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INTELLIGENT SYSTEMS IN ACCOUNTING, FINANCE AND MANAGEMENT: ISI JOURNAL AND PROCEEDING CITATIONS, AND RESEARCH ISSUES FROM MOST-CITED PAPERS

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SUMMARY

This paper analyses the citations from *Intelligent Systems in Accounting, Finance and Management* that have occurred in ISI's Web of Knowledge in February 2010. I found roughly 1000 citations to the journal under 10 different journal name abbreviations, with roughly 25% of the citations occurring during 2008–2009, associated with 27 of the more frequently cited papers. Using that citation data, the *H*-index and the 40 (42 with ties) most-cited papers are presented. I found that ISI's new proceedings data appear to have a different citation pattern than ISI's journal citation data, resulting in citations to more sources, but fewer citations per source. I also examine the research methodologies and applications of the most-cited papers in an attempt to determine what areas have been cited most and where there are potential gaps in the research. Copyright © 2010 John Wiley & Sons, Ltd.

Keywords: naming a journal; ISI proceeding citations; ISI journal citations; Google citations; most-cited papers; research topics in artificial intelligence

1. INTRODUCTION

How many Institute for Scientific Information—Thompson (ISI) Web of Knowledge citations have been made to papers published in John Wiley's *International Journal of Intelligent Systems in Accounting, Finance and Management* (IJISAFM)/*Intelligent Systems in Accounting, Finance and Management* (ISAFM)? What journal abbreviations have been used by ISI, also known as Social Science Citation Index (SSCI), to summarize citations to IJISAFM/ISAFM data? Which of those papers have the most ISI citations? What is the impact on the number of citations of ISI adding proceedings as a citation source? Using those most-cited papers, which methodologies and applications appear to have generated the most interest, and are there any 'gaps' that have only received limited attention?

Unfortunately, these questions have only received limited attention in the literature, since there has been a limited amount of research about publication content and citation patterns in IJISAFM/ISAFM ('this journal') and ISI's proceeding citations only began in January 2010. O'Leary (1995) investigated the primary applications addressed and corresponding methodologies used by the research papers in this journal; however, that was 15 years ago. More recently, O'Leary (2009) investigated the relationship between number of papers downloaded from Wiley's website over the time period 2000–2002 for IJISAFM, and the corresponding citations captured by both Google Scholar and ISI Web of Knowledge as of March 2008. In that paper, the primary focus was on how the most downloaded papers showed up in subsequent citations from those two sources. However, using Google Scholar,

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that paper also investigated the number of citations associated with those papers identified as the more frequently cited papers. Unfortunately, Google Scholar is only in 'beta' release. As a result, there were some limitations associated with that study which are addressed in this study by focusing on ISI's citations.

In particular, this paper expands that previous research to use information gathered from ISI's Web of Knowledge to drive the citation analysis. Using this approach, I find a number of different papers are among the most-cited papers, compared with the O'Leary (2009) analysis. I also find that using ISI's new proceedings data does not have much impact on determination of the most-cited papers, but increases the number of citations and substantially increases the number of papers cited one time. As a result of these findings, it appears that citation patterns may be different for proceedings than for journal articles, and I examine some reasons for that occurrence. Finally, I examine the methodologies and applications used in those most-cited papers. This approach can provide insight into which artificial intelligence methodologies and which applications have generated the most interest, and potentially where there are corresponding 'gaps' in the literature.

1.1. This Paper

This paper proceeds in the following manner. Section 2 briefly reviews citation analysis, including a brief discussion about ISI's Web of Knowledge and the difference between ISI's use of indexed and nonindexed journals. Section 3 examines some of the limitations associated with capturing citations from ISI for this journal. Section 4 establishes the research issues examined in this paper. Section 5 summarizes the approach used to generate and investigate the citations. Section 6 summarizes the findings, including a summary of the total number of citations, the *H*-index and the impact of ISI adding proceeding citations. Section 6 also examines the methodologies and applications addressed by the most-cited papers. Finally, section 7 summarizes the paper and provides some extensions.

2. CITATION ANALYSIS

Citation analyses have been done in many disciplines, including computer science (e.g. http://www.in-cites.com/analysis/03-sixth-com.html). Many of those investigations have generated an historical analysis of who is the most cited, what institutions and countries are the most cited and which journals are the most cited. Researchers have investigated the *H*-index of different journals and found that the *H*-index (Hirsch, 2005) is related to departmental rankings (e.g. O'Leary 2008) and that citations are related to both numbers and rankings of electronic downloads of journal papers, even after a number of years have gone by (O'Leary, 2009).

2.1. Importance of Citation Analysis

There are a number of benefits of citation analyses.

