AI in Accounting, Finance and Management

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ABSTRACT This paper summarizes the contributions to the *International Journal of Intelligent Systems in Accounting, Finance and Management* over its first four years. A taxonomy of papers by functional area and methodology is developed. Rankings of contributions by author, institution and country are summarized.

INTRODUCTION

The focus of the *International Journal of Intelligent Systems in Accounting, Finance and Management* (IJISAFM) is on the application of artificial intelligence (AI) and expert systems (ES) to business problems. In particular, the stated focus in the title is with applications in the functional areas of accounting, finance and management, with additional 'non-title' concern with insurance, marketing and other business areas.

The purpose of this paper is to summarize the contributions of IJISAFM to date, across its four-year life. This is done by breifly reviewing some of the honors associated with papers that have appeared in the journal, presenting a taxonomy of paper content by functional area and methodology, and the summarizing the primary contributors, their institutions and the countries in which those institutions reside.

HONORS

In August 1994 the Information Systems/Management Advisory Services Section of the American Accounting Association presented their 'Notable Contribution to the Literature Award' to a paper published in *International Journal of Intelligent Systems in Accounting, Finance and Management*: 'Case-based Reasoning and Risk Assessment in Audit Judgment', by E. Denna,

J. Hansen, R. Meservy and L. Wood, published in Volume 1, Number 3, September 1992. In addition, also in August 1994, B. Back was awarded the 'Notable Contribution to the Literature Award' for the 'AI/ES' Section of the American Accounting Association. She was given the award for a line of research that included a paper in that same issue: 'Assisting Inexperienced Accountants in Developing Financial Statements.'

HOME PAGE

The journal was one of the first to have a home page on the World Wide Web, thanks to Carol Brown. For those interested the URL is:

http://www.bus.orst.edu/faculty/brownc/
isafm/isafhome.htm

The home page contains a variety of different types of information, such as subscription information, editorial board information, etc. In addition, it has a list of the titles, authors and abstracts for papers contributed to IJISAFM and the predecessor journal *Expert Systems Review*.

SPECIAL ISSUES

There have been a number of issues of the journal devoted to specific topics. In particular,

through the first four volumes, both accounting and finance have had 3 special issues, while two focused on machine learning and neural networks. Other special issues have focused on computational models of organizations, insurance, organizational impact and tax. The following is a complete list.

Accounting (V4-N3, V3-N3, V1-N3)

Computational Models (V2-N4)

Finance (V4-N4, V4-N1, V3-N4)

Insurance (V2-N2)

Korea–Japan ES Conference (V3-N2)

Machine Learning and Neural Networks (V4-N2, V2-N1)

Organizational Impact (V2-N3)

Tax (V1-N2)

METHODOLOGY

There have been four volumes of *International Journal of Intelligent Systems in Accounting, Finance and Management*. Volumes 1–4 contained 81 papers (not including software reviews), for an average of about 20 papers per year and five papers per issue. The issues contained, respectively, Volume 1 (25 papers), Volume 2 (18 papers), Volume 3 (19 papers), and Volume 4 (19 papers).

For purposes of the authors/institution/country analyses, the initial summary of papers from the *Expert Systems Review* (O'Leary, 1992) was not included. In addition, for the author/institution/country analysis, the papers relating to the conference reports (Brown, 1992a,b; Brown *et al.*, 1994) and the citation anlaysis/abstract analysis papers (Brown *et al.*, 1992; Shankar *et al.*, 1992; O'Leary, This paper) were not included.

For the author/institution/country analysis two numbers were developed for each author and paper pair. First, the absolute number of appearances for each author, organization and country (total appearances). Second, we calculated the adjusted number of appearances. This was computed as $1/n(k)$, where k is the paper and $n(k)$ is the number of authors on the paper. For example, when a paper had two authors,

each author, their supporting organization and the country of origin of that organization, would each get 0.50.

Although this paper focuses on number of contributions, that does not mean that it has ignored quality issues. Since these papers all appeared in the same journal, issues of quality are normalized. Further, the practices of refereeing and editing minimize the variablity of quality.

TAXONOMY

I analyzed each of the papers in IJISAFM for all four volumes. Each paper was categorized according to a basic functional area

- Accounting/Auditing/Tax
- Finance
- Insurance
- Management/Organization/Strategy
- Methodology (impacts a business functional area, but not directly)
- General Interest (citation analysis, abstract analysis)

In addition, each paper was categorized according to a single type of methodology, including

(1) Multiple Agents
(2) Neural Networks
(3) Knowledge-based System applications
(4) Case-based Learning
(5) Machine Learning
(6) Research/Citations (this paper, abstract citation analysis)
(7) Testing and Validation
(8) Applications
(9) Constraint Logic Programming
(10) Probability and Certainty Factor Models, and a number of other categories

The findings are summarized in Table 1. The papers are relatively evenly distributed between the three primary functional areas of Accounting (29.63%), Finance (28.40%) and Management (20.99), with papers in those three areas accounting for 79% of the papers. The remaining 21% were distributed among Insurance, Methodologies and General Topics.

