A Novel Medical Diagnosis System

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The purpose of the study consists in the development of an open, large-scale heterogeneous medical diagnosis system capable of solving a large variety of difficult medical diagnosis problems. We propose the endowment of the expert systems specialized in medical diagnosis with the agents' capabilities. We name these agents *expert system agents* [1]. The expert system agents can solve cooperatively difficult diagnosis problems in a more flexible way than the expert systems. In this paper, we propose a cooperative heterogeneous medical diagnosis system. Cooperating diagnosis systems seems to be well suited for medical diagnosis in many medical domains [2]. The proposed system is composed from a set $MDS = \{M_1, ... M_k\}$ of *agents* (expert system agents, doctors) specialized in medical diagnosis with different specializations in medical domains. The proposed system can solve problems the solving of which require knowledge from more medical domains. Each agent member of the system can overtake problems for solving.

In the following, we describe briefly how an overtaken problem P is solved. An agent M ($M \in MDS$) receives the problem. If M is capable it processes the problem obtaining the result R. If R doesn't represent the solution of the problem, then M will find an agent capable to processes the result R (R represents a new problem). The problem P results transmission from an agent to another agent continues until the problem is solved. If an agent can't processes a received problem, then it must transmits the problem in the received form to a capable agent to processes it. The finding of an agent capable to processes a problem is based on the problem allocation described in the paper [3]. The parameters of a problem's announcement to the agents, and the parameters of the received responses to the problem announcement are also analyzed. An agent N transmits a problem announcement to more agents. From the agents who answer to the announcement, N must choose the best-fitted agent to processes the problem. In the choosing of the best-fitted agent, N analyses the parameters of the received responses. In the response to a problem announcement each agent indicates its capability and capacity to process the problem. The capability of an agent consists in the problems that can be solved by the agent [1]. For example, an expert system agent can be specialized in diagnosis in more medical domains. The capacity of an agent consists in the amount of problems that can be solved by the agent in deadline [1].

As an example, we consider the problem P (a cardiology and urology related illness). An expert system agent G specialized in general medicine, a doctor C specialized in cardiology and a doctor U specialized in urology can solve the problem. The problem P solving can be described as follows: $G(P) \Rightarrow C(R) \Rightarrow U(V) \Rightarrow S$. Processing P by G, the result R is obtained. Processing R by C the result V is obtained. Processing V by U the solution S is obtained. R represents symptoms of the patient's illnesses and the observations elaborated by G related to the patient's illnesses. V represents the cardiology related illness identified by C, the patient's illnesses symptoms and the observations elaborated by G. The result S represents the identified two illnesses (the problem P solution). The urology related illness is identified by U.

The main advantage of the proposed medical diagnosis problem solving is the flexible and precise solving of a large variety of difficult medical diagnosis problems, the solving of which require knowledge from more medical domains. The knowledge necessary to the diagnosis problems solving are not specified in advance, the diagnosis system members must discover cooperatively the problems solving. The agents' (human and artificial) capabilities and capacities are efficiently used. If an agent is not capable of processing a problem (he doesn't have the necessary capability and/or capacity) then it will transmit the problem to an agent capable to processes it. There are no uncertainties in a problem distribution from an agent to another agent. The parameters of the responses to the problem announcement contain knowledge that can be used in the decision elaboration.

References

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