Knowledge-based Cybernetics in Decision Support System based on Subjective Emotional Intelligence

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PLENARY TALK

Abstract—This plenary talk is to highlight issues on Cybernetics from the prospective of decision support using knowledge-based systems. Emotional Intelligence as cybernetics approach is using cognitive reasoning to collect the subjective attribute of human subject interacted with a system for providing technical advice.

This talk contributes in new Cybernetics paradigm on using multidisciplinary in decision making. It is related to the construction of Avatar that can interact with human subject for collecting subjective attributes (emotional and cognitive) and objective attributes (physical), for decision making.

Decision makers rank their criteria in relation to subjective attributes bounded by the situation of that system. These are reflecting the dynamics feature subjectivity of the situation on the system objective feature. Such style of decision making is projected on medical decision making which has a versatile subjective feature related to human patient articulated on systematic objective system of diagnosis related to the properties of that sickness or disease.

Decisions making for Medical Diagnosis system have to take diverse type of criteria reflecting the different categorized project on patient. Attributes related to medical decision making is crucial aspect in medical applications. However, these attributes are a mixture of linguistic values and fuzzy intervals. Also, there are Fuzzy relations that are used in description of Symptoms. Fuzzy set and fuzzy relations are used to represent medical knowledge as network of symptoms and diseases connected with each other by logical relations. Like high temperature is related to fever diagnosis. For example each object in the domain knowledge has n scores reflecting the symptoms, one for each m attribute. For example a symptoms (object) has an attribute from physical set properties, (e.g., high temperature), and other attributes set is from mental set properties (e.g., stress high, or emotional depression). Then for each attribute there is assorted list that list each symptoms with its attribute sorted by scores (fuzzy values). This can be evaluated and reasoned using monotone aggregation function or combining rules. This is because the decision making is aggregated on different ontologies that are using different knowledge layers to select the optimal alternatives due to selected criteria that have aggregation operators. These aggregation operators are used to model medical mental view (subjective) and physical view (objective) in our model.

The Virtual Doctor System (VDS) is a system assisting human doctor who is practicing medical diagnosis in real situation and environment. The interoperability is represented by utilizing the medical diagnosis cases of medical doctor, represented in machine executable fashion based on human patient interaction with virtual avatar resembling a real doctor. VDS is practiced as a virtual avatar interacting with the human patient based on physical views and mental view analysis. In this plenary talk I outline our VDS system and then discuss related issues in decision making in medical domain. Using fuzzy reasoning techniques in VDS, it becomes possible to provide better precision in circumstances that is related to partial known data and uncertainty on the acquisition of medical symptoms. We have employed combination of Fuzzy geometric aggregation for attributes for representing Physical ontology of VDS (Subjective attributes). We propose harmonic fuzzy reasoning in emotion Ontology in VDS based on cognitive model. The ego state model is represented using Bonferroni fuzzy reasoning model. These all are aligned and aggregated on medical knowledge based using different distance function and entropy functions. The purpose is to derive the weight of related attributes from medical knowledge base and rank the preference order of the set of alternatives based on intuitionistic fuzzy similarity measures related to mental (Subjective) and physical (Objective) symptoms for decision making. A set of ideal solution is provided based on simple cases scenarios. The weight of mental decision making is derived based on hamming distances fuzzy operators. The alignment is to provide an intelligent mapping between the mental view (Subjective) and physical view (Objective) based on fuzzy representation of each through different type of aggregation function. We have in the knowledge based a big weight if the evaluation value is close to the ideal solution, and on the same time has small value if the value is far from the ideal decision. If the weights of some attributes are not known or partially known then we need to predict this based on patient preferences.