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# The development of an AI journal ranking based on the revealed preference approach

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A B S T R A C T

This study presents a ranking of 182 academic journals in the field of artificial intelligence. For this, the revealed preference approach, also referred to as a citation impact method, was utilized to collect data from Google Scholar. This list was developed based on three relatively novel indices: h-index, g-index, and hc-index. These indices correlated almost perfectly with one another (ranging from 0.97 to 0.99), and they correlated strongly with Thomson's Journal Impact Factors (ranging from 0.64 to 0.69). It was concluded that journal longevity (years in print) is an important but not the only factor affecting an outlet's ranking position. Inclusion in Thomson's Journal Citation Reports is a must for a journal to be identified as a leading A+ or A level outlet. However, coverage by Thomson does not guarantee a high citation impact of an outlet. The presented list may be utilized by scholars who want to demonstrate their research output, various academic committees, librarians and administrators who are not familiar with the AI research domain.



## 1. Introduction

The purpose of this study is to develop a ranking of 182 academic journals in the field of artificial intelligence (AI) based on the revealed preference approach, which is also referred to as a journal citation impact method. For this, Google Scholar was employed to obtain citations and calculate three relatively new indices: h-index, g-index, and hc-index.

Each scientific domain has its own identity, which is determined by unique research areas, methods of inquiry, leading institutions, prolific scholars, and specific academic courses or programs (Serenko, Cocosila, & Turel, 2008; Serenko, Bontis, & Grant, 2009). Publication outlets also shape an academic field since they inform others about the very existence of a specific area. By using scholarly journals, discipline researchers may share ideas, preserve knowledge, spread innovation, critique colleagues, propose theories, and accumulate references. A well-established set of academic journals has become a sign of discipline maturity (Paul, 2004; Polites & Watson, 2008). In fact, it is impossible to name a recognized academic field that does not have its own domain-specific set of outlets. For instance, when the knowledge management/intellectual capital (KM/IC) field emerged in 1990s, discipline researchers had to submit their manuscripts to general management, accounting or information systems journals. However, for the past 15 years, the KM/IC body of knowledge has been growing exponentially (Serenko & Bontis, 2004) reaching 20 KM/IC-specific outlets by 2008 (Serenko & Bontis, 2009b). By looking at the set of these journals, it is possible to conclude that the KM/IC domain has been officially accepted as a unique scholarly field (Serenko, Bontis, Booker, Sadeddin, & Hardie, 2010).

Since its birth in 1950s, artificial intelligence has evolved into a well-established, recognized academic discipline that has its own identity. First AI-specific academic outlets appeared in late 1950s–early 1960s, and their number has continued

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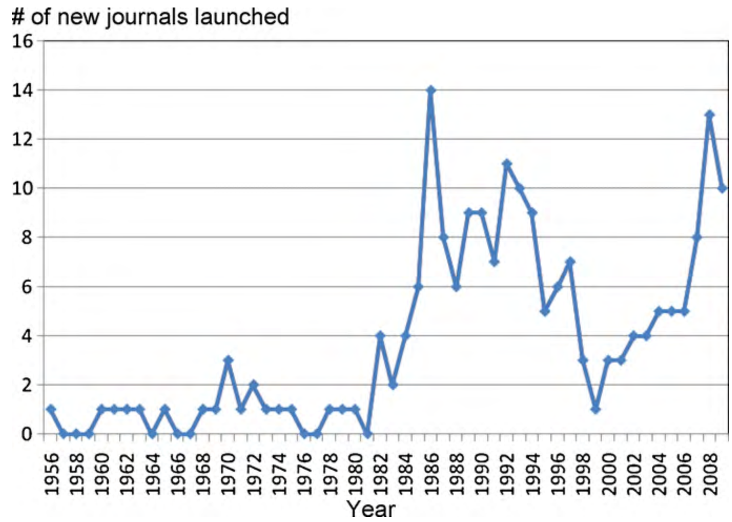


**Fig. 1.** Growth of AI Refereed Academic Journals.

to grow. A comprehensive search of the Ulrich's Periodicals Directory, Thomson Reuters Journal Citation Reports, existing AI journal ranking lists, Google Scholar, and the Internet identified a list of 202 refereed academic journals that mostly concentrate on various aspects of AI. It was observed that for the 1956–2009 period, on average almost four new AI journals were launched yearly. Fig. 1 demonstrates that there was a major growth in the number of new journals for the 1985–1997 period, and since 2002. As the number of outlets increases, so does the body of knowledge. This is consistent with the views of Price (1963) who suggests that in each scientific domain, the body of knowledge grows exponentially.

