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Integration of Neural Networks and Expert Systems in Medicine

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Expert Systems are used in medical diagnoses. They have the advantage to give an explanation of a diagnosis. This is very important especially in the domain of medicine where the user wants to have the diagnosis proved. But a main problem when dealing with Expert Systems is the acquisition of knowledge. It is difficult to transform the explicit and implicit knowledge of the expert of the domain, which also partly consists of own experience, in a form which is suitable for a knowledge base. The knowledge can also be inconsistent or incomplete. A second problem is that Expert Systems are not able to learn from experience or to operate with cases not represented in the knowledge base.

Artificial Neural Networks deal with knowledge in a subsymbolic form. Incomplete and imprecise data can be processed by approximating not linear relations in data and mapping the structure of high-dimensional data on low dimensional topologies. The knowledge of Neural Networks, however, is in this form not communicatable; i.e. it is necessary to transform the knowledge into a form humans are able to understand. By integrating both paradigmas, Expert Systems and Neural Networks, the disadvantages of both approaches can be redressed.

We developed a hybrid system REGINA which consists of a neural network classifier together with a visualisation tool and a machine learning algorithm to extract rules out of the learned Neural Network (1). These rules can be used as a knowledge base for an Expert System. A first exemplary application was the diagnoses of iron deficiency diseases. More of 98% of the cases are correctly diagnosed (1).

Reference

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