A MODEL FOR THE SYSTEMATIC APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE DIAGNOSIS OF PATHOLOGIC CONDITIONS IN A SYSTEM OR APPARATUS

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Abstract

A model of structure for a complementary expert system to the AEDMI project (An Epidemiological Approach to Computerized Medical Diagnosis) is proposed. Starting from a diagnosis of abnormality in a system or apparatus, the model identifies the organ affected, and determines which of the possible illnesses is the one we are faced with in a particular case. The reasoning is based on a tree-like structure divided into a set of three levels, assuming that greater sensitivity and less specificity of the questions, clinical variables, and the signs and symptoms to be taken into consideration is found at level I than at level III. Each time that the system is consulted for a real patient, the system offers the possibility to register all the parameters in a data base. The modules, rules, and diagnoses are registered and compared with physicians' judgment. The study of conflicting patterns helps to analyze clinical judgment and rule-based reasoning techniques in greater depth. The system is being implemented for more than one year and the data from 825 patients introduced are being currently assessed.

Introduction

The AEDMI general diagnostic system (Epidemiological Approach to Computerized Medical Diagnosis), designed at Hospital de Bellvitge and presented in another paper at this meeting (1), is based on the assessment of sensitivities, specificities, and predictivities of different symptom patterns associated with each diagnosis. The first 1-year experience of the program and the development of an expert system for the detection of adverse drug reactions (2) are current lines of research.

The AEDMI diagnostic system provides a context of the general complaints of the patient which are grouped by systems or apparatus. In order to continue the diagnostic process it is necessary to limit the knowledge domain and to build a clinical record with some defined objectives. The expert system described below is an example of this methodology.
Method
To maintain the proposed AEDMI epidemiological approach it would appear not operational to use different methodologies or to fall in the diversity of the existent expert systems (3). On the other hand, it is difficult to define a precise diagnosis if a broad spectrum scanning of signs and symptoms is used as in the AEDMI program (4). Moreover, any particular expert system requires to be applied in a previously defined context. The background epidemiological approach of the AEDMI general system is a prevalence study design. To continue the diagnostic procedure in the different systems, the use of a case-control design is foreseen (5-7). The knowledge systematization is adapted to the structure 'system - organ - disease'. In the current state of development of the project, the main syndromes or multisystem pathologies are analyzed without considering the connections among the different organs or systems involved.

Expert system model
The expert system model has been developed for the diagnosis of gastrointestinal disorders which are one of the most common pathologic conditions. The same model will be later progressively applied to remaining systems and apparatus included in the AEDMI program. The Aion Development System (8) is used as a tool to build the model due to its possibilities of forward and backward running, and the modular and tree-like knowledge representation.

The model can be adapted to different levels of depth in the diagnostic procedure, such as:

1/ System or apparatus
2/ Organ or location
3/ Disease

The questions in the present program distinguish between normal and abnormal conditions. According to their location in the general sequence of the program, it is possible to determine which apparatus or system they belong to (level I). Once the system or apparatus to which the possible pathological data has been identified, the questions necessary to locate the organ affected are then included, i.e. esophagus, stomach, etc. (level II). The delimitation of the affected organ only by the information provided by symptoms is