The Benefits of Expert Systems in Health Care. Practical Experiences from CATEG05-ES

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Abstract

Practical personal computer based Expert Systems offer benefits in many areas of health care. However for expert system technology to be useful there is a need to produce a cost effective way of developing practical user friendly systems. Building systems which provide an environment for experts to develop and test disease models is a particularly challenging application. This paper briefly discusses the benefits and shortfalls of expert systems that are currently available. In this context it outlines the development of CATEG05-ES, a successful expert system currently being used on a World Health Organisation project to improve the reliability of psychiatric diagnosis. The system allows experts without experience of computers to build and evaluate complex disease models or psychiatric schedules which condense symptoms, pathological factors and social factors into international disease classifications.

1. Introduction

1.1 Benefits and Shortfalls of Current Expert System Technology

The last three decades of research into medical expert systems have outlined the difficulty of representing complex medical knowledge and developing medical expert system applications (eg Clancy 86). Current technology has moved away from large research based medical systems towards smaller more practical systems. The increased need for information management and cost effective spreading of medical expertise springs from a need to widen access to medical knowledge and to help people manage and make sense of the large amount of information that is available in the health care field. Expert systems offer a way of providing these facilities in a cost effective way by:

(1) Making expertise more accessible. Expert systems can provide a convenient and economic way of spreading expert knowledge, making it more accessible to other people.

(2) Relieving experts from routine tasks. Expert systems can perform routine expert tasks such as the regular analysis of information or routine diagnosis of symptoms. The expert, relieved of these tasks can spend more time on the difficult analyses.

(3) Providing a useful way for experts to develop and test ideas and theories. Medical knowledge is becoming increasingly more complex and unmanageable. There is a need for tools which can store and reason with medical expertise taken from a number of experts.
There are a large number of commercial expert system tools currently available, ranging from high level programming languages to expert system shells. However with the advantages that these systems offer, why are expert systems not used more widely? There are several reasons for this:

(1) Expert system shells usually require an experienced programmer or even a development team to be used effectively. Shells are difficult to use and there are many problems associated with building up expertise in a rule base. This means that development costs and timescales are often prohibitive.

(2) They offer a very restricted way of storing and presenting knowledge. Most personal computer based expert system shells offer a way of entering information in the form of production rules. Unfortunately they fall far short of being able to adequately describe medical information. The expert has the difficulty of trying to convert his knowledge, which is often intuitive, into this rule form. The other problem is that as a rule base becomes larger, conflicts occur between rules which means that updating or expanding the system is very difficult.

(3) They do not allow easy updating or adding to the knowledge and expertise that they contain. It is often the case that once an expert system project has been completed the system is very difficult and expensive to update, as knowledge or requirements change.

One way of providing cost effective systems is to use a development environment which allows an expert without knowledge of computers to build medical expertise into the system. The system must be user friendly in the sense that the way the expert enters knowledge is familiar and convenient. This does not just mean providing a more English like rule form, but providing a more fundamentally natural way for an expert to break down his intuitive knowledge. Allowing the expert to check the knowledge is another important point, and providing a way for the system to explain its reasoning process. In our experience these practical problems need to be addressed by adopting a fundamentally different approach to expert system design. The CATEG05-ES project outlines some of the problems that arise when building medical expert system tools of this kind, and shows one way of solving them. The technology was commissioned by the Social Psychiatry Unit of the UK Medical Research Council.

2. CATEG05-ES - An Expert System to Aid the Development of Psychiatric Schedules

2.1 Background

In order to improve the reliability and validity of research into psychiatric diagnosis, standardised clinical interviews have been developed which adopt a structured approach to the assessment of a patients mental state. The system most widely used in the UK and by the World Health Organisation (WHO) is the 9th edition of the Present State Examination (PSE9) with its associated computer algorithms - CATEG04 (Wing, Cooper & Sartorius, 74). At the same time the WHO and several member countries have produced large glossaries of psychiatric disease classifications. In particular the WHO ICD-10 (International Classification of Disease) and the American DSM-IIIR (Diagnostic and Statistical Manual of Mental Disorders). SCAN (the Schedule for Clinical Assessment in Neuropsychiatry; Wing et al, 88) which includes PSE10, is being tested in an international project sponsored by WHO and the US Alcohol, Drug Abuse and Mental Health Administration (ADAMHA). Clinical data are being collected in 20 centres worldwide and will be classified using the computerised model of SCAN, CATEG05. SCAN condenses up to 900 symptoms, as well as pathological factors and social factors, into international classifications according to ICD-10 and DSM-IIIR. The development of the schedule is complicated by several factors. The international classifications interpret