1. The authors of the most-cited papers are likely to benefit, since to have a most-cited paper is likely to be prestigious and may facilitate resource allocations at their institutions. Diamond (1986) argues that citations have an economic benefit and that, as a result, citations provide a measure of human capital that an individual has associated with publications.

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2. Citation analysis of recent papers can point to emerging topics (e.g. Garfield and Welljams-Dorof, 1992). As a result, most-cited papers can lead to researchers examining recent topics or extending existing topics.
3. An older, most-cited paper is likely to point to historically important topics, e.g. using particular methodologies or application to particular settings. Thus, citation analysis can help structure a research discipline, by establishing key research topics.
4. Citation analysis provides a quantitative insight into history of a discipline. Ultimately, citations provide a basis to understand what has happened in a field in terms of contributors and topics investigated.
5. In some cases citations are used for annual performance evaluation, for getting a PhD or tenure (e.g. Xin, 2006). In such settings, individual researchers can benefit from the notoriety of having a paper among the most-cited papers.
6. Since citations are one measure of the attention paid to a paper by others, they provide an output measure of the importance of the paper. Accordingly, this notion suggests citations to the paper, not just the journal that a paper is published in, determine the relative importance or contribution of the paper. As a result, it is not surprising that Smith (2004) and others have asked the question 'Is an article in a top journal a top article?'

2.2. Qualitative Analysis

Citations provide a quantitative approach to measuring importance. Information about the published papers can be captured, categorized and counted. However, even the most optimistic citation expert does not suggest that citation data replaces qualitative analysis of experts in the field. Instead, as noted by Garfield and Welljams-Dorof (1992), citations simply supplement that expert perspective and can be used to provide a more balanced analysis.

2.3. ISI's Web of Knowledge

Historically, the most frequently used source of citation analysis has been ISI's Web of Science (e.g. Oxley, 1998). ISI has a Web presence that makes gathering citations for some individual or journal relatively easy. In addition, ISI limits its citations to particular journals that it indexes. As a result, ISI has a built-in quality filter by limiting the source of those citations.

ISI's database of citations been used for many purposes, including the ranking of

- individuals (Garfield and Welljams-Dorof, 1992);
- journals (Smith, 2004);
- US research universities in different scientific arenas, such as biology and neuroscience (Adams, 1998);
- scientific wealth of nations (e.g. May, 1997).

As of 1 January 2010, ISI began to include proceedings in their citations. Unfortunately, it is not clear what the impact of adding proceedings will be on the numbers of citations and the number of articles cited. In any case, ISI allows the user the ability to include or exclude the citation information gathered from proceedings. As a result, an emerging research issue is the nature and impact of that proceedings data on citations.

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2.4. ISI-indexed Journals Versus Not-indexed Journals

ISI indexes a number of publications in order to generate the citations for their databases. If a publication is indexed, then every reference in every article in those journals is captured and summarized in its list of citations. The paper itself is not indexed until (if) it is cited. Thus, every record in ISI has been cited at least one time in an ISI-indexed journal.

Inevitably, many journal names are longer than the space allocated in the ISI systems; as a result, ISI typically abbreviates the journal names in their databases using a unique abbreviation. Thus, cited journals have abbreviated names that are used to capture the citations from those journals. ISI provides a list of those names for journals that are indexed so that users can rapidly find the citations to those particular publications.

However, if a journal is not indexed then there is no single promulgated name or abbreviation used to capture citations. As a result, if a journal is not indexed then there can be multiple abbreviations, and in some cases a non-indexed journal can be indexed under the name of an indexed journal. Further, if a journal is not indexed, then that means that citations are not gathered from the references of those papers for ISI's World of Knowledge. Since it is likely that a major source of citations for a journal are articles from the journal itself, then that suggests that indexing a journal would lead to substantially more citations in the ISI index.

2.5. Measuring Number of Citations per Year

The ISI database is designed to allow the user the ability to determine the number of citations associated with papers published in a particular year. This concept is behind the notion of ISI's 'impact factor'. With impact factor, only citations to the most recent k years of publications are used to track citations to a journal, relative to the number of papers published in the journal during those k years. Typically, k is set to 2 or 5 years. Accordingly, the finding associated with impact factor is the extent to which papers from the most recent k years have been cited. No attention is paid to papers $k + 1$ years or older. This approach generates an estimate of the impact of recent papers, but does not include the impact of older papers. Unfortunately, this approach can be sensitive to short-term research fashions and the nature of the discipline. As a result of these and other issues, there has been concern over the use of journal impact factor to assess the quality of a journal (e.g. Seglen, 1997).

