A KNOWLEDGE-BASED SYSTEM FOR DECISION SUPPORT IN CHEST PAIN DIAGNOSIS

H. S. Lopes[1], M. S. Coutinho[2], R. Heinish[2], J. M. Barreto[2], and W. C. Lima[2]

[1] CEFET-PR / CPGEI - Av. 7 de setembro, 3165 - 80230-901 - Curitiba (PR) - Brazil

[2]Universidade Federal de Santa Catarina - P.O. Box 476 - 88040-970 - Florianópolis (SC) - Brazil

Introduction: Chest pain is a common symptom related to a broad set of diseases of several origins, like pulmonar, esophagic, psychogenic and cardiovascular. Among these, the highest morbity figures in the world are due to cardiovascular diseases. Emergency rooms is the place where most patients complaining chest pain are found, and is a place where it is often impossible to go through a detailed examination and diagnosis. Although it is currently accepted that the physician`s experience and his holistic judgement play the main role in diagnosis, the availability of computer systems to analyse medical data may be useful.

Methodology: An expert system to aid clinicians in non-thraumatic acute chest pain diagnosis was developed using the paradigm of analogy with diseases prototypes, where inferences are achieved by computing the similarity level between the prototype and a real case. This system, named DoToR, uses patient's data from 161 variables obtained in the anamnesis and in laboratory tests, and is currently capable to diagnose 12 different pathologies commonly related to chest pain. The following diseases can be recognised: stable and unstable angina, acute myocardial infarction, aortic dissection, cardiac tamponade, pulmonary embolism, pneumothorax, acute pericarditis, peptic ulcer, esophageal pain, musculoskelectal disorders and psychogenic chest pain. A machine learning system, based on genetic algorithms, is employed in order to improve DoToR`s diagnostic performance, by means of a qualitative learning simulation. The training instances were formed by a database covering all those 12 pathologies , with 90 simulated cases, which was built interviewing a group of 21 expert physicians.

Results: Several models for calculating similarity between disease prototypes and cases were tested, as well as learning parameters suitably adjusted. Without training, the system has achieved an average sensibility of 0.79 and specificity 0.92 (for all 12 diseases). After training, the system was tested with a database of 48 instances not previously seen, and 0.94 of sensibility and 0.91 of specificity were achieved.

Conclusions: Good results were obtained in the task domain of clinical diagnosis, using intradomain analogy, based on semantic similarity. The practical implementation using this methodology, even in the test prototype stage, has presented excellent performance on simulated cases. Its graphical interface was designed to be user-friendly, enabling non-experts to easily explore the capabilities of the system.