AI researchers have a variety of refereed scholarly outlets in which they may publish their works. But how do these journals compare with one another in terms of their overall quality, scientific rigor, practical impact or contribution to the body of knowledge? The field of scientometrics, which is referred to as a science about science, may clarify this matter. Scientometrics is a well-recognized discipline (Straub, 2006) that is based on classical works of Robert King Merton, Derek J. de Solla Price and Eugene Garfield (Garfield, 1972, 1979; Merton, 1976, 1973; Price, 1963). Scientometric studies report on the topics investigated in a specific scholarly domain, utilized methodologies, productive individuals or institutions, collaboration processes, citation impacts and research anomalies. One important stream of scientometric research relates to the analysis of academic journals with respect to their usage, quality, and impact. A frequent outcome of such studies is the development of journal ranking lists.

AI researchers have always been interested in the rankings of their refereed academic journals. As a result, a number of AI journal ranking investigations have been completed (Bobrow, 1993; Cheng, Holsapple, & Lee, 1994; Cheng, Holsapple, & Lee, 1996; Forgionne & Kohlib, 2001; Forgionne, Kohli, & Jennings, 2002; Gupta, 1994; Holsapple, Johnson, Manakyan, & Tanner, 1995). Ranking lists of AI outlets have been also presented by www.Journal-Ranking.com. A search of the Internet on the keywords 'AI journal ranking' generates a number of websites that present such lists.

There are several reasons why journal ranking lists are important (Lewis, Templeton, & Luo, 2007; Lowry, Romans, & Curtis, 2004; Lowry, Humphreys, Malwitz, & Nix, 2007). First, scholars prefer to publish their works in the highest ranked journals available for each specific topic. There is a strong belief in the academic community that papers appearing in leading journals are of higher quality, more credible, more widely read, and well-cited. Second, scholars need to know where to look for popular theories, methods, approaches, and ideas. For example, some supervisors advise their doctoral students to cite articles from top journals in their dissertations. Third, officials from funding agencies tend to consult journal ranking lists when they evaluate grant applicants' previous publication records or assess the quality of their scholarly output supported by a grant. Fourth, educational institutions and their officials tend to rely on formal journal ranking lists. As such, hiring, tenure and promotion, and merit pay committees, which are often comprised of the individuals who are unfamiliar with each applicant's research domain, tend to consult journal rankings during their deliberations (Coe & Weinstock, 1984). In many schools, full professor applicants have to publish a number of articles in 'A' outlets to be successful (Starbuck, 2005). Fifth, journal editors, board members, and publishers may use journal ranking information to position and promote their journals. Sixth, libraries may also employ ranking lists to allocate their journal subscription resources.

Not everyone agrees with the arguments presented above. For instance, the fact that a specific work appeared in a leading journal does not necessarily mean it is of high quality. Authors may send their manuscripts to journals that are most suitable for a specific topic regardless of an outlet's ranking (Bonev, 2009). This is particularly true with respect to interdisciplinary and niche journals. Additionally, some schools disregard formal journal ranking lists. Despite these exceptions, ranking lists have become so widely used that it is difficult to deny their importance and impact on academia (Franke, Edlund, & Oster, 1990; Manning & Barrette, 2005; Oltheten, Theoharakis, & Travlos, 2005; Theoharakis & Hirst, 2002; Vokurka, 1996; Walstrom & Hardgrave, 2001). Therefore, it is critical to develop journal ranking lists based on reliable and valid scientific approaches.

## 2. Literature review

There are two methods that may be employed to construct journal ranking lists: stated preference and revealed preference (Lowry et al., 2004, 2007; Truex, Cuellar, & Takeda, 2009). According to the *stated preference approach*, also referred to as an expert survey, a number of active discipline researchers (i.e., experts) rank each academic journal based on their personal perceptions of its overall quality, impact, rigor, relevance, or innovativeness (e.g., see Bharati & Tarasewich, 2002; Mylonopoulos & Theoharakis, 2001). A major advantage of the stated preference method is that obtained rankings may accurately reflect the opinion of a representative group of active field researchers. At the same time, this method has at least six pitfalls that need to be considered.