Unfortunately, with ISI's Web of Knowledge, it is more difficult to determine the number of citations that occur in a given year in the database to all of the articles in a journal. For example, determining how many articles referenced articles of any year in IJISAFM/ISAFM, during 2008, is not an easy query to make. One approach to circumvent that limitation is to take a 'snapshot' of the ISI database in one year and then take another snapshot in a later year or years. For example, if I have snapshots of the total number of citations in 2007 and 2010, then I can determine the total incremental number of citations that occurred in 2008 and 2009. This approach uses citations to all of a journal's articles, not just the more recent k.

There are a number of reasons why the latter approach is preferable to the former approach. First, for small k there is concern that citations are attributed to 'research fads and fashions'. Accordingly, there is a danger that to generate large impact factors the focus is on topics only of immediate interest. Second, if the focus of a publication truly is on research issues raised in recent papers, then it can become difficult to establish lines of research. Instead, the research would constantly be chasing new and newer topics. Third, the nature of the discipline itself and research in that discipline can drive the impact factor. To illustrate, some academic disciplines are more likely to be tuned to recent events.

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For example, research affected by changes in the law will be sensitive to current changes in the law. In such cases, the focus of the research truly can be expected to be on more recent research. Fourth, if current research is cited in a short window of size k, then there is concern that the research does not anticipate future research interests. Identification of older papers ($k + 1$ years or older) provides insight into the 'longevity' of the paper, with older papers still being cited. ISI addresses this issue, in part, by gathering and reporting the 'cited half-life'. Finally, this approach ignores the citations of older papers that form the classic foundation of lines of research in a discipline, and those over which the reputation of a journal has been developed.

2.6. Google Scholar

Like ISI, Google Scholar (http://scholar.google.com/schhp?hl=en&tab=ws) also provides a list of citations to research papers. In particular, Google Scholar generates a list of citations to resources that are found on the Internet. Unlike ISI, Google Scholar does not discriminate between journals, proceedings or unpublished papers that are available on the Internet. Any citations that it finds are captured and reported.

Google Scholar provides a 'beta' product that can be used to search for citations. Because it is in beta form, it is constantly changing, and findings are not necessarily stable. For example, in 2008, Google Scholar provided lists of leading scholars ('key author') for particular subject queries, but in 2009 those apparently were discontinued.

Currently, as part of its general search capability, Google Scholar allows the user to search any issue related to the papers, e.g. journal name. However, in addition to its general search capability, Google Scholar has an advanced search capability that allows a user to search for a topic within a particular journal name or abbreviation.

A number of researchers have compared the citations in ISI and Google Scholar (e.g. O'Leary, 2009) to find that the two sets of citations are highly correlated, and that, generally, Google Scholar generates larger numbers of citations.

2.7. Previous Study of ISAFM/IJISAFM Citations

There has been limited analysis of citations from ISAFM/IJISAFM. O'Leary (2009) investigated the relationship between those papers that were among the more frequently downloaded from the journal website in 2000–2002, and their citations in both ISI and Google Scholar. In addition, O'Leary used Google Scholar as the basis of a search for the most-cited papers in this journal. Using Google Scholar's search capability, and variations of this journal's name, the 40 most-cited papers from this journal were found. Then, for each of those papers, O'Leary went to the lead author and gathered all of the citations to the paper in ISI's Web of Knowledge.

Although O'Leary (2009) analysed the most-cited papers up until March 2008, using Google Scholar, the Google search engine was still in 'beta' format and, as a result, still had some limitations. Unfortunately, some of the more-cited papers in this journal were not found in O'Leary (2009). Although O'Leary (2009) used a number of different representations of the journal name as part of that search, a number of other more-cited papers were found when starting with ISI Web of Knowledge (see below), instead of Google Scholar, including some citations that were found to have larger numbers of Google Scholar citations.

Unfortunately, that limitation is still an issue today if Google Scholar is used. For example, a February 2010 search using the complete journal name did not yield Yu and Mylopoulos (1996), and

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other papers. As a result, in O'Leary (2009), some of the more frequently cited papers from this journal apparently were not found using a Google Scholar search. Accordingly, there is a need to complete that analysis and determine the more frequently cited papers in this journal. Because of the apparent limitations in Google Scholar, this paper uses ISI's World of Knowledge as the database to determine the most-cited papers and mitigate some of the limitations of that previous study.

ISI is easier to find journal names under which citations to the journal are captured. Under ISI, the many names associated with non-indexed journals can be assessed by analysing the citation records of authors who have published in a particular journal. However, under Google Scholar, it is not clear how to find out what journal names are used. Analysing citations of particular authors will not necessarily provide access to the journal names, since Google Scholar often provides only partial names.

