CSE AI Seminar

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"Condition Action Tree: A decision tree architecture for procedural knowledge capture and representation"

In many complex problem–solving applications, knowledge–based computer systems are unable to effectively handle degraded information or novel situations with ambiguous conditions. This means that designers of such intelligent systems must try to keep the human "in the loop", and there is a growing interest in using automation to amplify human skills rather than to replace them. Research has also pointed out the need for knowledge–based systems which share common representations with the user, leading to what are known as cooperative problem–solving systems.

Most of production and manufacturing expertise are established and stable procedural knowledge. Majority of experts in such domains express their expertise as flowcharts or implication networks. Capture and representation of such knowledge in rule–based or model–based systems is difficult, time–consuming, and hard for domain experts to maintain. It has been suggested that it is actually more fruitful in certain domains to concentrate on constructing models of belief organization for diagnosis than on models of physical entities. The concept of belief potentially has a wider scope than explicitly defined knowledge. This seminar presents one such architecture where the expert's knowledge about the behavior, the physical and structural hierarchy, and the functional characteristics of the environment are represented as hierarchical Condition Action Trees (CAT). CAT is a knowledge graph formalism based on decision tree and entropy principles.

Representation of knowledge as a hierarchy of CATs, rather than rules, has a three fold advantage. First of all, system performance and incremental expansion is improved, by eliminating the rule–base maintenance and rule interference. Secondly, decomposing the problem into functional CATs, provides access to intermediate states and thereby reducing the search space. Thirdly, such a knowledge representation based on the cause–and–effect networks of association is consistent with the experts mental model of the environment and the reasoning process. Overall, the development and maintenance effort, as well as the predictability of the system behavior, independent of the amount of knowledge added into the system is improved.

This seminar presents the CAT for capture and representation of procedural expertise. The overall architecture, presentation structure, and its knowledge engineering guidelines will be presented.

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