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Case-based learning for prediction of post-myocardial infarction outcomes

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Abstract. It is of prime importance to ascertain the prognosis of patients who have experienced heart attack or unstable angina, as they are prone to developing serious adverse after-effects. The aim of this study was to run machine learning algorithms over a cardiac database to derive associations between various clinical and pathological parameters and the occurrence of future adverse consequences. The rules induced from the data were used to build an expert system for prediction of outcomes for unseen cases and it was ported on the web for use over the Internet.
Key words – heart attack, prognosis, machine learning, web.

I. INTRODUCTION

The objective of our work was to determine associations between various clinical and pathological parameters, and adverse outcomes after acute myocardial infarction (AMI) and unstable angina (UA), by case-based learning of a myocardial infarction database.

II. METHODS

Retrospective data for 413 cases (316 cases of AMI {M : F :: 4 : 1}, and 97 cases of UA {M : F :: 1.6 : 1}) from Ruby Hall Clinic, Pune, was gathered and entered in a machine readable, structured form. Data for each patient was gathered with reference to 48 chosen relevant attributes. The outcomes were categorized into 22 classes. The CN2[1] [1] and the ITI algorithms[2] [2] were obtained from the Web and they were run over the two data sets. The one-year status of 166 patients (117 with AMI, and 49 with UA) could be ascertained by mail or telephonically.

III. RESULTS

The cross validation tests with the ITI, the CN2 (unordered) and the CN2 (ordered) algorithms showed that they had mean accuracies of 49.75%, 53.34% and 49.83% with standard deviations of 5.95, 3.48 and 9.02 respectively, when classifying outcomes after AMI. The mean accuracy with UA was 65.37%, 58.23% and 51.1% with standard deviations of 5.83, 7.07 and 8.5 respectively. Rules obtained were medically relevant and were used to build a consultation system - HEARTEXPERT (HE) - ported on a web server.

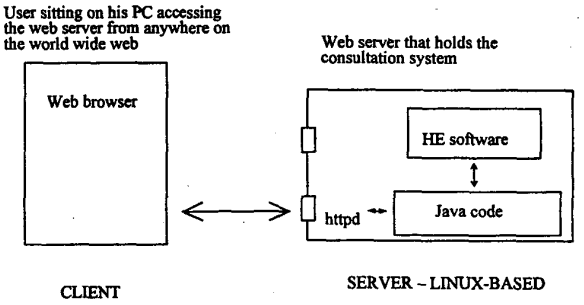

Fig. 1 : Client server architecture of HEARTEXPERT

Figure 1 illustrates the client-server structure of the system. The Java™ programming language and Common Gateway Interface scripts were used in implementation.

IV. DISCUSSION

Our study has demonstrated a stratification of patients into various risk categories to decide the future course of action for each patient. The accuracy of prediction obtained being much less than the desired figure of about 80 % could imply that the concept is very abstract and some other, possibly yet unknown factors, play a role. But, we had considered a number of clinical and laboratory factors. The size of our database was also small and, about 20 % of attribute values were missing in our database. We feel that prospects for future work addressing these issues seem to be bright.

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[2] P. E. Utgoff. An improved algorithm for incremental induction of decision trees. Proceedings of the 11th international conference on machine learning, New Brunswick, NJ, Morgan Kaufmann, 318-325, 1994.

[1] http://www.cs.utexas.edu/users/pclark/software.html#cn2
[2] http://www-ml.cs.umass.edu/iti/index.html