3. LIMITATIONS OF CAPTURING CITATIONS OF IJISAFM/ISAFM IN ISI'S WORLD OF KNOWLEDGE

IJISAFM and the subsequently renamed ISAFM were first published by John Wiley in 1992. The journal replaced the University of Southern California journal entitled *Expert Systems Review* that was privately published for 2 years.

When we named the journal *International Journal in Intelligent Systems in Accounting, Finance and Management* we thought that the name was appropriate, because it would capture interest, since the name would indicate that the journal was an application version of a journal already published by the same company (John Wiley), *International Journal of Intelligent Systems*, and the name included a broad set of business application areas: 'Accounting, Finance and Management'.

Although such a name may interest researchers and readers and establish its area of application, the name has made capturing and finding citations to the journal difficult. In particular, three basic issues have led to potential problems associated with ISI capturing citations for this journal.

3.1. Name is too Long

First, the name is too long. A long name may be abbreviated by the author, the journal referencing the paper and an indexer. Unfortunately, there is no guarantee that the abbreviations will be the same or that any of the users will recognize the name.

As a result, there are at least four problems associated with the length of the name of the journal that have inhibited the ability to find citations from IJISAFM. First, the name *International Journal of Intelligent Systems in Accounting, Finance and Management* is too long for authors. Because of the length of the name of the journal, in some cases researchers have tried to abbreviate the journal name in their references. Second, since journal page space is costly, journals are likely to try to abbreviate the name of the journal. Third, since there are many potential abbreviation combinations, it is probably not surprising that I found ISI has used at least 10 combinations to construct abbreviations for this journal. For example, based on an analysis of abbreviation names, ISI appears to have roughly 19 characters, including spaces, for journal abbreviations in their citation database. Unfortunately, the original journal name had 82 characters including spaces. As a result, over 75% of the characters must be removed, resulting in a potential loss of meaning. Fourth, there is no clear single dominant abbreviation from the title. As a result, multiple abbreviations could be generated, depending on what is seen in the name by the author, journal or indexer.

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3.2. Name is too Similar

The journal name also is too similar to at least one other journal. As a result, there is likely to be confusion as to the journal. IJISAFM had the same first five words as the journal *International Journal of Intelligent Systems*, edited by Ron Yager, and indexed by ISI. As a result, it is likely that some of the citations could be mistaken for the sister journal. Not surprisingly, I found over 100 papers from this journal captured in the citations under the main abbreviation for *International Journal of Intelligent Systems*, where there were roughly 800 properly indexed papers from *International Journal of Intelligent Systems*.

3.3. Name Change

Because of these problems and after an editor change, the name of this journal was changed to *Intelligent Systems in Accounting, Finance and Management* in 2004. Unfortunately, this further compounded problems with capturing citations from this journal. The change in names means that now there are even more different names/abbreviations under which we are likely to find citations. That is, papers from the different time periods are likely to be found under even more different abbreviations. In addition, the new name is still a long name. As a result, abbreviations still must be used to capture the journal name in a citation.

However, there is some 'good news' about the new name. Under the new name, a number of distinctive abbreviations could easily be made to distinguish it from the sister journal. For example, 'Intell Syst Acc', which would be only 15 characters long, or ISAF (its DOI—digital object identifier name), which is only four characters, could be used.

3.4. Impact of Choosing a Journal Name

This discussion has some implications for journal editors choosing a name for a journal in the future. In particular, if we had the ability to start over with a new name, we would have chosen one completely different than any other existing journal or book name. In addition, we would have chosen a short name so that no ISI abbreviation was necessary. Instead, ISI could use the actual name, rather than an abbreviation. In so doing, citations could be more easily and accurately tracked.

4. RESEARCH ISSUES

This paper addresses three basic research issues. First, in order to try to understand how many citations the journal has received in ISI-indexed journals, a detailed study was established. The purpose was to answer a number of questions regarding the number of citations, including:

- Where are the citations being recorded, i.e. under what abbreviations?
- How many citations has the journal received?
- What is the *H*-index of the journal?
- How many citations occurred during 2008 and 2009?

Second, this paper is concerned with beginning to understand the impact of ISI's movement to include proceedings on the number of citations and indices, such as, the *H*-index. Since ISI added the potential of citations from proceedings, there have been a number of questions, including:

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- How many citations are due to the proceedings in contrast to journals?
- Is the 'pattern' of citations from proceedings similar to the 'pattern' from journals?

Third, in concert with the notion that citation analysis can direct us to key topics, three major concerns addressed were:

- What were the primary intelligent system tools or approaches used by the most-cited papers?
- What were the primary application topics examined?
- What 'gaps' were there in the literature?

