

Expert Triage System in Cardiology Emergency Department

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Summary

Hospital challenges and employing artificial intelligence to tackle those challenges has been the topic of copious research. A key issue in any hospital is the triage unit which is ever more significant in heart specialized hospitals. Employing artificial intelligence methods especially the fuzzy method is a great help to medical diagnosis and prioritizing the patients in the cardiac ward.

In the present research, the Mamdani's fuzzy model was used to prioritize the triage rules in the hospital cardiac ward. As a developmental study, the present research aimed to propose and evaluate the patient prioritization system applied in the triage of a heart specialized hospital.

The system evaluation results obtained from the data provided by 200 patient visitors of Rajaie Cardiovascular, Medical & Research Center revealed that the proposed system, which enjoyed a sensitivity of 93% , accuracy of 96% and specificity of 97%, managed to have a proper prediction of the level of triage in the heart emergency room. The system also has this privilege that it has observed almost all the key factors involved in predicting the level of triage.

Fuzzy logic has come to the help of medical specialists. The present research used Mamdani fuzzy algorithm to classify patients in terms of their initial vital signs, nurses' and doctors' diagnosis. The proposed algorithm is capable of predicting of triage level in the heart emergency room with a sensitivity of 93%, accuracy of 96% and specificity of 97%.

Key words:

Fuzzy systems, fuzzy inference engine, triage level prediction, vital signs.

1. Introduction

A key issue in medical emergency especially for cardiac patients is setting priorities in the hospital triage. Difficulty of classifying emergency patients to such groups as outpatients, inpatients, terminally ill and ill along with an incorrect triage of patients can have negative consequences including death. There is, therefore, a need

for a proper triage system which would guarantee the accuracy of the triage [1-3].

Due to the fact that in the majority of emergence wards, the five-level ESI (Emergency Severity Index) is used to prioritize patients, and in some cases it is hard for the nursing staff to set priorities, it is essential to propose an intelligent method based on the fuzzy logic to prioritize patients[1, 3].

The fuzzy inference system (FIS) is a systematic process to convert a database to a nonlinear mapping. That is why knowledge-based fuzzy systems are used for engineering, medical and decision-making purposes [4-6].

The fuzzy inference system is to map inputs to outputs using membership functions and fuzzy rules. It is in fact a system which executes human experiences via membership functions and fuzzy rules. It is a general method of combining knowledge, intelligent technology, control and decision-making. Among the best fuzzy inference models are Mamdani, Takagi, Sugeno and Tsukamoto. Among these, those of Mamdani and Sugeno are the most widely used [7-10].

The fuzzy theory is an important tool to face the ambiguity-induced uncertainty. Though fuzzy systems describe indefinite and uncertain phenomena, the fuzzy theory is a precise theory. The fuzzy set was for the first time introduced by Professor Lotfzadeh in a dissertation entitled as: "Information and control fuzzy sets" in 1965 and was practically applied in 1970s. This decade was marked by the advent of fuzzy controllers in actual systems [5, 11-13].

The fuzzy logic is a big achievement in the fuzzy set in which the variables are linguistic rather than numerical. The fuzzy logic can be contrasted with the Boolean or Aristotelian logic which sees all values as binary, 0 or 1, black or white, yes or no. On the other hand, in the fuzzy logic, values vary between 0 and 1.

A fuzzy system is comprised of the following components:

- A fuzzification in the input which converts the