First, scholars change their opinion regarding journal quality very slowly (Tahai & Meyer, 1999). As a result, long-lasting journal perception memories may potentially distort the survey outcome. For example, some survey participants, especially those who have been disengaged from active research for the previous several years, may base their ranking decisions on somewhat obsolete perceptions of journal quality. In this case, they may underrate new, but at the same time innovative, rigorous and high-quality outlets simply because of their lack of current field knowledge. Second, in their ranking decisions, respondents consider various factors, such as the reputation of editor and review board, journal appearance in citation indices, opinion of key academics, inclusion in existing ranking lists, citation impact, opinion of colleagues, outlet longevity, acceptance rates and circulation (Rogers, Campbell, Louhiala-Salminen, Rentz, & Suchan, 2007; Serenko & Bontis, 2009b). However, some of these factors are purely subjective or even wrong. For instance, those raters who rely on the opinion of key academics or colleagues simply reinforce the dominant opinion. An outlet's longevity may hardly affect the editorial board's capability of attracting and selecting the highest-quality manuscripts. Very low acceptance rates do not necessarily mean that only the best works get accepted; on the contrary, over-reliance on rigor and tradition may result in the rejection of highly innovative papers. For example, once the author of this study submitted a manuscript to an A+ journal in a particular discipline. This work was rejected because the reviewers did not find the methodology rigorous enough in light of their perceptions of this outlet's requirements. This paper was later accepted by an A journal that placed more emphasize on its innovativeness and potential contribution; only a few years later this publication was cited over 80 times that clearly demonstrated its quality and impact.

Third, many researchers conducting journal ranking surveys heavily rely on previous ranking studies (Truex et al., 2009). The inherent methodological flaw is that the list of journals presented to survey respondents is based on the lists employed in previous projects. This phenomenon is also referred to as 'path dependency' or 'replicative fading;' the findings are degenerated because of reiterative duplication of previous results without considering new inputs. Because of this, newer outlets would never make it to the ranking list at all. To address this issue, some ranking surveys present respondents with a previously constructed list as well as allow them to add new journals. This however may only partially solve the problem since it is more difficult for respondents to recall rather than recognize journal names. As a result, omitted journals may be potentially added to the list, but they are unlikely to enjoy accurate ranking positions. Fourth, general familiarity with a journal may be confused with its quality and impact. Some survey respondents may be familiar with a specific outlet simply because they tend to read it more, for instance, if it has more issues per year or publishes more articles on particular topics. This familiarity, in turn, may be reflected on journal quality or impact ranking scores. Fifth, comprehensive and general outlets that appeal to a wider readership have an advantage over niche and specialized journals in ranking surveys. When a randomly chosen sample of active field researchers is selected, only a fraction of them would be familiar with the latter group of outlets. As a result, niche and specialized journals may receive somewhat lower scores compared to their more general counterparts, which would not necessarily reflect their overall quality and impact. Last, institutional politics may also play a role in the development of journal quality lists (Adler & Harzing, 2009; Gallivan & Benbunan-Fich, 2007). For example, some universities have established their own institutional journal ranking lists. In many cases, those lists contain outlets in which well-recognized members of these institutions have published or served on the editorial boards. The bias inherent in these institutional lists may be reflected on external journal ranking surveys.

In contrast, the *revealed preference approach*, also labeled as a citation impact technique,[1] addresses the issue of opinion bias by allowing developing ranking lists based on the actual citation impact of each outlet. According to this technique, there is a positive relationship between the citation impact of each outlet and its position in the ranking list. In other words, the more well-cited papers the journal has published, the higher its ranking position. Therefore, it eliminates most of the issues inherent in expert surveys. As such, the revealed preference approach relies on the actual citation behaviors of active field researchers, and not on their perceptions. Subjective measures of quality, such as the reputation of editor, acceptance rates or opinion of colleagues are hardly relevant. Appearance in previous ranking lists has little impact on each journal's citations, journal impact is measured in terms of the number of citations rather than general familiarity, and the influence of institutional politics is limited. In some cases, there may be pressure from journal editors or reviewers to include citations to their own journals or papers. Self-citations may also inflate the rankings. However, in most cases, individual scholars tend to cite the most appropriate sources in order to justify their viewpoints. Overall, citation studies are a popular tool for evaluating impact, contribution and dissemination of knowledge in various scientific domains, and they may be applied

[1] Even though the revealed preference method is mostly referred to as a citation impact technique, a recently developed Publication Power Approach, which employs a totally different perspective, also falls under this category.

to individuals, institutions, countries, or journals (Cheng, Kumar, Motwani, Reisman, & Madan, 1999; Goodrum, McCain, Lawrence, & Giles, 2001; Harzing, 2005; Holsapple, Johnson, Manakyan, & Tanner, 1994; Howard & Day, 1995; Kleijnen & Van Groenendaal, 2000).

