

Chapter XLIII

Artificial Intelligence in Medicine and Biomedicine

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ABSTRACT

Man has always strived to augment his abilities by inventing tools. Artificial intelligence in medicine (AIM), has taken up the challenge of creating and distributing advanced tools, utilising technical developments aimed at augmenting man's reasoning. Increasing quality healthcare needs and advances in medical and pharmaceutical sciences, yet restrictions on physicians' time for learning while practicing, indicate these tools will prove invaluable in effecting changes (i.e. Simpler organising, storing, and retrieving of important medical facts/new findings) especially when treating difficult cases; continual availability of same for learning purposes; assisting with appropriate diagnostic, prognostic and therapeutic decisions/decision making techniques, using databases, flowcharts and decision theory. Proof of these tools' indispensability through actual trials, is pending.

INTRODUCTION

Men and women strive to augment their abilities by building tools. From the invention of the club to lengthen their reach and strengthen their blows to the refinement of the electron microscope to sharpen their vision, tools have extended humans' ability to sense and to manipulate the world about them. Today we stand on

the threshold of new technical developments that will augment people's reasoning; the computer and the programming methods being devised for this are the new tools to effect this change.

Medicine and biomedicine are fields in which the help of such tools is critically needed. Our increasing expectations of the highest quality healthcare and the rapid growth of ever more

detailed medical knowledge leave the physician without adequate time to devote to each case and struggling to keep up with the newest developments in the field. There is also another huge problem. Continued training and recertification procedures encourage the physician to keep more of the relevant information constantly in mind, but fundamental limitations of human memory and recall coupled with the growth of knowledge assure that most of what is known cannot be known by most individuals. Currently, there is the opportunity for new computer tools to help organize, store, and retrieve appropriate medical knowledge needed by the practitioner in dealing with each difficult case, and to suggest appropriate diagnostic, prognostic, and therapeutic decisions and decision-making techniques.

A field that is now taking up the challenge of creating and distributing the tools mentioned above is artificial intelligence in medicine (AIM).

ARTIFICIAL INTELLIGENCE

What is artificial intelligence in medicine? One introductory textbook defines artificial intelligence this way: "Artificial Intelligence is the study of ideas which enable computers to do the things that make people seem intelligent. The central goals of Artificial Intelligence are to make computers more useful and to understand the principles which make intelligence possible." This is a rather straightforward definition, but it embodies certain assumptions about the idea of intelligence and the relationship between human reasoning and computation, which are, in some circles, quite controversial.

Historically, researchers in AI have had to defend this linkage against humanist attacks on the reduction of the human intellect to computational steps. The debate has sometimes been heated, as exemplified by the following quote

from the introduction to an early collection of AI papers.

Is it Possible for Computing Machines to Think?

If one defines thinking as an activity peculiarly and exclusively human then the answer is no. Any such behaviour in machines, therefore, would have to be called thinking-like behaviour. If someone postulates that there is something in the essence of thinking which is inscrutable, mysterious, and mystical then the answer is again no. But it the opposite answer if one admits that the question is to be answered by experiment and observation, comparing the behaviour of the computer with that behaviour of human beings to which the term "thinking" is generally applied.

ARTIFICIAL INTELLIGENCE IN MEDICINE

AIM is AI specialized to medical applications. Researchers in AIM need not engage in the controversy introduced above. Although we employ humanlike reasoning methods in the programs we write, we may justify that choice either as a commitment to a human-computer equivalence sought by some or as a good engineering technique for capturing the best-understood source of existing expertise on medicine: the practice of human experts. Most researchers adopt the latter view.

Another currently much smaller use of computers in medicine is their application to the substance rather than the form of healthcare. If the computer is a useful manager of billing records, it should also maintain medical records, laboratory data, data from clinical trials, and so forth. And if the computer is useful to store data, it should also help to analyze, organize, and retrieve it. Three main approaches to this

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