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Comparing the expert survey and citation impact journal ranking methods: Example from the field of Artificial Intelligence

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ABSTRACT

The purpose of this study is to: (1) develop a ranking of peer-reviewed AI journals; (2) compare the consistency of journal rankings developed with two dominant ranking techniques, expert surveys and journal impact measures; and (3) investigate the consistency of journal ranking scores assigned by different categories of expert judges. The ranking was constructed based on the survey of 873 active AI researchers who ranked the overall quality of 182 peer-reviewed AI journals. It is concluded that expert surveys and citation impact journal ranking methods cannot be used as substitutes. Instead, they should be used as complementary approaches. The key problem of the expert survey ranking technique is that in their ranking decisions, respondents are strongly influenced by their current research interests. As a result, their scores merely reflect their present research preferences rather than an objective assessment of each journal's quality. In addition, the application of the expert survey method favors journals that publish more articles per year.

1. Introduction and literature review

The contemporary society is fascinated with rankings. Rankings exist in all areas of human activities. Anecdotal evidence suggests that everything that can be possibly ranked has already been ranked. Examples include but are not limited to sports stars, celebrities, websites, technologies, movies, songs, business people, cars, and even countries. Academia also jumped on the bandwagon a long time ago; there are various rankings of universities, programs, departments and individual researchers, which appear in magazines, newspapers and scholarly outlets. Peer-reviewed journals have never been an exception; perhaps every scholarly journal with a publication history of a few years has already been ranked.

Academic journal ranking is a somewhat controversial matter (Mingers & Harzing, 2007). On the one hand, journal rankings offer various benefits. They help researchers demonstrate their accomplishments to colleagues, administrators and tenure and promotion committee members, especially those not familiar with the applicant's research domain (Coe & Weinstock, 1984; Lowry, Humphreys, Malwitz, & Nix, 2007). Academics publishing in top-tier journals receive higher salaries (Gomez-Mejia & Balkin, 1992; Mittal, Feick, & Murshed, 2008). MBA students attending business schools whose faculty publish in major journals earn more after graduation (O'Brien, Drnevich, Crook, & Armstrong, 2010). Some schools have developed policies to financially reward their faculty for publishing in top-tier journals (Manning & Barrette, 2005). By knowing journal rankings, scholars may submit their manuscripts to the highest-ranked outlet available for the topic to improve their future career. Libraries may utilize ranking lists to allocate their limited subscription resources. Students,

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new scholars and practitioners may consult ranking lists to find the most credible sources for theories, ideas, and research methods. Editors may want to know about the relative standing of their journals when they develop marketing campaigns, attract subscribers, suggest special issues, or recruit influential board members. On the other hand, journal rankings have been frequently criticized. Some administrators have become so obsessed with journal rankings that they demand their faculty to publish in a select list of top outlets (Suchan, 2008), for example, only in the Financial Times Top 45 List of Management Journals.[1] As a result, each faculty is limited to only one or two choices in his or her area of expertise. Some domains, for example, business and management communication, are entirely excluded from this list (Rogers, Campbell, Louhiala-Salminen, Rentz, & Suchan, 2007). In many places, a certain number of A level publications is a must for a promotion to full professor (Starbuck, 2005). However, it is the content of each paper rather than the journal that makes the actual contribution, and top-ranked journals still publish works that are never cited. By targeting a small set of top outlets, some scholars merely concentrate on meeting these journals' rigorous paper acceptance requirements rather than trying to truly contribute to science. Some scholars may ignore journal rankings and send their papers to the best outlets from their own perspective (Bonev, 2009).

Regardless of the pros and cons of journal rankings, their number is likely to grow in the foreseeable future. For example, the Journal Ranking Website operated by Dr. John Lamp at Deakin University,[2] which provides ranking data on over 20,000 peer-reviewed outlets from various domains, receives over 60,000 unique visitors per month.[3] Therefore, it is critical for scientometric scholars to have valid journal ranking methodologies available at their disposal. Even though it is difficult to eliminate all negative impacts of journal ranking lists, at the bare minimum the research community should ensure the rigor of the ranking methods. The two most frequently utilized ranking approaches have traditionally relied on expert surveys and journal citation impact measures (Lowry et al., 2007; Lowry, Romans, & Curtis, 2004; Truex, Cuellar, & Takeda, 2009). However, the results of prior investigations comparing the ranking lists produced by these methods have been inconsistent and inconclusive; whereas some investigations suggest that these ranking techniques may be used as substitutes (Thomas & Watkins, 1998), others demonstrate no relationship between expert scores and citation impact indicators (Maier, 2006). A key argument is that the outcome of expert survey-based rankings may depend on the type of respondents. For example, there is evidence to suggest that ranking scores depend on experts' research interests (Catling, Mason, & Upton, 2009; Donohue & Fox, 2000; Olson, 2005).

In this study, journals from the field of Artificial Intelligence (AI) were selected. AI is a well-established scientific domain that has its own history and identity. The term 'Artificial Intelligence' was invented by John McCarthy (1956, 1958) as the science and engineering of making intelligent machines. AI also boasts its own set of journals devoted to this quickly developing domain. A number of prior studies have investigated the quality and impact of AI outlets, but they have utilized citation-based measures (e.g., see Cheng, Holsapple, & Lee, 1994, 1996; Forgionne, Kohli, & Jennings, 2002; Forgionne & Kohlib, 2001; Holsapple, Johnson, Manakyan, & Tanner, 1995). Recently, an AI journal ranking was proposed based on a combination of the h-, g-, and hc-indices from Google Scholar (Serenko, 2010), which provides an excellent opportunity to compare two methods. In addition to obtaining the scientometric insights discussed earlier, it is also important to obtain a ranking of AI scholarly journals based on an expert survey to ensure the validity of the existing ranking lists.

Therefore, the purpose of this study is three-fold. The first is to develop a ranking of peer-reviewed AI journals by using the expert survey method. The second objective is to investigate whether the two dominant journal ranking techniques, expert surveys and journal impact measures, generate consistent ranking lists. The third purpose is to explore the consistency of journal ranking scores assigned by different categories of expert judges.

Each of the major journal ranking methods, expert surveys and journal impact measures, has advantages and limitations. During expert surveys, a number of active field researchers, practitioners and students, rank each outlet based on pre-specified criteria. A key benefit is that the journal's ranking position reflects a cumulative opinion of a representative group of its readers and contributors. The disadvantages, however, are more numerous. First, the score assignment process is very subjective, and respondents are dramatically influenced by the opinion of major academics (Rogers et al., 2007; Serenko & Bontis, 2009b). Second, there is a confounding effect of the familiarity bias. Those respondents who are more familiar with the outlet tend to rank it higher only because they are more familiar with this journal but not because of its quality (Serenko & Bontis, 2011). Third, it takes long time for most respondents to change their opinion about the journal's quality (Tahai & Meyer, 1999), which produces somewhat obsolete ranking lists. Fourth, survey developers often employ previous rankings to develop their own journal lists which are delivered to survey respondents (Truex et al., 2009). As a result, new journals, which were omitted in prior rankings, are less likely to be ranked in subsequent studies. Fifth, intra-institutional politics may also affect raters' decisions (Adler & Harzing, 2009) because some scholars may over-rate the outlets appearing in their internal ranking lists. Sixth, the journal's rigor, quality, and prestige are the frequent journal ranking criteria. They, however, represent different phenomena; this makes ranking lists from different studies hardly comparable. Seventh, practitioners usually represent a very small proportion of survey respondents yet they are an important stakeholder group that uses the rankings (Saha, Saint, & Christakis, 2003).

[1] http://library.mcmaster.ca/find/ft-research-rank-journals

[2] http://lamp.infosys.deakin.edu.au/era

[3] Personal communication with Dr. John Lamp from the School of Information Systems, Deakin University on January 4, 2011.