5. APPROACH

This paper used a different approach to gathering citations than O'Leary (2008), by focusing on those citations in ISI's Web of Knowledge rather than Google Scholar. However, unfortunately, since this journal is not indexed by ISI, there is no single journal title abbreviation under which the citations would be captured. As a result, a large number of potential ISI name abbreviations were examined for whether or not they included papers from ISAFM or IJISAFM. Those names were generated by examining the citations of known authors in order to determine the names under which their papers to this journal were categorized by ISI.

Using each of the ISI journal name abbreviations, on 4 and 5 February 2010, all (assuming those 10 journal names contain the universe of papers) of the individual citations to IJISAFM and ISAFM in ISI's Web of Knowledge were captured. Then, each of the entries was examined for whether or not it came from this journal by tracing each of the citations to a physical copy of this journal to determine if indeed it was associated with this publication. After all of the individual citation items were gathered, I aggregated all of the citations associated with each paper into a single total for each of the individual papers. As an example, in one case this meant combining six different independent records to form a single record for one paper with all of the different citations.

In order to be consistent with and allow comparison with O'Leary (2009), I also gathered the number of Google Scholar citations in February 2010 and included the ISI and Google data from 2008 generated in O'Leary (2009). In order to find the number of citations of each paper in Google Scholar, I entered the title of the research paper in Google Scholar search.

Finally, in order to understand what were the primary topics and applications of the most-cited papers from this journal, I examined each paper for its methodology and application base. I summarized those in a matrix which I used to determine the primary intelligent system tools used and what application they were used to study.

6. FINDINGS

This research resulted in a number of different findings regarding the citations from this journal in ISI.

6.1. Names of Journal in ISI and Google Scholar Advanced

Ultimately, 10 journal name abbreviations were found in the ISI Web of Knowledge to contain citation references to at least one paper in IJISAFM/ISAFM. Those names are summarized in Table I.

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Table I. Abbreviations used in ISI to Capture Citations to ISAF and IJISAF

	ISI Abbreviations
1	INT J INTEL SYSTEM A
2	INT J INTELL SYST
3	INT J INTELL SYST AC
4	INT J INTELLIGENT SY
5	INTELL SYST ACCOUNT
6	INTELL SYST ACCOUNTI
7	INTELLIGENT SYST ACC
8	INTELLIGENT SYSTEM A
9	INTELLIGENT SYSTEMS
10	J INTELLIGENT SYSTEM

Similarly, I analysed Google Scholar Advanced and found the journal name allowed that the system would take up to 59 characters, including spaces. I found that the following names included papers from this journal: 'International Journal of Intelligent Systems in Accounting', and 'Intelligent Systems in Accounting, Finance and Management' and 'Int. J. Intell. Sys. Acc. Fin. Mgmt.' It is not clear if there are additional names that should be included.

6.2. Number of ISI-Cited Papers and ISI Citations

The total number of ISI citations to this journal and corresponding articles, when including proceedings, were 227 and 970 respectively. When proceedings were not included, there were 191 items and 917 citations.

As a basis of comparison with other journals, O'Leary (2007) found that the journal *Human Systems Management* over its 25-year history had roughly 444 ISI citations and had been indexed in earlier years by ISI. Over a 23-year history (1986–2008), the ISI-indexed journal *Artificial Intelligence Review* had 276 items and 1948 citations under the name 'ARTIF INTELL REV'.

6.3. Impact of Proceedings on Number of ISI Citations

The total numbers of ISI citations, with proceedings and without proceedings, are summarized in Tables II and III by abbreviation. I found 36 new papers, along with 53 citations, with an average of 1.47 citations when proceedings were accounted for. This was a 15.86% increase in the number of papers, but a 5.46% increase in the number of citations. As seen in Table IV, as of this point in time, the primary impact of the proceedings is to increase the number of papers with one citation. Accordingly, at least for this specific journal, the additional proceedings citations generally do not contribute substantial numbers of citations, but more papers are cited. It will be interesting to see how or if this changes over time. However, to this point in time, it appears that the pattern of citations with journals and proceedings is different, with proceedings having a substantially lower number of citations per paper, but relatively more papers cited.

