Commercial Applications of Artificial Intelligence

John Kingston

AIAI-TR-99

November 1991

This article was published in *Elektronik- und Computermarkt Woche/ AARAU* (a Swiss weekly journal), v.30, 26 July 1989, under the title "Antwort auf alle Probleme?"

Artificial Intelligence Applications Institute
University of Edinburgh
80 South Bridge
Edinburgh EH1 1HN
United Kingdom

Many people these days have heard of Artificial Intelligence (or AI, as those in the know call it). It's a subject that many people know a little about; it seems to be cited as a possible answer to almost any technological problem. Such claims are often overstated; however, over the last five years in particular, the science of AI has become sophisticated enough to produce systems that are commercially usable, and useful.

Broadly speaking, AI is a science that attempts to give computers some of the capabilities of a human being. Areas in which considerable work has been done include understanding speech, understanding 'natural' language, encoding expertise about a particular area, seeing objects and identifying them, planning courses of action, reasoning about mathematical equations, and adding a measure of intelligence to robots. Few AI systems can perform tasks as well as a trained, experienced human can; however, many systems do not need to perform as well as a human in order to be commercially useful. AI systems may be commercially useful because they automate some aspects of someone's job, leaving that person free to concentrate on less routine problems; or because they perform a task which no-one in the company has enough knowledge or experience to perform; or because their performance is better than that of existing computer systems.

Many of the AI systems which are currently in use commercially are "expert systems" - systems which encode the expertise of a human about a particular topic. Expert systems have been applied to a range of tasks, including design, monitoring, and scheduling. They have been found to be particularly useful for problems requiring diagnosis or classification, such as diagnosing bacterial infections, prospecting for oil, finding faults in car engines, or deciding whether to grant loans. An example of the latter is a system called the Authorizer's Assistant, developed by American Express. Although the majority of credit transactions made using American Express cards are processed entirely by computer, some transactions require authorization by a human. Authorization is typically required if the card-holder has not paid previous charges, or if the size or frequency of transactions raises suspicions of fraud. The Authorizer's Assistant obtains on-line information about the past transactions of the card-holder, and other factors; it can also supply a series of polite questions which the authorizer can ask the card-holder by telephone, in order to obtain further information. The final output of the system is an assessment of the creditworthiness of the card-holder, and a recommendation about granting or declining the loan. A further screen summarises the system's various conclusions which contribute to its assessment of the card-holder, and gives a brief description of company policy to justify each conclusion. The choice of questions, and the final recommendation, are based on the encoded knowledge of experienced human authorizers.

The Authorizer's Assistant is expected to be fully deployed during 1988. During validation testing, it was found that the system was one of the rare breed of systems which performed more efficiently than humans performing the same task; it authorized 96.5 per cent of transactions correctly, as against an average of 85 per cent for human authorizers. The system also performed most authorizations much faster than humans could. However, the system has some limitations, particularly in the area of "common sense". For instance, it cannot use information which can be gleaned from the name of the shop, restaurant or other establishment at which the card is being presented; nor can it make allowances for immediate human concerns, such as "It's winter, and my wife has had a baby prematurely".

The Authorizer's Assistant was developed using Inference ART,[1] which is a sophisticated package for developing knowledge-based systems, and a Symbolics Lisp-based workstation, which is a specialised workstation used primarily for AI research. One of the advantages of using a specialised development package is that its structure makes it easy to modify the system slightly if American Express' policy on loans should change (which happened several times during the development of the system). However, both Inference ART and Symbolics workstations cost a great deal of money, and several less sophisticated expert systems, which have been developed to run on more standard hardware such as IBM PCs, have found a niche in the commercial world. A good example is a commercially available system developed by Robson Rhodes, a management consultancy firm, which deals with dismissal of employees according to UK employment law. Since employees are allowed to sue if they believe they have been sacked unfairly, it can be costly if the employee is treated too harshly; and, since employee dismissal can be an emotive affair, the ability to seek immediate, dispassionate advice is often useful. The system asks for information about the employee in question; it then diagnoses whether the employee is eligible to be dismissed, whether an industrial tribunal would be likely to view the dismissal as unfair, and how much the company would have to pay in compensation for an unfair dismissal. The system can produce its own recommendation for an appropriate procedure to follow. Screens of explanatory text are also included, so that if the user of the system wants to know why a particular question is being asked, the system can supply a brief explanation of the particular laws which it is trying to comply with. The terminology used is also explained. Over 100 copies of the system had been sold by mid-1988. The system was developed in four man-months using an expert system development package called Xi Plus, available from Expertech Ltd., who market the system jointly.

Many expert systems have been developed to deal with physical systems rather than systems of man-made rules. An example of such a system which monitors a process and diagnoses faults in that process is the ESCORT system. ESCORT ("Expert System for Complex Operations in Real Time") was developed by PA Computers and Telecommunications to help locate faults in process plants. In a typical manufacturing process, a computerised plant supervisory system sounds alarms if it believes that a fault has arisen in the process machinery. In many reasonably sophisticated processes, an alarm may sound every 3 or 4 minutes. Normally, about 80% of all alarms are caused by faults elsewhere in the plant, or are false alarms; however, it is up to the control room operator to diagnose which alarm really indicates a fault. If there is more than one fault, or potential fault, the operator must also decide how urgently each fault needs to be put right. The frequency of alarms makes this a pressurised and hence difficult task.

ESCORT aims to diagnose which alarms really indicate a fault, and then lists the faults in order of priority for repair. It does this by maintaining a computerised model of the plant, with each component in the system explicitly represented by a data structure (a small, independent, section of the program). Connections between components are also explicitly represented. While this representation draws heavily on computer resources, it allows ESCORT to associate correct and faulty 'behaviour' with each component just as it would occur in real life. This enables the system to analyse the effects of a particular fault on the processes in the plant, and thus to predict which alarms will be set off. ESCORT also includes some expertise derived from experienced control room operators which enables it to prioritise the list of faults that it diagnoses.

ESCORT is implemented in KEE[2] and runs on a Symbolics AI workstation. It is currently being installed at the British Petroleum butadiene manufacturing plant at Grangemouth in Scotland; interest has also been shown by a food processing company and the Ministry of Defence.

What of the other areas of Artificial Intelligence? While much significant work has been carried out in other areas, few commercial applications have emerged as yet. However, given that the beginnings of expert systems research were in the 1960s, ten years before many other areas of Artificial Intelligence, and that many commercial applications of expert systems have only been developed in the last five years, it seems likely that the other areas of Artificial Intelligence will produce commercial applications in the next decade.

Acknowledgements

I gratefully acknowledge the following sources: Expertech Ltd.; Laurent Piketty, Inference Corp.; Roy Sargeant, PA Computers and Telecommunications; and Austin Tate, AI Applications Institute, University of Edinburgh.

Addresses

Expertech Ltd,
Expertech House
172 Bath Road
Slough
Berkshire
England

Ferranti plc
Ty-Coch Way
Cwmbran
Gwent NP44 7XX
Wales

Inference Corporation
5300 West Century Boulevard
Los Angeles
California 90045
U.S.A

IntelliCorp, Inc.
1975 El Camino Real West
Mountain View
California 94040,
U.S.A.

PA Computers and Telecommunications
International Head Office
Rochester House
33 Greycoat Street
London SW1P 2QF
England

Symbolics, Inc.
4 New England Tech Center
555 Virginia Road
Concord, MA 01742
U.S.A.