The use of journal impact measures allows to eliminate the subjectivity inherent in expert surveys because this method assumes a positive relationship between the independently reported indices and the journal's rank. The most popular journal impact measures include the Journal Impact Factor (JIF), eigenfactor and article influence factor reported in Thomson Reuters' Journal Citation Reports (Franceschet, 2010), and h-index (Hirsch, 2005), g-index (Egghe, 2006) and hc-index (Sidiropoulos, Katsaros, & Manolopoulos, 2007), which are usually obtained from Google Scholar (GS) (Harzing & van der Wal, 2008) or Scopus (Meho & Yang, 2007). This approach, however, is not without its own pitfalls. First, self-citations, which appear when a paper published in a journal cites articles in the same journal (Rousseau, 1999), may also affect journal impact indices. In some extreme and unethical cases, journal editors force authors to cite specific (and often irrelevant) articles in the same outlet as a condition for paper acceptance (Sevinc, 2004). Even though the relationship between a journal's self-citing behavior and its citation impact measures is more complicated than it seems (Frandsen, 2007), the issue of self-citations is often used to question the validity of citation-based rankings, especially given a considerable increase in journal self-citation rates (Peritz & Bar-Ilan, 2002). Second, journal databases may contain errors resulting in incorrectly reported journal impact indices (Elkins, Maher, Herbert, Moseley, & Sherrington, 2010). Third, citations data tend to be skewed (Calver & Bradley, 2009; Seglen, 1992) with a few papers generating a large number of citations whereas many works remain uncited. When a journal ranking relies solely on its citation impact, a few extremely well-cited papers may dramatically inflate the citation indexes and over-estimate the actual journal's ranking position. Fourth, niche journals, which are read and cited by a small community of researchers, may attract fewer citations compared to the outlets catering to the general audience. Fifth, journals that have been longer in-print generate higher citation indices. Sixth, high journal impact factors do not endorse the quality of all articles (Seglen, 1997). Seventh, strange phenomena have been observed with respect to citation-based factors. For instance, the number of article citations is positively correlated with the following title attributes: length, the presence of a colon and the presence of an acronym (Jacques & Sebire, 2010).

Since numerous journal ranking lists have been constructed by means of expert surveys and journal impact measures, it is critical to investigate whether the application of these approaches results in comparable outcomes. Appendix A summarizes the key findings of 23 prior studies employing both methods. The findings are rather paradoxical; whereas several investigations conclude that both methods may be used as substitutes, others report negligible or even negative correlations between the obtained journal scores. Even when a moderate or strong correlation between the rankings was observed, dramatic differences in the rank of particular outlets were often reported that warrants further investigation of this issue.

Particularly, the literature advocates that the outcome of expert survey rankings depends on the personal characteristics of survey participants. In most ranking studies, researchers recruit raters by contacting academic and professional associations (Nederhof, Luwel, & Moed, 2001), using faculty listings, or approaching Deans, Department Chairs and senior scholars (Gillenson & Stutz, 1991). In some cases, however, the respondents exhibit low levels of agreement (Gordon, 1982). There are several factors that may explain these inconsistencies (Catling et al., 2009; Donohue & Fox, 2000; Olson, 2005). First, it is possible that ether the country or region of residence affects journal perception quality (Lowry et al., 2004, 2007); some raters may favor national journals because of mere familiarity. Second, the educational research background of survey respondents plays an important role. During doctoral training, students study the literature existing in a specific set of journals which are related to their dissertation topic. As a result, they may perceive specific journals as more relevant and, therefore, rank them higher. Third, the argument above holds true with respect to the respondents' current research area. Fourth, as scholars progress in their academic careers, the impact of their doctoral education may gradually diminish and their understanding of the value of publications, scientific work, and quality of journals may change. Fifth, male and female scientists differ in terms of their overall research productivity, occupied positions, career opportunities and recognition (Etzkowitz, Kemelgor, & Uzzi, 2000; Fox, 2005). Therefore, gender may influence people's perceptions of journal quality. Therefore, this study investigates the consistency of journal quality perceptions depending on the raters': (1) country/region of residence; (2) educational background; (3) major research area; (4) years of academic experience; and (5) gender.

2. Methodology and results

2.1. Method

Sampling is one of the most critical issues in journal quality surveys. The key objective is to ensure that each outlet is represented by the same number of people who published at least once in it. If, for example, respondents are recruited from academic associations, conferences or distribution lists, they may favor specific research topics or outlets sponsored by these bodies and rank respective journals higher. To avoid this situation, names and emails of 30 authors were randomly chosen from each of the 182 AI outlets ranked by Serenko (2010), which currently represents the most complete list of AI journals. The publication period from 2005 to 2009 inclusive was covered to ensure that the authors' contact information would be up to date. To ensure that no author was contacted more than once, duplicate author names were replaced with new ones. Because Journal of Chinese Information Processing and Open Cybernetics & Systemics Journal were new, only 13 and 18 authors were selected from these outlets, respectively. 5431 authors were contacted by email, followed by three follow-up reminders.

It is possible that the respondents get tired when they rank the last journals in the long list of 182 outlets. The halo effect, when the extremely high or low quality of a preceding journal may affect quality perceptions of the subsequent journals, may also have a confounding effect on the final scores. Therefore, to avoid order bias, five versions of the survey with randomized

Table 1
Spearman Rank Correlations for Journal Indices (all values are significant at the $p < 0.01$ level unless indicated otherwise. Note that correlations between GS citation-impact score and h-, g-, and hc-indices are not available because the latter are a composite part of the former which violates the assumption of variable independence).

	Survey score	GS citation-impact score	2009 JIF	Longevity (years in print)	H-index	G-index	Hc-index
GS citation-impact score	0.623	1.000					
2009 JIF	0.508	0.578	1.000				
Longevity (years in print)	0.248	0.575	0.094 (n.s.)	1.000			
H-index	0.615	N/A	0.577	0.610	1.000		
G-index	0.610	N/A	0.550	0.596	0.989	1.000	
Hc-index	0.640	N/A	0.590	0.500	0.977	0.970	1.000
ERA Score	0.364	0.649	0.563	0.274	0.651	0.628	0.658

Table 2
Journal tier comparison – expert survey.

	Expert survey tier A+	Expert survey tier A	Expert survey tier B	Expert survey tier C	Expert survey tier D
Average survey score	2.130	1.691	0.579	0.360	0.272
Average GS citation-impact score	4.256	2.757	1.754	1.413	1.581
Average longevity (years in print)	25	22	18	15	24
% of Thomson indexed journals	100%	97%	68%	42%	67%

Table 3
Journal tier comparison – expert survey vs. Google Scholar citation-based method and ERA (note that ERA has the following journal tiers: A*, A, B, and C. Therefore, expert survey categories C and D were combined for tier comparison).

	Expert survey tier A+	Expert survey tier A	Expert survey tier B	Expert survey tier C	Expert survey tier D
GS citation impact A+	5	3	1	0	0
GS citation impact A	4	18	10	3	1
GS citation impact B	0	12	54	17	6
GS citation impact C	0	3	22	10	2
GS citation impact D	0	0	5	6	0
ERA A*	5	6	3	2	
ERA A	3	12	19	3	
ERA B	0	12	25	15	
ERA C	0	5	39	12	
ERA – missing journals	0	1	6	12	

journal orders were created. IP addresses were captured to identify and remove duplicate entries. Each respondent was presented with the list of journals and asked to score each one based on the journal's overall contribution to the AI field on a seven-point Likert-type scale. The following labels were used: none (0); marginal (1); some (2); average (3); good (4); very good (5); and outstanding (6). To obtain each journal's final score, the rankings by individual respondents were averaged for each journal. A number of demographic variables were also collected. Appendix B presents the questionnaire. The final journal scores and ranks were compared with those reported by Serenko (2010), Thomson Reuter's 2009 JIF from JCR, and the Excellence in Research for Australia (ERA) Initiative[4] (the list as of March 2010). ERA is a controversial yet important endeavor undertaken by the Australian government to assess research output and quality of the national higher education institutions. As part of this initiative, a ranking of peer-reviewed journals from various fields was developed by involving experts and academic associations who considered various factors, including journal citation impact measures.

2.2. Results

Out of 5431 emails sent, 540 bounced back. Overall, 873 valid questionnaires were completed at the response rate of 18%. The actual response rate was probably higher since some of the invitations might have been blocked by the receivers' spam filters. Appendix C presents the obtained journal ranking. Consistent with previous ranking lists (Bontis & Serenko, 2009; Gillenson & Stafford, 2008; Serenko & Bontis, 2009a), journal tiers were assigned as follows: 5% of A+ (9 journals), 20% of A (36 journals), 50% of B (92 journals), 20% of C (36 journals), and 5% of D (9 journals). The Kolmogorov–Smirnov Test demonstrated that all variables did not follow a normal distribution ($p < 0.01$). Therefore, non-parametric statistics should be applied.