6.4. Most-cited Papers and *H*-Index

In order to maintain consistency with O'Leary (2009), I analysed the 40 ISI most-cited papers from this journal (actually 42 here, because of ties in numbers of citations). Those papers and their citations,

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Table II. ISI name and citations (proceedings included)

ISI Abbreviation	Number in ISAFM	Total in ISI abbreviation	Total number of citations	ISAFM time range
INT J INTEL SYSTEM A	1	1	1	1999
INT J INTELL SYST	114	1366	620	1992–2005
INT J INTELL SYST AC	11	11	16	1994–2004
INT J INTELLIGENT SY	20	203	25	1993–2004
INTELL SYST ACCOUNT	3	3	9	1993–2006
INTELL SYST ACCOUNTI	1	1	6	2004
INTELLIGENT SYST ACC	1	1	1	1997
INTELLIGENT SYSTEM A	2	37	2	1993–1997
INTELLIGENT SYSTEMS	67	857	276	1992–2009
J INTELLIGENT SYSTEM	7	174	14	1992–2001
	227	2654	970	

Table III. ISI name and citations (proceedings not included)

ISI Abbreviation	Number in ISAFM	Total in ISI abbreviation	Total number of citations	ISAFM time range
INT J INTEL SYSTEM A	1	1	1	1999
INT J INTELL SYST	101	1182	603	1992–2005
INT J INTELL SYST AC	11	11	16	1994–2004
INT J INTELLIGENT SY	15	133	19	1993–2004
INTELL SYST ACCOUNT	3	3	9	1993–2006
INTELL SYST ACCOUNTI	1	1	6	2004
INTELLIGENT SYST ACC	1	1	1	1997
INTELLIGENT SYSTEM A	0	0	0	1993–1997
INTELLIGENT SYSTEMS	52	580	249	1992–2009
J INTELLIGENT SYSTEM	6	124	13	1992–2001
	191	2036	917	

Table IV. Frequency of occurrence of citations per paper

Number of citations	Total number of papers	
	With proceedings	No proceedings
20–72	9	9
15–19	8	6
10–14	14	16
6–9	18	16
5	10	9
4	12	12
3	13	14
2	25	24
1	57	44
	166	150

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Table V. Most-cited papers

Rank	Reference	ISI		Google	
		2010	2008	2010	2008
1	Slowinski and Zopounidis (1995)	72	47	129	88
2	Bryant (1997)	38	9	44	32
3	Herbst and Karagiannis (2000)	36	19	110	78
4	Kohara *et al*. (1997)	32	16	56	34
5	Decker (1994)	29	20	129	93
5	Fanning and Cogger (1998)	29	9	78	44
7	Lee and Kim (1997)	28		44	
8	Yu and Mylopoulos (1996)	24		153	
9	Singh and Huhns (1999)	22	6	48	28
10	O'Leary (1998)	19	12	46	31
11	Anandarajan *et al*. (2001)	18		22	
11	Jhee and Lee (1993)	18	6	33	18
13	Chung and Tam (1993)	16	8	36	21
13	McKee (2000)	16	8	36	14
15	Coakley and Brown (2000)	15	6	41	31
15	Fanning and Cogger (1995)	15		54	
15	Boritz *et al*. (1995)	15	11	43	29
18	Swicegood and Clark (2001)	14		20	
18	Poh *et al*. (1998)	14	4	19	16
20	Brown and Gupta (1994)	13	8	29	16
20	Jung *et al*. (1999)	13	4	31	16
22	Maher and Sen (1997)	12	8	38	25
23	Barniv *et al*. (1997)	11	6	26	26
23	Fanning and Cogger (1994)	11	2	36	35
25	Bell (1997)	10	4	25	13
25	Jin and Levitt (1993)	10		31	
25	Kwon *et al*. (1997)	10	8	29	20
25	Lin and Carley (1993)	10	9	18	11
25	Nissen (2000)	10		19	
25	Srivastava *et al*. (1996)	10	6	23	16
25	Stefanowski and Wilk (2001)	10	6	21	10
32	Bensic *et al*. (2005)	9		6	
32	Nanda and Pendharkar (2001)	9		16	
34	Duchessi *et al*. (1993)	8		5	
34	Etheridge and Sriram (1997)	8	6	27	17
36	Bennell and Sutcliffe (2004)	7		14	
36	Chen *et al*. (1999)	7	2	17	10
36	Duan *et al*. (1998)	7		2	
36	Morris (1994)	7	4	20	11
36	O'Keefe *et al*. (1993)	7		8	
36	O'Leary (1995)	7		8	
36	Vojinovic *et al*. (2001)	7		13	
Totals		683	254	2003	783

including proceedings, are summarized in Table V. Those 42 most-cited papers yield 70.4% (683) of the total ISI citations to this journal and 25.1% of the papers that were cited.

I also found that using or not using the proceedings information did not change the ISI Web of Knowledge *H*-index for IJISAFM/ISAFM. In both cases the *H*-index was 15.

In addition, I investigated the Google Scholar *H*-index and found that it was 25, compared with 20 in 2008 (O'Leary 2009). This increase included four papers not included in O'Leary (2009) for reasons discussed below. In addition, for the 42 most-cited papers, the correlation between numbers of citations for the ISI and Google Scholar lists (including and not including proceedings) was 0.756.

