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Logic of plausible reasoning driven algorithm of casting defects diagnostic process

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Abstract

This article shows assumptions to the development of the 'CastExpert' expert system dedicated for diagnostics of casting defect. Mechanism of forward chaining based on implemented base of rule will be presented on example of expertise of 'crack' defect. Ranking of reasons occurrence of defect take advantage in implementation. Such ranking was created with the logic of plausible reasoning. Article presents initial results of work on algorithm of conduct of dialog with a user by the system where the sequence of asking questions is subordinated to rank of certain reason of the defect. The main goal of the project is to increase the utility of the system and improve the quality of communication with user.

1. Expert systems in defect diagnostics

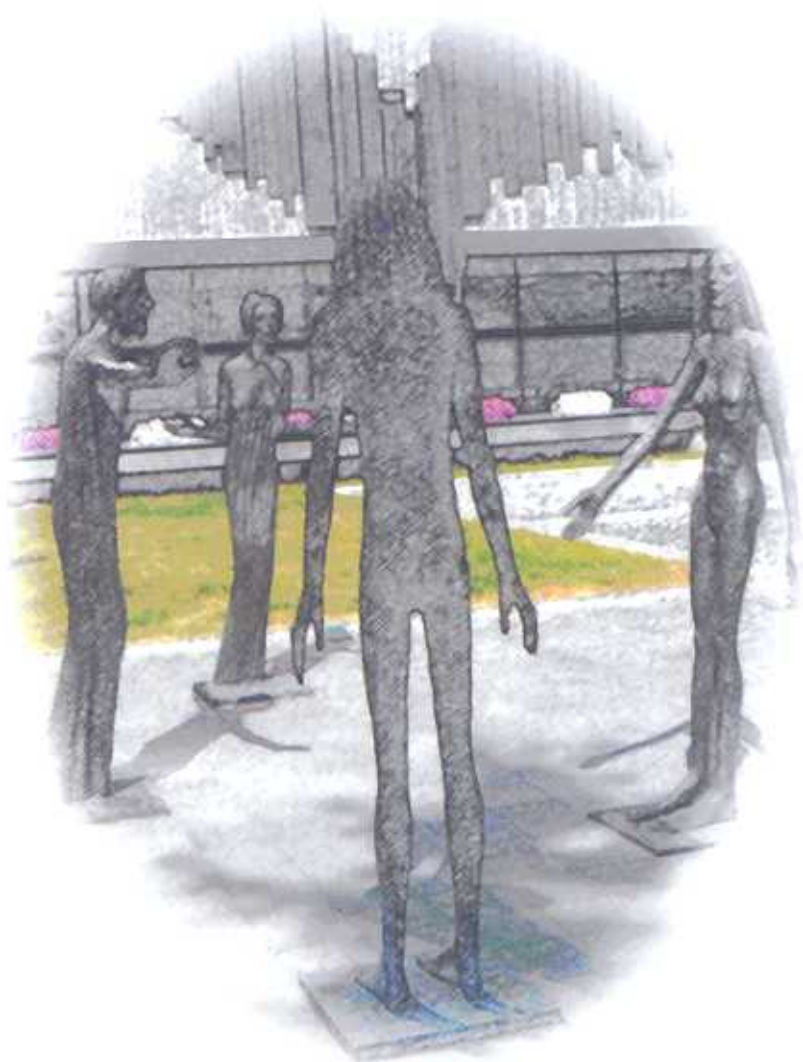
An expert system is a computer program that makes use of the knowledge and reasoning procedures to provide assistance in solving problems which are so difficult that they can only be solved with the aid of the expert's knowledge [1]. This class of program presents one of the branches of applied artificial intelligence. The basic idea of an expert system consists in transferring the expert's knowledge into a computer program equipped with the knowledge base, concrete reasoning rules and a specific language of communication with the user or a user interface enabling such a communication. The whole knowledge stored in the system can be used repeatedly by any number of users seeking for advice. The program is to provide the best solution of the problem, and if necessary, to show the algorithm explaining how it arrived at the end-conclusions. The main issue that a diagnostic expert system needs to deal with is evaluation of a certain environment on the basis of observations and defect detection. A suitable method of proceeding will be displayed every time when a certain object is functioning inappropriately [2].

The classical language used to create expert systems has been *Prolog*. But currently, instead of creating a system from the very beginning, prepared expert system shells with implemented reasoning capabilities are used. Such a shell represents actually an expert system with an empty knowledge base [3].

One of the expert system shells used in the *CastExpert* system is *CLIPS* (*C Language Integrated Production System*), which was created in 1985 by Johnson Space Center (NASA). Since that time, it has been considerably improved; the 6.24 version is now available. *CLIPS* provides a complete environment for the construction of expert systems and contains the tools needed to create the rule-based systems and knowledge representation. It can also be extended by the programmers [4]. Another example is *JESS* (*Java Expert System Shell*) – created in 1995 by Sandia National Laboratories (a governmental organization in the USA). *JESS* was originally conceived as a Java clone of *CLIPS*, but nowadays it is an independent expert system shell [5].

2. CastExpert system

CastExpert is an expert system which on the basis of detailed knowledge can draw conclusions in the manner that resembles the human reasoning process. It is based on the technique of symbolic information processing; the rules are used here as a form of knowledge notation [6]. The prototype version of the *CastExpert* system has been activated on the servers of Foundry Engineering Department at the AGH University of Science and Technology in Krakow. Since then research on development and integration of the scattered information system *INFOCAST* and the systems of knowledge management with other modules has been conducted. The great advantage of the system is that it has low hardware requirements; and namely: the Java applet viewer, the mere reasoning mechanism and the subsystem of cooperation with the user



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