Promedas: a medical diagnostic expert system

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Introduction
Promedas is a medical diagnostic expert system that helps medical doctors to diagnose complex patient cases. Promedas is based on a probabilistic Bayesian network. The Promedas system currently consists of about about 2000 conditions, 3700 diagnoses (among which side effects of medication) and 2000 tests.

Model construction
The model is developed by specifying the prevalences (prior probabilities of the disease and the sensitivities and specificities (the conditional probabilities of the findings given the presence or absence of the disease. The prevalences are specified depending on age, gender, race and the conditions if necessary. In addition, for all relevant diagnose - test relations the sensitivity and specificity are specified.

Bayesian network
The medical knowledge is converted into a Bayesian network. From this network it is possible to compute the probabilities of individual diseases, given some patient findings. The computation is complex and uses efficient Bayesian inference methods.

Example
Small part of the Promedas probabilistic network for medical diagnosis. A small subset of diagnoses are shown, with some of the conditions that affect their prior probability. In addition, some tests are shown, whose probability is affected by these diagnoses. Connections between these diagnoses and other tests are suppressed, as well as connections between the shown tests and other diagnoses. In this example, a patient is a sushi chef who recently visited Nigeria. Both these facts affect his prior prevalence for lung flukes. His white blood cell count is above normal as well as his rectal temperature. In addition, he coughs and at times has some unspecific pain. Based on these findings, Promedas computes the marginal probabilities for each of the diagnoses (in red).

Use of promedas
Promedas has been operational in the UMC Utrecht since the fall of 2008. Promedas is coupled to the laboratory data base to automatically retrieve patient data. It is used on average about 1200 times per month. Promedas has been evaluated on a set of 34 text book patient cases and gives the correct diagnose in the top 3 list of differential diagnoses. Promedas has been evaluated on a set of 54 patient cases from the division of internal medicine of the UMCU and gives the correct diagnose in the top 3 list of differential diagnoses in 49 of the cases. The module to diagnose the side-effects of medication has been evaluated on 45 patient cases from the hospital and the literature. Promedas correctly diagnoses all cases in the top 10 list of differential diagnoses and 87 % of the cases in the top 5 list. These results are excellent and cannot be obtained with a protocol based system. Promedas is also available for use on the web.

http://www.promedas.nl