Since its introduction by Gross and Gross (1927), the citation impact approach has become a widely applied tool, especially after the emergence of the Science Citation Index (Garfield, 1972, 1979; Holsapple et al., 1994; MacRoberts & MacRoberts, 1989). There are arguments that citation impact is the best way for non-discipline researchers to assess a person's or journal's contribution to the body of knowledge (Meho, 2007). One the one hand, the stated and revealed preference techniques may generate highly comparable results in some disciplines (Bontis & Serenko, 2009; Mingers & Harzing, 2007). On the other hand, there is no evidence to support this claim with respect to the AI field. Moreover, Barnes (2005) demonstrated that these approaches may sometimes generate different results for individual outlets. In this project, the revealed preference method was selected in order to continue the line of research by Cheng et al. (1996). In addition, it has fewer biases compared to expert surveys.

Before the advent of the Internet, Thomson Reuters (formerly known as the Institute for Scientific Information, or ISI) was perhaps the only comprehensive database containing references to thousands of refereed scholarly journals and generating the Journal Citation Reports which formed the foundation for journal ranking lists (Meho, 2007; Meho & Yang, 2007). However, the use of Thomson's data in journal ranking studies has several drawbacks. First, the readerships of journals indexed by Thomson is limited to a select number of subscribed individuals and institutions (Harzing & van der Wal, 2008a). As a result, articles from these journals receive less exposure, which may diminish their citation impact. In contrast, Google Scholar contains many articles that are freely available online. Second, whereas Thomson utilizes only references from journals, Google Scholar provides a more comprehensive coverage by considering citations coming from journals, conference proceedings, books, chapters, industry reports, patents, etc., including non-English publications (Kousha & Thelwall, 2007; Nisonger, 2004). Third, Thomson indexes only a small part of all refereed journals. For example, it contains only 36% of all Information Systems outlets (Fisher, Shanks, & Lamp, 2007). Out of 202 AI journals identified in the present study, only 61% were indexed by Thomson. As such, Thomson's citation impact data for a larger segment of outlets is missing, and these journals are simply excluded from citation-based journal ranking lists. Google Scholar offers citation data for a dramatically larger number of academic outlets. Overall, it is concluded that Google Scholar is a more suitable source of citation data to develop a ranking of AI journals.

A number of previous studies developed general, comprehensive, or cross-disciplinary ranking lists of academic journals. This approach, however, may potentially produce inaccurate results that in turn may hinder the development of science. For example, AI journals are sometimes included in rankings of general management or computer science outlets. However, compared to a computer science journal, which is targeted to general computer science researchers, an AI-specific outlet may be read by a smaller community of scholars who are interested in AI topics only. Therefore, an AI-focused journal would obtain fewer citations and lower ranking than general computer science journals; however this position would not necessarily reflect its actual contribution. For example, when AI journals are included in the lists of information systems journals, they are rarely ranked highly (Fisher et al., 2007). Therefore, this project focuses on AI-specific academic journals only to avoid results confounding and to establish a valid ranking list.

In order to develop the ranking, the following three indices were utilized: h-index, g-index, and hc-index. These are very popular measures of journal quality that may be obtained from Google Scholar. The key difference between these indices and Thomson's Citation Impact Factors is that the former reflect the citation impact of the outlet since its very inception, whereas the latter cover only a short period of time, usually 2 or 5 years. It is believed that measuring the quality of AI outlets based on the citation impact of only recent publications may not accurately reflect their entire contribution to the body of knowledge and skew the rankings.

According to the h-index, proposed by Hirsch (2005), a "scientist has index $h$ if h of his or her $Np$ papers have at least $h$ citations each and the other ($Np$–$h$) papers have fewer than $h$ citations each" (p. 16569). Despite its novelty, h-index was successfully utilized in various scientometric studies (Ball, 2005; Banks, 2006; Liang, 2006; Moussa & Touzani, 2010; Saad, 2006). Its major advantage is that it can distinguish between outlets that generate most of their citations from only a few works, and those that produce well-cited publications more consistently. A key drawback of the h-index is that it ignores the actual number of citations of papers that exceed the cut-off value of h (Egghe, 2008). G-index corrects this weakness by considering an overall number of citations from a set of works. According to Egghe (2006), when all journal's articles are "ranked in decreasing order of the number of citations that they received, the g-index is the (unique) largest number such that the top $g$ articles received (together) at least $g^2$ citations" (p. 131). Therefore, g-index, which has been already employed in several projects (Harzing & van der Wal, 2008b; Tol, 2008), considers both the number of well-cited publications and their overall citation performance throughout the entire journal's existence.