For each journal, the number of articles published in 2009 was counted. It was observed that the number of published articles is positively correlated with the obtained score (rho = 0.390). Table 1 outlines Spearman Rank Correlations for the obtained scores, indices and ranks. Table 2 compares expert survey journal tiers. Table 3 outlines the number of journals

[4] For more information and latest ranking data, refer to the ERA website at: http://www.arc.gov.au/era/default.htm.

Table 4
Spearman Rank Correlations for journal scores based on respondents' place of residence (all values are significant at the $p < 0.01$ level unless indicated otherwise).

	Europe	Australasia and Asia	North America	Middle East and Africa
Europe ($n = 365$)	1.000			
Australasia and Asia ($n = 197$)	0.838	1.000		
North America: The US, Canada, and Mexico ($n = 165$)	0.898	0.828	1.000	
Middle East and Africa ($n = 56$)	0.812	0.824	0.790	1.000
Citation-impact score	0.619	0.533	0.670	0.418
2009 JIF	0.504	0.509	0.519	0.413
Longevity (years in print)	0.244	0.253	0.253	0.134 (n.s.)
ERA score	0.365	0.326	0.389	0.230

Table 5
Spearman Rank Correlations for journal scores based on respondents' area of a Ph.D. dissertation (all values are significant at the $p < 0.01$ level unless indicated otherwise).

	Computer science and AI	Engineering	Mathematics, statistics and logic	MIS, EB, IT, informatics, and HCI	Other
Computer Science and AI ($n = 475$)	1.000				
Engineering (software, system, civil, electrical, electronic, mechanical and biomedical) ($n = 151$)	0.780	1.000			
Mathematics, Statistics and Logic ($n = 57$)	0.725	0.569	1.000		
Management Information Systems, Electronic Business, Information Technology, Informatics, and Human-Computer Interaction ($n = 46$)	0.737	0.615	0.693	1.000	
Other ($n = 69$)	0.731	0.588	0.632	0.517	1.000
Citation-impact score	0.651	0.451	0.404	0.440	0.557
2009 JIF	0.514	0.475	0.328	0.429	0.437
Longevity (years in print)	0.230	0.251	0.123 (n.s.)	0.153 (n.s.)	0.229
ERA Score	0.388	0.271	0.135 (n.s.)	0.207	0.381

from survey expert tiers present in the same tier of other rankings methods. For instance, it shows that the tier A of the expert survey list contains 12 tier B outlets from the Google Scholar ranking, and 5 C-level ERA outlets. Several observations were made. First, the scores obtained through an expert survey correlated moderately with the citation-based scores provided by Google Scholar (rho = 0.623) and with Thomson's JIF (rho = 0.508). Second, stunning differences in the ranking position of some outlets were discovered; 15 journals jumped half-list up or down in the survey-based ranking. For example, Chemometrics and Intelligent Laboratory Systems dropped from being 45 to 179, and IEEE Computational Intelligence Magazine gained 128 ranks. The ranking position of only five outlets remained unchanged. Third, out of all journals, which improved their ranking position, 47% were covered by Thomson, whereas out of those, which dropped in rank, 64% were indexed. Fourth, the ERA ranking correlated moderately with Google Scholar based scores (rho = 0.649) and JIF (rho = 0.563), but weakly with survey scores (rho = 0.364). This is not surprising since JIF was one of the criteria used to develop ERA rankings. Fifth, journal longevity has a moderate effect on Google Scholar-based rankings (rho = 0.575), a weak effect on survey-based rankings (rho = 0.248) and no impact on JIF (rho = 0.094, n.s.). Sixth, tier D of the expert survey ranking did not follow the expected pattern; the average longevity of its journals was almost as high as those from tier A+, and 67% of them were indexed by Thomson, in contrast to the expected number below 40%. In fact, tier D generally consisted of niche journals, which were perhaps read and cited within a very small community. Seventh, dramatic inconsistencies between journal tiers from different rankings were observed (see Table 3). Last, 19 journals were missing in the ERA ranking. This is unfortunate given the potential impact of decisions made based on the ERA results.

Tables 4–8 present correlations for survey ranking scores based on the personal and demographic characteristics of respondents. It was observed that the region of residence, career stage and gender had very little, if any effect on general ranking scores (i.e., the ranking scores correlated very strongly). In contrast, the area of a Ph.D. dissertation had some effect, and the major current research area had a strong impact on ranking scores. For instance, a dramatic difference between the scores of researchers working in the areas of Natural Interfaces and Robotics was discovered (rho = 0.415). A visual inspection of the ranking lists depending on prior education revealed that respondents with the engineering background favored technical, robotics and engineering journals, whereas those who concentrated on mathematics in their Ph.D. emphasized the contribution of outlets specializing on fuzzy logic, algorithms, and math.

The highest ranked journals were very strongly linked to the respondents' major research area. For example, those who studied Robotics ranked 8 Robotics journals in the top list of 9 journals. Scholars from Cognitive Science favored outlets on Machine Learning, Neural Networks, and Machine Intelligence. Respondents who concentrated on Natural Interfaces highly ranked the outlets specializing on Image Recognition, Computer Vision, and Pattern Analysis. In a similar vein,

Table 6
Spearman Rank Correlations for journal scores based on respondents' major current research area (all values are significant at the $p<0.01$ level unless indicated otherwise).

	Cognitive science	Natural interfaces	Robotics	Other AI and non-AI
Cognitive science ($n=293$) Topics: Applications in the cognitive science of AI, Expert systems, Knowledge-based systems, Adaptive learning systems, Fuzzy logic systems, Neural networks, Genetic algorithm software, and Intelligent agents.	1.000			
Natural interfaces ($n=156$) Topics: Natural language processing, Speech recognition, Virtual reality, Linguistics, Computer vision, Machine translation, Computational linguistics, Computer graphics, and Image processing.	0.520	1.000		
Robotics ($n=74$) Topics: Sight or visual perception, Touch, Locomotion, Navigation, Robot machines with computer intelligence, and Machines with humanlike physical capabilities.	0.661	0.415	1.000	
Other AI and non-AI ($n=223$)	0.860	0.471	0.593	1.000
Citation-impact score	0.544	0.567	0.402	0.445
2009 JIF	0.492	0.421	0.380	0.391
Longevity (years in print)	0.156 (n.s.)	0.238	0.227	0.193
ERA score	0.269	0.417	0.236	0.238

Table 7
Spearman Rank Correlations for journal scores based on respondents' academic full-time work experience (all values are significant at the $p<0.01$ level unless indicated otherwise).

	Junior	Mid-career	Senior
Junior, 0–6 yr ($n=200$)	1.000		
Mid-career, 7–15 yr ($n=335$)	0.913	1.000	
Senior, over 15 yr ($n=289$)	0.888	0.937	1.000
Citation-impact score	0.617	0.609	0.605
2009 JIF	0.516	0.528	0.478
Longevity (years in print)	0.217	0.210	0.286
ERA score	0.383	0.381	0.329

Tables 5 and 6 reveal a less consistent correlation of journal scores from different groups of respondents with the GS citation scores, JIF, journal longevity and ERA ranks.

3. Implications

The purpose of this study was to develop a ranking of peer-reviewed AI journals, compare the consistency of journal ranking lists created by means of expert surveys and citation-impact measures, and investigate whether personal and demographic journal rater characteristics, such as country/region of residence, educational background, major research area, years of academic experience and gender, affect their ranking decisions. For this, 182 AI journals were rated by 873 AI researchers. Based on the findings, several implications emerged that warrant further elaboration.

3.1. Implication #1. The application of the expert survey journal ranking method favors journals that publish more articles per year

In this study, a positive non-parametric correlation of 0.39 between the number of yearly published articles and the journal's score was observed. This phenomenon may be explained theoretically; the more readers the journal has, the more people are familiar with it. Familiarity, in turn, is closely related to perceived journal quality (Serenko & Bontis, 2011) and inflates the ranking of journals that have a wider subscription base.

Table 8
Spearman Rank Correlations for journal scores based on respondents' gender (all values are significant at the $p<0.01$ level unless indicated otherwise).

