INTRODUCTION

The purpose of this book is to combine academic and practitioner literature that falls between accounting or auditing and computer science or knowledge engineering expert systems. It includes a collection of articles which were already published in scholarly journals as well as unpublished papers which were presented to small groups of scholars and practitioners.

This book is not an introductory text and is only suitable for readers with basic knowledge in artificial intelligence, expert systems, accounting, and auditing. The book is divided into five areas:

1. **Foundations:** covering some key concepts of ES, AI, and a view of the future.
2. **Methodology and Surveys:** involving an overview of published work in the field and methodological issues.
3. **Applications in Auditing:** covering a series of pre-paradigmatic works in auditing in subareas as auditor judgment, EDP audit, audit scheduling, internal control evaluation, etc.
4. **Applications in Accounting:** encompassing the first attempts of formalizing accounting issues in an ES framework.
5. **Applications in Practice:** describing some work performed in the professional world and its interpretation.

This introductory chapter examines some of the history of the field, its major domains, some basic concepts, their evolution, and key issues for the use of AI/ES in accounting and auditing.

Artificial Intelligence (AI) and Expert Systems (ES)

Artificial Intelligence (AI) is a field of science which attempts to get machines to exhibit behavior that we call intelligent behavior when we observe it in human beings. Since these machines are always computers, artificial intelligence (AI) in our day is a branch of computer science.

An expert system (ES) is a branch of artificial intelligence. An ES is a set of programs, computer routines and data which has a wide base of knowledge in a restricted domain and uses structured reasoning to perform tasks which a human expert could do.

1. **Game Playing**: involved computer usage for games such as chess playing machines, blackjack, and more menial games as tic-tac-toe.
2. **Problem solving**: efforts involved attempts to prove formulae, develop theorems and manipulate algebraic formulae.
3. **Language Translation**: problems involved many of the currently addressed problems of natural language manipulation, and related language constructs among languages for translation purposes.
4. **Pattern recognition**: focused in identifying particular patterns out of a string of events or cues.

It complained at the same time about the stagnation of the field of artificial intelligence. Its advance remained rather slow until the late seventies when developments in hardware and software as well as some major conceptual leaps allowed for substantial progress. AI research evolved from the search for generalizable solutions and algorithms to the concept of partial solution of problems based on expertise. This opened the domain of the field to the examination of problems with no clear-cut solution, but where expert knowledge could improve the quality of outcomes.

Many branches of AI exist and work proceeds rapidly in these fields. Currently AI[2] main fields of research involve work in:

- **Natural languages**: where researchers work on problems related to natural language interface, machine translation, understanding the spoken language, etc.

ble molecular structures, making it possible to obtain a satisfactory answer with a fraction of the effort. The idea of using rules to represent expert knowledge has permeated expert systems work.

CASNET[7] was developed for the diagnosis and therapy of glaucoma, and has been rated by professionals as having performance close to experts. It led to a methodology for modeling diseases in general and to the development of the software EXPERT, a general tool that also has been applied to rheumatology and endocrinology. The program introduced a causal network to model diseases.

The **MACSIMA**[8] program has achieved high competence in the symbolic computations associated with applied analysis.

CADUCEUS[9] **and MYCIN**[10] address different medical diagnosis problems. CADUCEUS (also known as INTERNIST-1) addresses a large semantic network of relationships between diseases and symptoms in internal medicine. MYCIN works on the diagnosis and treatment of infectious blood diseases. The first program encompassed approximately 100,000 associations in 1982. The second program comprises about 400 rules.

The efforts from researchers at Carnegie-Mellon University in conjunction with Digital Equipment Corporation led to the development of R1,[11] an expert system to configure DEC VAX computer systems.

Another interesting application of expert systems is speech-understanding systems. HEARSAY-II incorporates a 1000 word vocabulary and "its skill rivals that of a ten-year-old child."[12]

Figure 1 displays the evolution of a set of expert systems over the years. The figure is based on a chart presented by Hayes-Roth et al.[13] with some modifications.

Generic languages for the development of expert systems were often the by-product of early effects in expert systems. The MYCIN effort led to EMYCIN; Rand Corporation's efforts led to ROSIE;[15] the work at Carnegie-Mellon University led to the development of the OPS series of production system languages;[16] and the HEARSAY work led to AGE.

These early efforts shaped much of today's expert systems work. Many application efforts have since been attempted with more or less noteworthy effects. Noteworthy efforts include applications in: interpretation of oil drilling data (Schlumberger), equipment failure diagnosis, military threat assessment and targeting, VLSI design, crisis management, etc. Among the less

noted areas of application are accounting and auditing applications.

Artificial Intelligence, Expert Systems, Accounting, and Auditing

Knowledge can be defined as **descriptions, relationships, and procedures in some domain of interest.** For example, an auditor has knowledge about a series of facts relative to accounting rules and data. Among these rules, for example, are how to compute depreciation and the methods to measure inventory. On the other hand auditors have a good feeling for certain data relationships such as the fact that a company in financial distress may have cash flow problems, a company preparing to enter Chapter 11 may hoard cash, and that these problems are reflected in the statement of sources and uses of funds. In addition, the auditor knows that the controller is responsible for accounting practices and the treasurer for cash flow management. These relationships, descriptions, and procedures (say as prescribed in GAAP and GAAS) are the **knowledge base** of auditors.

Expert systems have been used in: 1) design, 2) prediction, 3) diagnosis, 4) monitoring, 5) planning, 6) debugging, 7) repair, 8) instruction, 9) interpretation, and 10) control functions among many others. Potential applications to the audit area could be developed along each of these functions. For example:

1. **Design:** reconstructing the path of data flows in an integrated computer system based on client documentation, some program logic, and the structure of approvals and authorizations in the organization.
2. **Prediction:** an auditor examining relevant figures and issuing a "going concern" qualification.
3. **Diagnosis:** an auditor infers breakdown in controls from patterns in daily sales.
4. **Planning:** planning the steps in the audit process (audit planning).
5. **Monitoring:** keeping track of transactions in an online system to detect potential problems.
6. **Debugging:** evaluating the integrity of particular computer systems that may affect the accounting process and identification problems.

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