The papers were categorized into twenty-four different methodologies. The broad range of tasks indicates that the authors have used

Table 1 Taxonomy of contributions to IJISAFM

Methodology	Accounting/ Auditing/ Tax	Finance	Functional area Management/ Organization/ Strategy	Methods	Insurance	General	Totals	Total (%)
Multiple Agents		5	7	1			13	16.05
Neural Networks	2	6	1	1			10	12.35
Knowlege-based and Expert Systems	1	2	3		2		8	9.88
Case-based Reasoning	6		1				7	8.64
Machine Learning	1	3		1			5	6.17
Research/Citations	3		1			1	5	6.17
Testing & Validation	4				1		5	6.17
Applications	1	1			2		4	4.94
Constraint Logic Programming		2	1				3	3.70
Probability & Certainty Factor Models	1			2			3	3.70
Conference Reports						2	2	2.47
Explanation		1		1			2	2.47
Knowledge Acquisition	2						2	2.47
Congnitive Models	1						1	1.23
Database Systems				1			1	1.23
Dynamic Problem			1				1	1.23
Education	1						1	1.23
Graph Theoretic			1				1	1.23
Hypertext				1			1	1.23
Legal Issues	1						1	1.23
Natural Language		1					1	1.23
Organizational Impact			1				1	1.23
Platforms		1					1	1.23
Rough Sets		1					1	1.23
Previous Papers in ESR						1	1	1.23
Totals	24	23	17	8	5	4	81	100.00%
Percentages	29.63	28.40	20.99	9.88	6.17	4.90	100.00%	

a number of methodologies to address the problems. The above-listed ten most frequent methodologies were used in almost 80% of the papers. Three, Multiple Agents (16.05%), Neural Networks (12.35%) and Knowledge-based Systems (9.88%), acounted for almost 40% of the papers.

There were differences in methodologies used across functional areas. The most frequent methodologies were Case-based reasoning (20% of accounting/auditing/tax papers), Neural Networks and Multiple Agents (21.74% and 26%, respectively, in finance), and Multiple Agents (41.17% in Management/Organization and Strategy). Perhaps the most diversfied functional area in terms of methodologies was Accounting, with papers in twelve different categories.

AUTHORS

The authors with two or more appearances are summarized in Table 2. Two authors have contributed four papers, one author has contributed three and thirteen authors have contributed two papars. Those sixteen authors have contributed 23.125% of the total author appearances of 160 and 21.50% of the adjusted appearances.

The leading three contributors were Carol Brown, James Hansen and Daniel O'Leary. The

Table 2 Author contributions

Author	Acutal number	Adjusted number
Carol Brown	4	1.83
Daniel O'Leary	4	2.08
James Hansen	3	1.08
Ho Guen Lee	2	1.50
Walter Hamscher	2	1.33
Gene Rowe	2	1.00
George Wright	2	1.00
Kenneth Cogger	2	0.83
Kurt Fanning	2	0.83
Rober Michaelsen	2	0.83
Kathleen Swigger	2	0.83
Jae Kyu Lee	2	0.75
K. Michael Goul	2	0.58
Rayman Meservy	2	0.58
Robert O'Keefe	2	0.58
Eric Denna	2	0.50

Table 3 Universities employing authors[a]

University	Adjusted number	Actual number
Arizona State University	1.50	5
Brigham Young University	2.75	9
Carnegie Mellon University	2.00	3
Hong Kong University of Science and Technology	1.50	2
Oregon State University	3.00	7
Rensselaer Polytechnic University	2.08	6
Stanford University	1.50	3
Texas A&M University	1.50	6
University of Florida	1.75	3
University of Kansas	1.16	3
University of Massachusetts	1.25	3
University of North Texas	2.00	5
University of Southern California	3.58	7

[a]Only those universities with more than one adjusted appearance are listed.

contributions of O'Leary (editor) were early in the history of the journal, concentrated in Volumes 1 and 2. Brown and Hansen's contributions have been over the life of the journal.

INSTITUTIONS

The institutions supporting the authors are summarized in Table 3 and 4. Table 3 provides a list of the universities whose researchers have contributed more than one adjusted appearance. Researchers from these universities have contributed about 34% of the author-adjusted appearances. Table 4 provides a list of non-universities whose researchers have

Table 4 Non-university organizations employing authors[a]

Business organization	Adjusted number	Acutal number
British Telecom	1.0	2
Coopers & Lybrand	1.0	3
Internal Revenue Service	1.0	2
Lockheed (AI Center and Software Technology)	1.5	4
PHZ Partners	1.0	2
Price Waterhouse	2.0	4
Systor AG, Swiss Bank Group	1.0	1

[a]Only those business organizations with at least one adjusted appearance are listed.

Table 5 Ranking of countries with authors' contributions[a]

Country	Adjusted number	Actual number
United States	54.0	121
United Kingdom	4.0	8
Korea	2.5	7
Japan	2.0	4
Germany	2.0	2
Hong Kong	1.5	2
Switzerland	1.5	2
Canada	1.0	3
Australia	1.0	2
Belgium	1.0	2
The Netherlands	1.0	2
Denmark	1.0	1
Finland	1.0	1
Greece	0.5	1
Poland	0.5	1
Taiwan	0.5	1
Total	75.0	160

[a]Ranked by adjusted number and then by actual number

contributed at least one adjusted appearance. Researchers from these organizations have accounted for over 11% of the adjusted appearances.

COUNTRIES

There has been a large international contribution of IJISAFM. Approximately 25% of the papers were published by authors associated with non-United States affiliations. This is roughly the same as journals such as *IEEE Expert* (e.g., O'Leary 1995). Besides the USA, the largest contributors, based on adjusted contributions, were the United Kingdom, Korea, Japan and Germany (Table 5).

EXTENSIONS

The results presented here could be extended in at least two ways. First, they could be combined with analyses of author/institution/country contributions to other journals, in order to gain a broader understanding of the contributors to AI in business. Second, these results could be combined with results for the *Expert Systems Review*, the predecessor journal to IJISAFM.

Acknowledgements

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