	Male	Female
Male ($n=686$)	1.000	
Female ($n=104$)	0.897	1.000
Citation-impact score	0.629	0.520
2009 JIF	0.522	0.422
Longevity (years in print)	0.255	0.204
ERA score	0.367	0.303

3.2. Implication #2. The two leading journal ranking methods, expert surveys and citation impact measures, cannot be used as substitutes. Instead, they should be used as complementary ranking approaches

Journal rankings developed by means of expert surveys and citation impact measures are moderately correlated. This is expected since journal raters consider various factors when they form journal quality perceptions, including JIF which is also correlated with other citation indices. At the same time, stark differences were observed for particular outlets; for example, some of them moved up or down half-way through the list. Either technique has its own strengths and weaknesses. Therefore, they should be used together in the same ranking study to improve results validity, but not as substitutes.

3.3. Implication #3. The impact of journal longevity (i.e., years in-print) on journal ranking depends on the ranking method

Journal longevity has a moderate effect on journal h-, g-, and hc-indices obtained from Google Scholar (correlation of 0.575), weak effect on survey ranking scores (correlation of 0.248) and no impact on Thomson's JIFs (no statistically significant correlation). This finding may be explained theoretically. H-, g-, and hc-indices take into consideration the entire output of the journal, which benefits older outlets that have had a chance to publish more papers. Older journals have a higher exposure rate, have a large subscriber base and are read by a wider audience, which in turn increases the likelihood that survey participants are more aware of them and perceive them of somewhat higher quality. In contrast, JIF goes back for only two years. Therefore, the effect of articles published before the two-year period is virtually non-existent.

3.4. Implication #4. Google Scholar citation-based journal lists underestimate the ranking of outlets not covered by Thomson

Out of all journals that increased of decreased their ranking position, 47% and 64% were covered by Thomson, respectively. Assuming that the results of an expert survey accurately reflect the cumulative opinion of the scientific community, it is suggested that the GS citation-based ranking technique disadvantages journals excluded from Thomson. Even though Google Scholar and Thomson are entirely different databases, the presence of an article in one database (i.e., Thomson) increases its chances of being cited in another database (i.e., Google Scholar) because it is exposed to a wider audience. During expert surveys, this confounding effect is eliminated or at least reduced.

3.5. Implication #5. The quality of a journal cannot be determined based on its appearance in a single ranking list developed with a single method

Stark inconsistencies were observed in journal tiers based on the results of an expert survey, GS citation impact measures, and ERA ranking. In some cases, overlap between journal tiers was below 50%. For example, the survey-based tier A included 12 tier A, 6 A*, 12 B, and 5 C journals from ERA. Two A* ERA journals were ranked C (see Table 3). Moreover, 19 journals were entirely missing in the ERA ranking; those were mostly new outlets. Therefore, multiple ranking lists developed by using different methods should be consulted to determine the relative standing of a particular outlet.

3.6. Implication #6. The respondent's region of residence, career stage and gender have very little effect on journal ranking scores

This study demonstrated that respondents from diverse geographical regions, at different career stages and of opposite gender perceive journal quality very similarly. This finding questions the development of country- or region-specific journal ranking lists. Even though the overall scientific output of male and female researchers may sometimes differ (Etzkowitz et al., 2000; Fox, 2005), they rank the same academic outlets very consistently.

3.7. Implication #7. In their journal ranking decisions, respondents are somewhat influenced by their area of education (i.e., Ph.D. area), and are strongly influenced by their current research interests

This study empirically confirmed one of the major limitations of the expert survey journal ranking method because survey respondents assign journal scores based on their previous and current research interests. As a result, the final ranking closely corresponds to the research profile of the group of respondents. For example, scholars who study Robotics overemphasize the quality of Robotics journals, and those investigating Cognitive Science over-score Machine Learning outlets. Therefore, journal ranking developers should ensure that all research areas are represented equally among the potential respondents. One of the approaches is to select the same number of authors from each outlet under investigation.

However, in many previous ranking studies respondents did not accurately represent all research areas equally. For example, to design a ranking of IS outlets, Mylonopoulos and Theoharakis (2001) limited survey participation to the subscribers of the ISWorld mailing list. To create a list of electronic commerce journals, Bharati and Tarasewich (2002) not only followed a similar approach, but also made their questionnaire openly available online. It is possible that some survey respondents were not actively engaged in electronic commerce research and were not fully familiar with all of the outlets being ranked.

In fact, the use of the ISWorld email distribution list has been a popular approach in MIS journal rankings (e.g., see Peffers & Ya, 2003; Walstrom & Hardgrave, 2001). This method cannot assure the validity of the final rankings because there is no evidence to suggest that the research interests of its members are very broad and cover all topics to the same extent. At the same time, some of the studies above were employed in the development of the IS journal ranking published by the Association of Information Systems,[5] which has major implications for the development of the entire IS domain. It is hoped that future researchers will consider this major limitation of expert survey rankings.

4. Conclusion

In this study, a ranking of 182 peer-reviewed journals from the field of Artificial Intelligence was constructed based on the survey results from 873 AI researchers who published at least once in one of these outlets. The final ranking was compared with those based on the family of h-indices obtained from Google Scholar, and some differences between the methods were highlighted and explained. It was concluded that these techniques cannot be used as substitutes; instead they may be used to complement each other. The recent journal ranking developed by ERA does not correlate well with those produced by other approaches. The ERA's journal ranks are more related to citation-based measures than to the peer-assessment of journal quality, and some outlets are missing in the ERA list. In their reports of journal quality, survey respondents rely on their previous and current research areas and over-rate the corresponding journals. Therefore, all research topics and journals should be represented equally in journal quality surveys. In fact, the development of journal ranking lists requires a great degree of expertise and advance planning to ensure the validity of the findings.

The authors caution that the suggested journal ranking list should not be interpreted literally or used as a solo criterion by which to assess the quality of an outlet. This investigation does not argue that a particular journal is of high or low quality, it simply presents the results of a scientometric study by following the methodology recognized within particular scientific circles. There are various benefits of having valid journal rankings, and this project attempted to improve our understanding of the ranking methods.

Appendix A. Comparison of rankings based on expert surveys and citation-based measures

JIF – Journal Impact Factor; JCR – Journal Citation Reports; WOS – Web of Science; GS – Google Scholar.

Study	Ranking method		Key findings/conclusions
	Expert surveys	Citation-based	
Bontis and Serenko (2009)	233 experts ranked 20 knowledge management and intellectual capital journals.	H-index and g-index from GS.	The ranking lists were relatively consistent, with correlations between survey-based scores and h- and g-indices of 0.8. There were, however, differences in the ranks of several journals.
Butler (2002)	A list of 20 high impact journals in 9 scientific fields was constructed by the National Committee of the Australian Academy of Science.	2 yr and 5 yr JIF from WOS.	Journal longevity is a key factor affecting raters' decisions. Peers tend to favor journals with high impact factors that have long publication history. Relatively new journals, despite their high JIF, have a lower chance of being recognized as high-quality.
Donohue and Fox (2000)	242 members of the Decision Sciences Institute, USA rated 65 decision and management science journals.	1 yr, 5 yr and 10 yr JIF from WOS.	The following correlations between the ratings were found: 0.49 (1 yr JIF); 0.58 (5 yr JIF); and 0.59 (10 yr JIF). The authors conclude that peer-review ratings and JIF scores are correlated.
DuBois and Reeb (2000)	131 participants of the annual meeting of the Academy of International Business in Vienna, Austria rated 30 international business journals.	Citations from 5 major international business journals from 1995 to 1997. JIF was adjusted to remove self-citations.	Both methods produced highly comparable results.
Dul, Karwowski, and Vinken (2005)	130 European ergonomists rated the scientific quality of 10 international English-language ergonomics journals.	2 yr JIF from WOS.	The ranking lists produced by both methods are very similar, with the correlation of 0.9.
Goodyear et al. (2009)	A ranking of education journals was created by surveying 303 faculty from US research universities.	2 yr JIF from WOS, 20 yr h-index from WOS, and 20 yr h-index from GS.	Respondents lacked consensus on what core discipline journals are. The core journals, which were nominated by most survey participants, generally exhibited low impact scores.

[5] http://home.aisnet.org.

