

Abstract

Expert systems provide expert quality advice, diagnoses and recommendations given real world problems. This expert knowledge is widely represented in rules and the rule base is capable of selecting a suitable firing order of rules for answering a question. Technically it is called as Conflict Resolution and there exist many conflict resolution techniques for expert systems.

In real life activities responding to natural human reactions is very subjective. It depends on the emotional status of the two people in interaction. The inability of representing this emotion in expert systems has created a barrier in making machine interactions with people more natural. In this sense, research into incorporation of emotional aspects with expert system technology is of great importance. With an aim of developing a mechanism of emotion based conflict resolution for expert systems, this thesis proposes an approach of taking emotions into expert systems, design a technique of modeling the emotions and evaluate the model using a real world application.

In modeling the emotions into expert systems we have exploited the Buddhist theory of mind. As drawn from *Abhidhamma* in Buddhist theory human responses are defined as a result of thought process arises in human mind. It further describes the mind as a continuous flow of thoughts or consciousness. The thought process arise in mind depends on the mental qualities associated with the thought process. Different combinations of these mental qualities referred as

mental factors or emotions are responsible for differences in responses. One key feature of mental factors is that they are correlated. Also there exist some patterns of mental factors arise in consciousness. Different consciousnesses can be identified by these patterns of emotions. Thus we have developed a model for emotions using the correlation and the patterns of emotions in consciousness.

The model of emotions in this thesis consists with a one-dimensional array of groups of emotions. This vector of emotions is consisting with three interdependent subgroups, from where the nature of the consciousness is easily identified. This model of emotions is used as the basis of designing the emotion based conflict resolution mechanism.

The postulated model for emotions is used to emulate the response driven conflict resolution of expert systems. In doing so, three hypotheses were formulated namely, *Buddhist theory of mind can be used for modeling emotions*, *The model of emotions can be attached to rules/ answers in expert system* and *Emotion model can be used to derive a mechanism for emotion based conflict resolution*. The first hypothesis was achieved by modeling the emotions. A system, facilitating the emotion based conflict resolution in expert systems is designed to test the other hypotheses.

The system developed for testing the hypotheses emulates a human expert where emotions are involved in reasoning. The question/ answer scenario of the expert system is developed incorporating the emotion based conflict resolution

mechanism. The system receives the user answers as the inputs to the system and produce appropriate questions and recommendations as its outputs.

The emotion driven conflict resolution mechanism is introduced into the process of the system. Design model of our system is directly associated with the *inference engine* and the *knowledge base* of an expert system. Emotions are associated with the rules in the rule base and the answers provided by the user. These emotions are in a form of a vector, which is derived using the concepts of Buddhist theory. During the interaction session the emotion vector, which is being assigned to the answer, is operated with the emotion vectors of the conflict set of rules. The resolution is based on the majority basis of resultant emotion vectors. The rule base is updated with the emotion vector occurred at majority.

The evaluation of the emotion based conflict resolution technique is formed as a comparison of the system with a human expert. A system emulating an academic student counselor is developed in this regard. This is selected, as the counseling is somewhat emotion dependent. The system is evaluated using a group of students and two student counselors. Each student is allowed to interact with the system and a human counselor alternatively, followed by a questionnaire. The conclusions drawn by analyzing the questionnaire supported our aim of developing a mechanism of emotion based conflict resolution for expert systems. The system was capable of convincing the effect of emotions in the conflict resolution technique with a human to system proportion of fifty-seven to forty three, which is seven percent away from the equality condition of fifty to fifty

percent. Ultimately it is concluded as a success by achieving the aims and objectives setup in the thesis.