However, both h- and g-index do not consider the age of each article (i.e., the year when it was published). For example, an older journal, which published many well-cited works in the past but is currently less visible in the field, may still enjoy high h- and g-indices. At the same time, these indices are lower for prominent new outlets that are likely to produce a large number of well-cited articles in future but have published a small number of papers because of time constraints. Contemporary h-index, or hc-index, addresses this issue by considering the age of each article by placing more weight on recent works and reducing the impact of older publications (Sidiropoulos, Katsaros, & Manolopoulos, 2007). In other words, it ages each article when calculating its citation impact by encouraging well-cited recent works. For instance, citations of a paper that was published in the current year count four times. If an article appeared 4 years ago, its citations count only one time; 6 years ago–4/6 times, etc. Therefore, an older paper gradually loses its value even if it is cited, whereas new well-cited papers gain weight.

Overall, it is suggested that these three measures may be successfully utilized to develop a ranking of AI scholarly journals. The following section describes the methodology in detail and presents the findings.

## 3. Methodology and results

### 3.1. Method

By using the Ulrich's Periodicals Directory, Thomson Reuters Journal Citation Reports, existing AI journal ranking lists, Google Scholar and the Internet, a compressive and exhaustive search for academic refereed journals, which mainly report on various aspects of AI research, was conducted. In the result, 202 outlets were identified. Out of them, 20 were either forthcoming or so new that they did not attract any citations. Only journals that were currently in print were considered (i.e., discontinued journals were excluded). Overall, 182 AI journals were retained for further analysis. Citation data were obtained from Google Scholar in January–February 2009 by using Harzing's Publish or Perish tool that automatically generates citation indices. For all journals that changed their titles, including journals that merged together, manual data aggregation was done. All articles that were included in at least one index were manually confirmed with the publisher to ensure the accuracy of the results. No restriction on the discipline was placed, and the 'Lookup Direct' function was applied to retrieve the latest data directly from Google. Overall, this approach is consistent with those utilized in previous journal ranking projects (Cuellar, Takeda, & Truex, 2008; Serenko & Bontis, 2009a).

### 3.2. Findings

Table 1 presents the final journal ranking list. The outlets were ranked according to the following process: (1) h-, g-, and hc-indices were calculated for each outlet. (2) Each index was standardized. To standardize the scores, index mean was subtracted from each raw score and the result was divided by the index standard deviation. As a result, the mean of the standardized index was zero. (3) The average of these three standardized indices (h, g, and hc) was calculated for each journal. (4) The final score for each journal was recorded by adding the value of two. This was done to avoid negative score values, which resulted from standardization.

Consistent with previous approaches (Bontis & Serenko, 2009; Gillenson & Stafford, 2008; Serenko & Bontis, 2009a), the list includes approximately 5% of A+ (i.e., 9 journals), 20% of A (i.e., 36 journals), 50% of B (i.e., 89 journals), 20% of C (i.e., 37 journals), and 5% of D (i.e., 11 journals) level outlets. This is done to limit the number of top-tier outlets to a small but reasonable number, and to allow scholars to publish their works in journals of acceptable quality (i.e., B). For example, the number of A+ journals was calculated as follows: 182 times 5% = 9.

Table 2 presents non-parametric Spearman rank correlations for the utilized indices. For 123 journals that are indexed by Thomson, Journal Impact Factors (JIF) were also correlated with the indices obtained in the present study. First, it was found that h-index, g-index and hc-index correlated almost perfectly. Second, JIF also strongly correlated with these three indices that is consistent with prior research (Pauly & Stergiou, 2005). Third, h-, g-, and hc-indices moderately correlated with the journal's longevity (years in print), but no such correlation was discovered for JIF. A Spearman's rank correlation was also measured between a journal rank and its longevity (rho = 0.669, $p < 0.001$).

Table 3 outlines journal tier comparison. First, differences among journal groups were observed. Second, all A+ and A, most B, few C, and almost none D level outlets were indexed by Thomson. Therefore, there is a positive relationship between a journal's ranking position and its inclusion in the Thomson index. Third, a positive relationship between a journal's ranking position and its longevity (years in print) was discovered.