Appendix A (*Continued*)

Study	Ranking method		Key findings/conclusions
	Expert surveys	Citation-based	
Goldstein and Maier (2010)	A survey of 186 faculty who were the members of the Association of Collegiate Schools of Planning.	2 yr and 5 yr JIF from WOS.	No statistically significant correlations between the journal value perceptions and journal citation impact factors were found. Instead, a number of negative correlations were obtained.
Gordon (1982)	250 USA academics teaching in doctoral sociology programs rated 59 social sciences journals.	Overall number of citations, impact factor, immediacy index, and number of source items from JCR.	Correlations ranged from 0.28 to 0.61, averaging at approximately 0.4. The author concludes that a strong association exists between two methods but notes that the level of consensus among survey respondents was low as evident in high standard deviations on scored items.
Haddow and Genoni (2010)	Australian humanities and social science journals included in the Excellence in Research for Australia four-tier peer-ranking.	H-index, impact factor and diffusion factor were calculated for WOS 6 yr, Scopus 6 yr, and GS 6 yr.	No association between tier rank and the number of WOS and Scopus citations was found. Instead, the top A* category received the lowest average number of Scopus citations per title than A, B and even C categories. For WOS, A* journals were cited less frequently that A and B outlets. Even though h-index, JIF, and diffusion factor generally reflected tier rankings, many inconsistencies were observed. E.g., WOS h-index for tier A was lower than that for tier B.
Hodge and Lacasse (2010)	29 social work journals were ranked based on expert raking of these journals' empirical quality.	GS lifetime h-index and WOS 5 yr JIF.	The following correlations between expert rankings and citation-based ranking were found: GS h-index (0.63) and WOS 5 yr JIF (0.61). The ranking of some outlets, however, differed significantly. E.g., Social Service Review was ranked #1 by experts, but scored only # 13 on h-index.
Kao et al. (2008)	345 professors from Taiwan rated 46 Taiwanese journals in humanities and social sciences.	Cross-citations and citations in dissertation for 4 yr.	The results from both approaches were very inconsistent. E.g., only one journal had the same ranking position in each list, and over a half of all outlets had significantly different rankings.
Korevaar and Moed (1996)	A survey of 68 experts in the field of mathematics. Out of them, 30 knew the purpose of the study and 38 did not. The results were further discussed with 8 experts.	The ratio of the average number of all journal's citations and the average citation rate of all journals from the same category, measured over 3 yr, 5 yr, 9 yr, 13 yr and lifetime.	Expert opinion corresponded very well with journal citation indicators. Experts are able to distinguish among 'top', 'very good', and 'less good' journal categories.
Lewison (2002)	UK researchers rated journals from seven biomedical sub-fields.	5 yr JIF from WOS.	The results were very mixed. Overall, JIF did not correlate well with subjective ratings. The correlation, however, depended on the sub-field. Whereas it was almost non-existent in practical sub-fields, it was moderate in more scientific sub-domains.
Maier (2006)	A ranking of regional science journals was developed through a web survey of 740 members of the European Regional Science Association.	5 yr JIF from WOS.	All correlation values were between −0.115 and 0.080 (none was statistically significant) for the entire journal set; and between −0.091 and 0.092 (none was statistically significant) after two ambiguous journals were eliminated. A significant positive correlation between peer judgment and impact factors was found only for a small core of five journals.
McAllister, Anderson, and Narin (1980)	298 faculty from 97 USA universities rated an average article appearing in one of 58 journals from 10 different research fields.	Average number of citations per article and Computer Horizons, Inc. (CHI) Influence Methodology.	Overall, the method produced similar results with an overall correlation of 0.74. There were, however, several outliers.
Olson (2005)	The ranking of 39 operations management journals was based on two surveys of 177 faculty of top-25 US business schools.	5 yr JIF from WOS.	There was a moderate correlation between perceptions of journal quality and JIF (0.48). However, there was no correlation between perceptions of journal visibility (number of respondents familiar with this outlet) and JIF. Journal quality perceptions also changed over time.
Rousseau (2008)	11 environmental and resource economics journals were ranked by 150 field experts.	2 yr JIF from WOS.	The two rankings differed significantly with the correlation of 0.59. The ranking of two journals (Australian Journal of Agricultural and Resource Economics, and Environmental and Resource Economics) differed dramatically.

Appendix A (*Continued*)

Study	Ranking method		Key findings/conclusions
	Expert surveys	Citation-based	
Saha et al. (2003)	113 internal medicine physicians and 151 graduates from a postdoctoral training program in clinical and health services research in the USA rated 9 clinical medicine journals.	2 yr JIF from WOS.	JIF is a reasonable measure of the quality of clinical medicine journals because peer-review scores and JIF correlated very strongly ($r = 0.83$ for research group and 0.62 for practitioner group).
Schloegl and Stock (2004)	40 international and 10 national German-language journals in library and information science were rated by 257 information specialists from Germany, Austria, and Switzerland.	International journals: WOS 2 yr JIF, references per article, self-citations, and citing half-life. National journals: adjusted JIF, references per article, and self-citations.	The findings are rather paradoxical; no pattern between peer-ratings and bibliometric measures was discovered. Whereas some correlations were strong and positive, some were strong and negative. E.g., correlation of −0.17 was observed between reading frequency of a regional journal and its impact factor.
Sellers, Mathiesen, Perry, and Smith (2004)	Mail survey of 556 social work faculty who rated 38 social work journals.	2 yr JIF from WOS.	The ranking lists were very inconsistent. The correlation between the methods was 0.45. The top rated journal, Social Service Review, was placed in the second quartile based on its JIF. Only three out of ten top-ranked journals based on their JIF were included in the top-10 survey-based ranking.
Sonderstrup-Andersen and Sonderstrup-Andersen (2008)	An ordinary mail survey of 37 Danish Diabetes researchers.	2 yr JIF from WOS.	A significant correlation of 0.48 was observed between how the respondents rated the journals in which they would prefer publishing and these journals' impact factors.
Thomas and Watkins (1998)	A peer-based journal ranking developed within the UK Research Assessment Exercise.	Discipline contribution score reflecting the impact of a journal on journals within the same field, measured in citations from these journals.	Rankings based on peer review and bibliometric indicators were strongly correlated.
Vanclay (2008)	Four experts ranked forestry journals in terms of their academic standing.	WOS 2 yr JIF; WOS 8 yr h-index; GS 8 yr h-index; and GS lifetime h-index.	A noticeable discrepancy between the expert rankings and citation-based rankings was observed. The correlations for experts' rankings were: WOS JIF (0.52); WOS 8 yr h-index (0.64); GS 8 yr h-index (0.61); and GS lifetime h-index (0.52). Experts' rankings of some journals differed dramatically from citation-based rankings.

Appendix B. Expert survey

Instructions

There is only one question that we would like to ask you about each of 182 journals listed below. If you are unfamiliar with a particular journal, simply skip it (do not rank it).

Even though the questionnaire appears to be long, it takes less than 10 min to complete it. Your participation is vital. We will be happy to send you a copy of the report upon the completion of this project.

This journal's overall contribution to the AI field is:							
Journal of Machine Learning Research	None	Marginal	Some	Average	Good	Very Good	Outstanding
Journal of Visual Communication and Image Representation	None	Marginal	Some	Average	Good	Very Good	Outstanding
Note: A list of 182 journals was presented. Five versions of the survey with randomized journal orders were used.							
What is your country/region? _______________							
What is your highest degree earned? (bachelor/master/doctor)							
What is your major field for highest degree earned? _______________							
What is your primary research area? _______________							
How many years of academic full-time work experience do you have? _______________							
What is you gender? M/F							

Appendix C. Journal ranking

(* – Indexed by Thomson Reuters. All Google Scholar (GS) scores and indices were provided by Serenko (2010). N/A Excellence in Research for Australia (ERA) rank indicates that this journal was excluded from the ERA ranking.)

