partial domain knowledge (rules). An original similarity measures is proposed by combining the sigmoid similarity function with the fuzzy sets to ameliorate the system accuracy in the detection of cardiac arrhythmias. The experiments presented in this work concern the detection of Premature Ventricular Contraction PVC, normal and abnormal cardiac beats from a pattern extracted from the Electronic medical records collected and published by Beth Israel Hospital (MIT-BIH). The achieved results demonstrate the efficiency and the performance of the developed system.

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#### 1. Introduction

Up till now the most important source of information used by the cardiologists for the cardiac diseases diagnosis is the Electrocardiogram (ECG). The ECG is a signal produced by an electrocardiograph, which records the electrical activity of the heart. Through its wave's duration and axes values the cardiologists recognize the abnormality of the heart beat for detecting the cardiac arrhythmias.

The classification consists of associating an object with a predefined class. There are many methods and approaches from the artificial intelligence which prove a good performance to accomplish this task as artificial neural network ANN, fuzzy systems, and similarity based classification (SBC) and other paradigms (1-5). However, each application of these approaches has positives and weaknesses that are sometime accepted and some time not accepted according to the importance and the context of the application. The medical applications including aided diagnosis and decision support systems are a critical kind of applications where the precision and the transparency are very important because it touch the human health and life.

The CBR is an intelligent approach inspired from many discipline it draws a human reasoning model. It consists of using the prior expertise to resolve new problems. This expertise is stored as a set or collection of cases called cases base. Each case represents one problem associated with its solution. The intensive-knowledge case based reasoning is a variant of CBR in which the cases is enriched by partial domain knowledge. Also the distributed case based reasoning is a variant of CBR in which the reasoning is distributed through a set of agent and the cases through a set of case bases. These variants have been developed to ameliorate the accuracy and the performance of the systems.

In this work we have developed an original classification system (IK-CBRC) for achieving the medical applications needs and for developing a flexible and accurate model. The developed system apply the intensive-knowledge case based reasoning variant and the distributed reasoning approaches via a set of agents and a set of case bases