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Table VI. Number of most-cited papers and their citations by year

Year	Number of papers	Number of citations
1993	6	69
1994	4	60
1995	4	109
1996	2	34
1997	8	149
1998	4	69
1999	3	42
2000	4	77
2001	5	58
2002	0	0
2003	0	0
2004	1	7
2005	1	9

6.5. Citations and Time

I analysed the relationship between rank and number of citations among the most-cited papers. Both the correlation between time and rank and between time and number of citations was statistically insignificant. Several recent papers were among the most cited, including Bennell and Sutcliffe (2004) and Bensic *et al*. (2005). In addition, recent papers not making the list, but having a relatively large number of citations, included Maringer and Oyewumi (2007) and Li and Li (2009).

However, when analysing Table VI, it is apparent that both the number of papers and numbers of citations among the most cited are, as expected, negatively correlated with year (more in the older years) and statistically significantly different than zero (–0.654 and –0.644). Further, the number of most-cited papers and number of citations in those papers are positively correlated over time, and statistically significantly different than zero (0.912).

6.6. Comparison of ISI's Web of Knowledge in 2008 with 2010

O'Leary (2009) data that was generated in March 2008 can be compared with February 2010 in this study, roughly a 2-year difference. Of the most-cited 42 papers, 27 were also included in O'Leary (2009). The correlation between the number of ISI citations for those 27 papers from 2008 and 2010 was 0.8987. Accordingly, the number of ISI citations in 2008 and 2010 are highly correlated and statistically significantly different than zero. Similarly, for those 27 papers, the numbers of citations from Google Scholar in 2008 and 2010 are highly correlated and statistically significantly different than zero with a correlation of 0.979. Further, the ISI citations and the Google citations were highly correlated and statistically significantly different than zero for both 2008 (0.796, for 27 citations) and 2010 (0.756 for 42 citations) respectively.

Finally, the number of Google citations in 2008 and the number of ISI citations in 2010, and the number of ISI citations in 2008 and the number of Google citations in 2010, for the 27 most-cited papers, were highly correlated and statistically significantly different than zero (0.791 and 0.823 respectively). As a result, it appears that the Google citations may help predict the ISI citations and conversely.

Using this data we can also access the number of ISI citations that occurred over almost 2 years, beginning in March 2008 through January 2010, among those 27 papers. For the 27 papers there were respectively 254 and 503 citations. This indicates that simply for those 27 papers there were roughly

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250 citations in 2008 and 2009. This illustrates that those most-cited papers from this journal are apparently dynamic and resilient over time, since they are generating substantial numbers of citations, apparently helping to create foundations for lines of research.

Unfortunately, I only have data for those 27 papers, since those were the only papers occurring in O'Leary (2009). However, this suggests that, over 2008–2009, additional ISI citations were also made to this journal, beyond those 27 papers.

6.7. Missing Papers from O'Leary (2009): Why Didn't We Find Some of the Papers the First Time?

It is unclear as to why only 27 of the 40 (42 because of ties) most-cited papers were found from the Google Scholar search taken in O'Leary (2009). Based on the numbers of citations in this study, it appears that some of the papers that were not found as among the more cited could have been among the more cited had they been found. However, it is likely that the same name problems discussed above that influenced how Google has the journal captured in its database influenced the ability to find papers in Google Scholar. In particular, the right abbreviation for the name must be found and used to find papers, if a search on a journal name is pursued. As seen above, at least three names are used in Google Scholar to index papers from this journal.

In some cases, papers are not indexed under a journal name in Google Scholar (e.g. Jin and Levitt, 1993) or are indexed under alternative publication source names (e.g. Fanning and Cogger, 1995). In addition, to further substantiate the results in O'Leary (2009), on 7 February 2010 I did a general search in Google Scholar for 'International Journal of Intelligent Systems in Accounting, Finance and Management' and did not find Yu and Mylopoulos (1996), Lee and Kim (1997) or Jin and Levitt (1993) in Google Scholar in 2010. I think that the findings can be attributed to the fact that Google Scholar is in beta format, and it is likely that there are some limitations associated with the tool at this time. Perhaps an advanced search under an abbreviation of the journal name would have found more of the papers included here back in 2008. Although the papers may be found with direct search of the article title, authors or by analysing the journal title under Google Scholar Advanced, variations in the indexing of the journal title can inhibit the ability to find articles and the number of citations to the papers in Google Scholar.