Survey rank	Survey tier	Journal title	Survey score	GS citation impact score	GS citation impact rank	GS citation impact tier	2009 JIF	Year[a]	GS h-index	GS g-index	GS hc-index	ERA rank
1	A+	IEEE Transactions on Pattern Analysis and Machine Intelligence*	2.716	6	1	A+	4.378	1979	172	375	138	A*
2	A+	IEEE Transactions on Systems, Man, & Cybernetics, all parts combined (formerly IEEE Trans. on: Man-Machine Systems; Systems Science and Cybernetics; Human Factors in Electronics; and IRE Trans. on Human Factors in Electronics) [b]*	2.558	5.15	5	A+	Not used	1960	167	335	88	not used
3	A+	Machine Learning*	2.230	5.27	3	A+	1.663	1986	148	304	124	A*
4	A+	IEEE Transactions on Neural Networks*	2.171	4.35	8	A+	2.889	1990	127	227	94	A*
5	A+	Artificial Intelligence: An International Journal*	2.119	5.61	2	A+	3.036	1970	186	321	117	A*
6	A+	Journal of Artificial Intelligence Research*	2.044	2.51	37	A	1.981	1993	59	105	42	A
7	A+	IEEE Transactions on Knowledge and Data Engineering*	1.856	3.42	16	A	2.285	1989	86	160	75	A
8	A+	Journal of Machine Learning Research*	1.767	3.13	23	A	2.789	2000	73	130	72	A
9	A+	IEEE Transactions on Evolutionary Computation*	1.710	2.86	27	A	4.589	1997	64	130	57	A*
10	A	IEEE Transactions on Fuzzy Systems*	1.691	3.22	20	A	3.343	1993	86	149	63	A*
11	A	IEEE Transactions on Robotics (formerly IEEE Journal of Robotics and Automation; IEEE Trans. on Robotics and Automation)[c]*	1.667	4.08	11	A	2.035	1985	121	190	91	A*
12	A	IEEE Transactions on Image Processing*	1.632	4.91	6	A+	2.848	1992	143	241	123	A*
13	A	IEEE Intelligent Systems (formerly IEEE Intelligent Systems and their Applications; IEEE Expert)*	1.536	2.65	31	A	3.144	1986	63	118	45	A
14	A	AI Magazine*	1.494	3.33	19	A	1.018	1980	84	152	72	C
15	A	Neural Networks (The Official Journal of the International Neural Network Society, European Neural Network Society & Japanese Neural Network Society)*	1.431	3.84	12	A	1.879	1988	111	210	71	A
16	A	Pattern Recognition Letters*	1.396	2.84	28	A	1.303	1982	76	114	53	B
17	A	Pattern Recognition: The Journal of the Pattern Recognition Society*	1.338	4.09	10	A	2.554	1968	124	209	82	A*
18	A	Neural Computation*	1.334	4.79	7	A+	2.175	1989	138	259	110	A

Appendix C (*Continued*)

Survey rank	Survey tier	Journal title	Survey score	GS citation impact score	GS citation impact rank	GS citation impact tier	2009 JIF	Year[a]	GS h-index	GS g-index	GS hc-index	ERA rank
19	A	Fuzzy Sets and Systems: An International Journal in Information Science and Engineering*	1.300	3.48	15	A	2.138	1978	117	185	47	A
20	A	International Journal of Computer Vision *	1.277	5.26	4	A+	3.508	1987	152	293	124	A
21	A	IEEE Computational Intelligence Magazine*	1.233	1.19	149	C	2.622	2006	9	15	6	C
22	A	IEEE Transactions on Audio, Speech and Language Processing (formerly IEEE Trans. on Speech and Audio Processing)*	1.220	3.21	21	A	1.782	1993	83	142	67	A*
23	A	Data & Knowledge Engineering*	1.199	2.54	36	A	1.745	1985	58	102	46	B
24	A	Evolutionary Computation (MIT Press)*	1.196	2.92	26	A	3.103	1993	67	145	54	A
25	A	Data Mining and Knowledge Discovery*	1.195	3.01	25	A	2.95	1997	65	157	58	A
26	A	Neurocomputing*	1.190	2.35	46	B	1.44	1989	53	96	37	B
27	A	IEEE Robotics and Automation Magazine*	1.111	1.89	73	B	2.09	1994	38	59	25	B
28	A	Expert Systems with Applications: An International Journal*	1.107	2.13	57	B	2.908	1990	48	69	33	B
29	A	Applied Artificial Intelligence: An International Journal*	1.086	2.22	52	B	0.58	1987	44	82	38	B
30	A	International Journal of Intelligent Systems *	1.016	2.07	66	B	1.194	1986	45	68	31	B
31	A	IEEE Transactions on Intelligent Transportation Systems*	1.001	1.79	83	B	2.092	2000	30	49	26	B
32	A	Knowledge-Based Systems*	0.979	2.04	69	B	1.308	1987	41	68	31	B
33	A	Artificial Intelligence in Medicine*	0.969	2.2	53	B	1.645	1989	48	71	38	A
34	A	Computer Vision and Image Understanding (formerly CVGIP: Image Understanding) [d]*	0.945	3.2	22	A	1.676		91	160	53	A
35	A	Artificial Intelligence Review: An International Science and Engineering Journal*	0.943	2.12	59	B	0.057	1986	43	82	31	C
36	A	Autonomous Agents and Multi-Agent Systems*	0.929	2.4	42	A	1.51	1998	48	98	44	A
37	A	International Journal of Pattern Recognition and Artificial Intelligence*	0.908	1.84	78	B	0.512	1987	37	58	22	B
38	A	Computational Intelligence: An International Journal*	0.896	2.56	34	A	5.378	1985	62	111	41	A
38	A	Robotics and Autonomous Systems (formerly Robotics)	0.896	2.49	38	A	1.361	1985	61	91	44	A
40	A	Annals of Mathematics and Artificial Intelligence	0.892	2.34	47	B	0.893	1990	52	80	43	C
41	A	International Journal of Computational Intelligence	0.871	1.12	160	C		2005	6	8	5	C
42	A	Applied Intelligence	0.859	1.72	89	B	0.988	1970	31	46	21	B

Appendix C (*Continued*)

Survey rank	Survey tier	Journal title	Survey score	GS citation impact score	GS citation impact rank	GS citation impact tier	2009 JIF	Year[a]	GS h-index	GS g-index	GS hc-index	ERA rank
43	A	International Journal of Robotics Research	0.841	3.53	14	A	1.993	1982	105	175	64	A*
44	A	International Journal of Robotics and Automation	0.827	1.28	142	C	0.339	1986	15	21	7	N/A
45	A	Autonomous Robots	0.826	2.61	33	A	1.235	1994	59	100	52	B
46	B	International Journal of Approximate Reasoning	0.816	2.11	62	B	2.09	1987	48	75	29	B
47	B	AI Communications	0.809	1.8	81	B	0.755	1988	31	52	25	B
47	B	Expert Systems: The Journal of Knowledge Engineering	0.809	1.55	108	B	1.231	1984	25	43	13	C
49	B	Computational Linguistics	0.802	4.27	9	A+	2.212	1975	109	233	99	A*
50	B	Neural Processing Letters	0.795	1.72	89	B	1.015	1994	26	53	22	B
51	B	Journal of Automated Reasoning	0.780	2.64	32	A	1.926	1985	67	101	48	A
52	B	Image and Vision Computing	0.779	3.05	24	A	1.474	1983	79	124	64	B
53	B	Automatica: A Journal of IFAC, the International Federation of Automatic Control	0.773	3.35	18	A	2.631	1963	98	166	58	A*
54	B	International Journal on Artificial Intelligence Tools	0.766	1.64	101	B	0.436	1992	24	42	21	C
55	B	Applied Soft Computing: The Official Journal of the World Federation on Soft Computing	0.762	1.48	116	B	2.415	2001	19	27	18	C
56	B	International Journal of Knowledge-Based and Intelligent Engineering Systems	0.759	1.18	151	C		1997	9	14	6	B
57	B	International Journal of Neural Systems	0.757	1.85	75	B	2.988	1989	35	65	21	B
58	B	Journal of Logic and Computation	0.749	2.55	35	A	0.789	1990	60	100	46	A
58	B	Pattern Analysis and Applications	0.749	1.76	84	B	1.293	1998	27	61	21	C
60	B	Journal of Field Robotics (formerly Journal of Robotic Systems)	0.746	2.07	66	B	1.989	1984	47	79	25	A
61	B	International Journal of Soft Computing	0.743	1.01	176	D		2006	2	2	2	N/A
62	B	Knowledge Engineering Review	0.708	2.42	40	A	1.143	1984	46	125	36	B
63	B	Artificial Life	0.706	2.18	54	B	1.96	1994	45	83	34	A
64	B	International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems	0.704	1.72	89	B	1.147	1993	30	54	19	C
65	B	Journal of Experimental & Theoretical Artificial Intelligence	0.691	1.96	71	B	0.533	1989	34	72	28	C
66	B	Machine Vision and Applications: An International Journal*	0.688	2.05	68	B	0.952	1988	41	73	30	B
67	B	Intelligent Data Analysis: An International Journal*	0.686	1.73	85	B	0.929	1997	28	53	21	B
68	B	Cognitive Systems Research*	0.655	1.64	101	B	0.571	1999	24	40	22	C
69	B	Complex Systems	0.651	2.14	56	B		1987	47	99	23	C
70	B	International Journal of Computational Intelligence Research	0.649	1.12	160	C		2005	5	10	5	C

