UNIVERSITY OF PERADENIYA

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Development of a Prototype for Fuzzy Logic Based Medical Decision Support System

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by

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Abstract

The key problem addressed in this study is that how to computerize the process of medical diagnosis. In this study a decision support mechanism based on fuzzy logical relations is attempted.

Five respiratory related diseases with similar presenting clinical features, which are hard to distinguish from one another for the non-expert, were selected for the initial prototype.

Fuzzy medical knowledge bases are used to model the uncertainty and the vagueness of medical concepts. Three types of relationships were identified to exist among clinical features and diseases, namely *occurrence*, *confirmability* and *negation*.

Fuzzy logical reasoning mechanisms provide the inference process, based on the min-max compositional rule to calculate indication relations expressing occurrence, confirmability and negation medical knowledge. These lead to confirmed and excluded diagnoses as well as diagnostic hypotheses. The diagnostic hypotheses are ranked according to their respective products of occurrence, confirmability and negation relation values.

A few self learning mechanisms were attempted for the Decision Support System (DSS). The objectives of these strategies were to account for errors in converting the expert's knowledge to the fuzzy framework and to allow the DSS to adapt to the prevalence of diseases in the environment in which it is being used. Optimization algorithms based on the Nelder Mead Simplex method and the Genetic Algorithm were attempted in

combination with two different objective functions; binary cost function and ranked objective function; in order to minimize the diagnostic errors and to qualify the expert's knowledge entered to the system. The Genetic Algorithmic approach using the ranked objective function was found to be more efficient in optimizing the knowledge-base than the other methods.

The final system is capable of handling four hundred and seventy clinical features and can diagnose seventy diseases commonly encountered in critical care medicine.

Keywords: Fuzzy logic, Decision Support Systems, Medical diagnosis, Fuzzy compositional rules, Adaptive learning.