6.8. Topics and Methodology

Table VII provides a summary of the primary methodologies and applications used among the most-cited papers in Table V. The dominant methodology among those papers is neural networks, followed by multiple agents and case-based reasoning. The dominant application is bankruptcy prediction, followed by predicting stock prices, options, etc., with a tie for third between accounting/finance and management/organizations. The joint methodology and applications with the largest number of papers were neural net bankruptcy prediction and neural net stock price/options/derivative prediction.

7. SUMMARY AND EXTENSIONS

This paper investigated three key issues. First, what is the nature of ISI citations in IJISAFM/ISAFM? What titles are used to capture the citations and which papers are among the most cited? How many

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Table VII. Summary of the primary methodologies and applications used among the most-cited papers in Table V

	Bankruptcy prediction	Stock price/ options pricing/ derivatives	Accounting/ finance	Management and organizations	Workflow	Credit	e-Business	Forecasting	Fraud	Gaming	Marketing	Total
Neural networks	9	4	1			1		1	2		1	19
Multiple agents				3	2		1					6
Case-based reasoning	1		2			1	1					5
Expert systems			1	1						1		3
Artificial intelligence			1	1								2
Machine learning	1				1							2
Rough sets	2											2
Data mining								1				1
Fuzzy		1										1
Genetic algorithm		1										1
	13	6	5	5	3	2	2	2	2	1	1	42

citations are made to the more cited papers? What is the *H*-index of the journal? Second, how do ISI's citations to journals differ from ISI's citations to proceedings? Third, what artificial intelligence methodologies and what application areas were used in the most-cited papers?

7.1. Number of Citations and Publication Titles

This paper studied the most-cited ISI-cited papers from this journal and contrasted those citations over the time period 2008 to 2010. I found roughly 1000 ISI citations among 10 different titles, with an *H*-index of 15. Using Google Scholar, I found that those same papers had roughly 1600 Google citations, among three titles of this journal, with an *H*-index of 25.

This paper found that O'Leary's (2009) study using Google Scholar as a basis to find most-cited papers to this journal had some gaps, in that it did not find certain of the more-cited papers (15 of the 42 most cited when using ISI citations). Further, recent searches discussed in this paper above substantiated the findings that many of the more-cited papers were not found using a journal name search in Google Scholar. As a result, it is important to keep in mind that Google Scholar is a 'beta' product and that there are certain limitations in its use, which appear to be mitigated by the use of ISI as a tool to find which are the most cited. Future research could focus on understanding the journal name indexing in Google Scholar. Future research also could again compare the number of citations with those obtained at some time in the future, in order to compare citations and citation rates occurring to this journal.

7.2. ISI Journal and Proceedings Citation Patterns

This paper found that the pattern of ISI's citations from journals is different than ISI's citations from proceedings. In particular, I found that the ISI citations to proceedings appear to be to a larger number of articles, but fewer citations per article. As part of that trend, there seem to be a large number of single-citation articles in ISI's proceeding citations.

There are a number of reasons to suggest that the citation pattern is different. First, proceedings generally are not as heavily refereed as journals. Journal papers can go through multiple rounds of refereeing, by multiple referees, whereas proceedings typically involve a single round, generally with one or two referees. Further, the expectations for a journal paper compared with a conference proceeding paper generally are less. As a result, there would be less concern with ensuring that key citations are included in proceedings compared with journal papers. Second, proceedings generally are more space constrained. For example, proceedings papers frequently are limited in length as a condition of submission. As a result, there is less room for citations or even referencing previous research. Third, there may be more self-citation in proceedings than in journals. If a journal uses so-called blind refereeing, then authors are not likely to include self-citations since those self-citations may provide a signal to the referee as to who the author is. However, in proceedings, the author may be interested in signalling to the conference that they are an expert in the area of the paper. In such situations, with fewer referees or less intense refereeing, self-referencing could provide the conference proceedings officials an indication of quality of the publication. However, this is an empirical question subject to potential future research.

In order to study patterns of citations in proceedings more completely, future research could investigate additional journals to determine whether the effect illustrated here is consistent across other journals. In addition, the citation pattern of proceedings would need to be examined over time for this and other journals. Both of these approaches would allow determining whether the citation patterns are different in proceedings than in journals.

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7.3. Methodologies and Applications of Most Cited

Finally, this paper summarized the methodologies and applications used in the most-cited papers. Such a summary of artificial intelligence methodologies and applications used by the most cited can be used to provide insight into potential research projects from at least two different perspectives. First, the analysis in Table VII can be used to provide insight into the potential 'gaps' in the literature. For example, none of the most-cited papers attacks the bankruptcy problem using intelligent agents or genetic algorithms. Second, if the research seems concentrated on particular problems and methodologies, then that could indicate that those are more important problems and methodologies. Using this perspective, bankruptcy prediction and neural networks would seem to be particularly important.

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