Appendix C (*Continued*)

Survey rank	Survey tier	Journal title	Survey score	GS citation impact score	GS citation impact rank	GS citation impact tier	2009 JIF	Year[a]	GS h-index	GS g-index	GS hc-index	ERA rank
71	B	Fuzzy Optimization and Decision Making *	0.640	1.37	128	B	1.059	2002	16	24	12	C
72	B	Journal of Intelligent and Fuzzy Systems: Applications in Engineering and Technology*	0.635	1.47	118	B	0.74	1993	19	43	11	C
73	B	Soft Computing: A Fusion of Foundations, Methodologies and Applications*	0.629	1.31	135	C	1.328	1997	11	27	10	C
74	B	Biological Cybernetics: Advances in Computational Neuroscience*	0.625	3.72	13	A	1.697	1961	112	202	64	A
75	B	Advanced Robotics: The International Journal of the Robotics Society of Japan*	0.623	1.63	104	B	0.629	1986	26	39	20	B
76	B	Network: Computation in Neural Systems*	0.620	2.4	42	A	1.536	1990	51	91	44	C
77	B	Robotica*	0.619	1.67	98	B	0.992	1983	29	42	20	A
78	B	Computer Speech and Language*	0.616	2.23	50	B	1.034	1986	48	96	31	A
78	B	Journal of Intelligent and Robotic Systems*	0.616	1.68	96	B	0.858	1988	29	47	19	C
78	B	Journal of Pattern Recognition Research	0.616	1.03	171	C		2006	2	3	3	N/A
81	B	Engineering Applications of Artificial Intelligence: The International Journal of Intelligent Real-Time Automation*	0.612	1.73	85	B	1.444	1988	32	43	22	B
81	B	Journal of Computational Neuroscience*	0.612	2.28	49	B	2.22	1994	49	75	42	B
83	B	Adaptive Behavior*	0.607	2.23	50	B	1.911	1992	48	82	36	A
84	B	Journal of Intelligent Information Systems (integrating Artificial Intelligence and Database Technologies)*	0.604	2.29	48	B	0.98	1992	46	95	37	C
84	B	Minds and Machines: Journal for Artificial Intelligence, Philosophy and Cognitive Science*	0.604	1.7	94	B	0.783	1991	29	43	22	A
86	B	International Journal of Computational Intelligence and Applications	0.603	1.27	144	C		2001	12	18	9	A
87	B	Robotics and Computer-Integrated Manufacturing (formerly Computer Integrated Manufacturing Systems)*	0.601	1.82	80	B	1.687	1984	40	52	20	A
88	B	Advances in Fuzzy Sets and Systems	0.589	0.99	180	D		2006	1	1	1	C
89	B	International Journal of Advanced Robotic Systems	0.581	1.19	149	C		2004	8	12	8	B
90	B	Artificial Life and Robotics	0.578	1.3	139	C		1997	14	19	10	C
91	B	International Journal of Humanoid Robotics*	0.576	1.34	132	B	1.23	2004	12	25	12	C
92	B	Journal of Mathematical Imaging and Vision*	0.562	2.11	62	B	1.437	1992	44	63	37	B
93	B	International Journal of Artificial Intelligence in Education	0.546	2.12	59	B		1989	45	80	30	C

Appendix C (*Continued*)

Survey rank	Survey tier	Journal title	Survey score	GS citation impact score	GS citation impact rank	GS citation impact tier	2009 JIF	Year[a]	GS h-index	GS g-index	GS hc-index	ERA rank
94	B	International Journal of Hybrid Intelligent Systems	0.543	1.16	152	C		2004	7	11	7	C
95	B	Genetic Programming and Evolvable Machines*	0.537	1.71	92	B	1.091	2000	29	43	23	B
96	B	Connection Science*	0.535	2.1	64	B	0.806	1989	42	76	32	B
97	B	International Journal of Software Engineering and Knowledge Engineering*	0.534	1.73	85	B	0.327	1991	28	52	22	B
98	B	Cybernetics and Systems: An International Journal*	0.533	1.88	74	B	0.78	1971	35	72	21	B
99	B	Neural Computing and Applications*	0.525	1.52	111	B	0.812	1993	23	34	15	B
100	B	Journal of Heuristics*	0.523	2.12	59	B	1.264	1995	42	68	37	A
100	B	Web Intelligence and Agent Systems: An International Journal	0.523	1.3	139	C		2003	12	20	11	C
102	B	Journal of Advanced Computational Intelligence and Intelligent Informatics	0.515	1.16	152	C		1997	7	11	7	C
103	B	Natural Language Engineering	0.509	2.18	54	B		1995	43	75	38	A
104	B	International Journal of Intelligent Systems, Technologies and Applications	0.505	1.12	160	C		2005	5	8	6	B
105	B	ACM Journal of Experimental Algorithmics	0.497	1.52	111	B		1996	19	31	19	A
106	B	Neural Network World*	0.496	1.4	123	B	0.475	1991	21	28	9	C
107	B	Evolutionary Intelligence	0.495	1.02	172	D		2008	2	3	2	C
108	B	Journal of Computer and Systems Sciences International*	0.494	1.22	146	C	0.168	1962	10	19	6	C
109	B	Kybernetika (International Journal Published by Institute of Information Theory and Automation)*	0.489	1.51	113	B	0.445	1965	24	41	11	C
110	B	Machine Translation	0.488	1.7	94	B		1986	28	44	22	B
111	B	IET Computer Vision*	0.485	1.01	176	D	0.969	2007	2	2	2	B
112	B	Journal of Multiple-Valued Logic and Soft Computing*	0.482	1.21	148	C	0.343	1995	9	12	9	C
113	B	Constraints: An International Journal*	0.481	1.96	71	B	1.297	1996	37	56	32	A
114	B	ACM Transactions on Asian Language Information Processing	0.477	1.4	123	B		2002	16	25	14	B
115	B	Journal of Intelligent Manufacturing*	0.473	1.8	81	B	0.938	1990	34	52	23	A
116	B	Artificial Intelligence for Engineering Design, Analysis and Manufacturing*	0.470	1.58	106	B	0.636	1987	28	45	12	A
117	B	Journal of Visual Communication and Image Representation*	0.467	2.13	57	B	1.326	1990	42	81	33	C
118	B	Medical Image Analysis*	0.464	2.66	30	A	3.093	1996	59	111	52	A*
119	B	Artificial Intelligence and Law	0.460	1.71	92	B		1992	29	50	20	C
120	B	Computational Intelligence and Neuroscience	0.449	1.06	169	C		2007	3	5	4	C

Appendix C (*Continued*)

Survey rank	Survey tier	Journal title	Survey score	GS citation impact score	GS citation impact rank	GS citation impact tier	2009 JIF	Year[a]	GS h-index	GS g-index	GS hc-index	ERA rank
121	B	International Journal of Systems Science*	0.446	1.84	78	B	0.918	1970	37	62	20	C
122	B	Advanced Engineering Informatics (formerly Artificial Intelligence in Engineering)*	0.444	1.85	75	B	1.73	1986	37	49	26	B
122	B	Graphical Models (formerly Graphical Models & Image Processing; Computer Graphics and Image Processing; Computer Vision, Graphics, and Image Processing)*	0.444	3.37	17	A	0.926	1972	111	196	38	C
124	B	International Journal of Intelligent Information Technologies	0.442	1.09	165	C		2005	4	7	5	C
124	B	International Journal on Document Analysis and Recognition*	0.442	1.64	101	B	1.213	1998	25	40	21	N/A
126	B	Journal of Visual Languages and Computing*	0.440	2.09	65	B	1.082	1990	42	75	32	A
127	B	Intelligent Automation & Soft Computing*	0.439	1.31	135	C	0.349	1995	14	26	8	C
128	B	Journal of Artificial Evolution and Applications	0.438	1.01	176	D		2008	1	2	2	C
129	B	Control and Intelligent Systems	0.436	1.13	158	C		1973	7	10	5	C
130	B	Computing and Informatics (formerly Computers and Artificial Intelligence)*	0.432	1.39	125	B	0.456	1982	20	33	7	N/A
130	B	Journal of Uncertain Systems	0.432	1.14	156	C		2007	5	12	6	N/A
132	B	International Journal of Cognitive Informatics & Natural Intelligence	0.431	1.1	164	C		2007	4	6	6	C
133	B	Speech Communication*	0.428	2.74	29	A	1.196	1982	71	110	50	A
134	B	Journal of Applied Non-Classical Logics	0.427	1.37	128	B		1991	18	26	10	B
134	B	Journal of Computational Methods in Sciences and Engineering	0.427	1.15	155	C		2001	7	10	6	N/A
136	B	International Journal of Engineering Intelligent Systems for Electrical Engineering and Communications *	0.419	1.13	158	C	0.205	1993	6	11	5	C
136	B	Journal of Robotics and Mechatronics	0.419	1.29	141	C		1989	14	21	8	C
138	C	User Modeling & User-Adapted Interaction: The Journal of Personalization Research*	0.416	2.42	40	A	2.345	1991	52	100	42	A
139	C	Kybernetes: The International Journal of Cybernetics, Systems and Management Sciences*	0.400	1.51	113	B	0.308	1972	25	36	12	N/A
140	C	AI and Society: Journal of Knowledge, Culture and Communication	0.399	1.46	121	B		1987	19	35	13	C
141	C	Machine Graphics and Vision: International Journal	0.396	1.33	133	B		1992	14	25	10	C

Appendix C (*Continued*)

Survey rank	Survey tier	Journal title	Survey score	GS citation impact score	GS citation impact rank	GS citation impact tier	2009 JIF	Year[a]	GS h-index	GS g-index	GS hc-index	ERA rank
142	C	Journal of Systemics, Cybernetics and Informatics	0.393	1.09	165	C		2003	6	6	4	C
143	C	International Journal of Information Technology & Decision Making*	0.391	1.31	135	C	1.312	2002	13	19	11	C
144	C	Journal of Automation, Mobile Robotics & Intelligent Systems	0.389	1.02	172	D		2007	2	3	2	N/A
145	C	Intelligent Decision Technologies: An International Journal	0.387	1.02	172	D		2007	2	4	2	N/A
146	C	International Journal of Computational Cognition	0.386	1.28	142	C		2003	12	19	10	N/A
147	C	Journal of Neural Engineering*	0.385	1.39	125	B	3.739	2004	15	26	14	A*
148	C	International Journal of Parallel, Emergent and Distributed Systems	0.384	1.47	118	B		1993	19	32	15	B
148	C	Journal of Japanese Society for Artificial Intelligence	0.384	1.33	133	B		1986	14	32	7	N/A
150	C	The Visual Computer: International Journal of Computer Graphics*	0.383	2.45	39	A	0.786	1985	61	96	39	B
151	C	Information Visualization	0.379	1.49	115	B		2002	18	35	16	C
152	C	Journal of Real-Time Image Processing	0.375	1.09	165	C		2006	5	5	5	N/A
153	C	Industrial Robot: An International Journal*	0.369	1.22	146	C	1	1974	11	20	5	C
154	C	Open Cybernetics & Systemics Journal	0.365	0.99	180	D		2007	1	1	1	N/A
155	C	Integrated Computer-Aided Engineering*	0.361	1.47	118	B	2.042	1994	20	33	14	C
156	C	Journal of Automata, Languages and Combinatorics (formerly Journal of Information Processing and Cybernetics)	0.357	1.46	121	B		1996	23	35	10	C
157	C	International Journal of Cooperative Information Systems*	0.356	1.85	75	B	0.528	1992	34	54	26	C
157	C	Journal of Cybernetics and Informatics (Slovak Society for Cybernetics and Informatics)	0.356	1	179	D		2003	2	2	1	N/A
159	C	Mathware & Soft Computing	0.352	1.37	128	B		1994	17	28	10	N/A
160	C	Journal of Computer Science and Technology*	0.348	1.54	110	B	0.632	1986	21	42	15	B
161	C	International Journal of Intelligent Systems in Accounting, Finance & Management	0.346	1.23	145	C		1992	10	22	6	C
161	C	Journal of Computational and Graphical Statistics*	0.346	2.39	44	A	1.258	1992	51	110	36	A*
163	C	International Journal of Corpus Linguistics	0.342	1.39	125	B		1996	19	27	10	B
164	C	Mechatronics: The Science of Intelligent Machines*	0.341	1.73	85	B	1.198	1991	33	47	20	B
165	C	International Journal of Speech Technology	0.336	1.37	128	B		1995	17	24	11	B
166	C	International Journal of Advanced Intelligence Paradigms[e]	0.333	0.99	180	D		2008	1	1	1	Not ranked

Appendix C (*Continued*)

Survey rank	Survey tier	Journal title	Survey score	GS citation impact score	GS citation impact rank	GS citation impact tier	2009 JIF	Year[a]	GS h-index	GS g-index	GS hc-index	ERA rank
167	C	International Journal of Medical Robotics and Computer Assisted Surgery *	0.332	1.02	172	D	1.376	2004	2	3	2	B
168	C	Journal of Quantitative Linguistics *	0.326	1.31	135	C	0.4	1994	13	22	10	B
169	C	Literary and Linguistic Computing	0.317	1.62	105	B		1986	27	45	16	B
170	C	Journal of Automation and Information Sciences	0.313	1.08	168	C		1969	6	6	3	N/A
171	C	International Journal of Innovative Computing, Information and Control*	0.310	1.14	156	C	2.932	2005	6	10	6	B
172	C	International Journal of Innovative Computing and Applications	0.299	1.05	170	C		2007	3	5	3	C
173	C	Automated Software Engineering: An International Journal *	0.298	1.97	70	B	1.267	1994	35	59	33	A
174	D	Automation and Remote Control (Avtomatika i Telemekhanika) [f]*	0.292	1.55	108	B	0.251	1956	28	48	9	B
174	D	Journal of Interactive Learning Research	0.292	1.56	107	B		1990	24	38	16	B
176	D	International Journal of Asian Language Processing: An International Journal of Chinese and Oriental Languages Information Processing Society (formerly Journal of Chinese Language and Computing, or Communications of COLIPS)	0.282	1.12	160	C		1991	6	8	5	N/A
177	D	Journal of Chinese Information Processing	0.281	1.16	152	C		1986	9	12	5	N/A
178	D	Design Automation for Embedded Systems: An International Journal*	0.273	1.65	99	B	0.333	1996	26	43	20	C
179	D	Chemometrics and Intelligent Laboratory Systems: An International Journal Sponsored by the Chemometrics Society (incorporating Laboratory Automation & Information Management)*	0.271	2.38	45	A	2.111	1986	62	97	32	B
180	D	Journal of Computational Acoustics*	0.262	1.48	116	B	0.421	1993	21	33	14	B
181	D	International Journal of Lexicography*	0.261	1.68	96	B	0.594	1988	27	65	13	B
182	D	Journal of East Asian Linguistics*	0.233	1.65	99	B	0.31	1992	28	47	17	A

[a] The year the first volume was published.

[b] Since the 2009 JIF of IEEE Transactions on Systems, Man and Cybernetics is available for each part separately, its JIF and ERA ranking were excluded from analysis. Note that it was impossible to measure h, g, and hc-indices for each part separately because of inconsistent journal names (i.e., in most cases, 'Part' was missing in journal titles).

[c] Note that IEEE Trans. on Robotics and Automation was split into two journals.

[d] CVGIP: Image Understanding's year was not used in analysis since this journal was not initially directed towards AI topics.

[e] International Journal of Advanced Intelligence Paradigms was listed in the ERA ranking, but it was not ranked because it was too new.

[f] Automation and Remote Control was founded in 1936. However, it has been translated into English since 1956. Therefore, the year 1956 was used in analysis.

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