## 4. Discussion and conclusions

The purpose of this project was to develop a comprehensive ranking of academic refereed journals in the field of artificial intelligence. For this, 182 outlets were identified and ranked based on the average of the standardized values of h-index, g-index and hc-index. The citation data was obtained from Google Scholar by means of Harzing's Publish or Perish tool. The proposed list is consistent with previous rankings of AI journals. For example, out of 10 premium AI journals (http://www3.ntu.edu.sg/home/ASSourav/jrank.htm), the present study identified 8 as A+ and 2 as A journals. Given that all correlations between the three obtained indices and Thomson's Journal Impact Factors were strong (i.e., over 0.6), it is concluded that Google Scholar offers somewhat comparable results with a wider coverage. As such, by using the Thomson's data, it would be impossible to rank all the outlets identified in this study.

The scientometric literature advocates that journal longevity (i.e., years in print) is usually considered an important factor influencing an outlet's position in ranking lists. The rationale is that journals with longer history have wider readerships, get more exposure, publish more works, and generate more citations. In the final ranking, a positive relationship between the journal tier and its longevity was identified. For example, A+ outlets have been 28 years in print, whereas B journals only 19 (see Table 3). The Spearman's rank correlation between a journal's rank and its longevity was also strong (rho = 0.669, $p < 0.001$). At the same time, journal longevity explains only 45% of the variance with respect to its ranking position. A

**Table 1**
AI journal ranking (*indexed by Thomson).

| Rank | Tier | Title | Year[a] | Score | h-Index | g-Index | hc-Index | 2008 JIF[b] |
|---|---|---|---|---|---|---|---|---|
| 1 | A+ | IEEE Transactions on Pattern Analysis and Machine Intelligence* | 1979 | 6.00 | 172 | 375 | 138 | 5.960 |
| 2 | A+ | Artificial Intelligence: An International Journal* | 1970 | 5.61 | 186 | 321 | 117 | 3.397 |
| 3 | A+ | Machine Learning* | 1986 | 5.27 | 148 | 304 | 124 | 2.326 |
| 4 | A+ | International Journal of Computer Vision* | 1987 | 5.26 | 152 | 293 | 124 | 5.358 |
| 5 | A+ | IEEE Transactions on Systems, Man, & Cybernetics, all parts combined (formerly IEEE Transactions on: Man–Machine Systems; Systems Science and Cybernetics; Human Factors in Electronics; and IRE Transactions on Human Factors in Electronics)[c]* | 1960 | 5.15 | 167 | 335 | 88 | not used |
| 6 | A+ | IEEE Transactions on Image Processing* | 1992 | 4.91 | 143 | 241 | 123 | 3.315 |
| 7 | A+ | Neural Computation* | 1989 | 4.79 | 138 | 259 | 110 | 2.378 |
| 8 | A+ | IEEE Transactions on Neural Networks* | 1990 | 4.35 | 127 | 227 | 94 | 3.726 |
| 9 | A+ | Computational Linguistics* | 1975 | 4.27 | 109 | 233 | 99 | 2.656 |
| 10 | A | Pattern Recognition: The Journal of the Pattern Recognition Society* | 1968 | 4.09 | 124 | 209 | 82 | 3.279 |
| 11 | A | IEEE Transactions on Robotics (formerly IEEE Journal of Robotics and Automation; IEEE Transactions on Robotics and Automation. Note that IEEE Transactions on Robotics and Automation was split into two journals)* | 1985 | 4.08 | 121 | 190 | 91 | 2.656 |
| 12 | A | Neural Networks (The Official Journal of the International Neural Network Society, European Neural Network Society & Japanese Neural Network Society)* | 1988 | 3.84 | 111 | 210 | 71 | 2.656 |
| 13 | A | Biological Cybernetics: Advances in Computational Neuroscience* | 1961 | 3.72 | 112 | 202 | 64 | 1.935 |
| 14 | A | International Journal of Robotics Research* | 1982 | 3.53 | 105 | 175 | 64 | 2.882 |
| 15 | A | Fuzzy Sets and Systems: An International Journal in Information Science and Engineering* | 1978 | 3.48 | 117 | 185 | 47 | 1.833 |
| 16 | A | IEEE Transactions on Knowledge and Data Engineering* | 1989 | 3.42 | 86 | 160 | 75 | 2.236 |
| 17 | A | Graphical Models (formerly Graphical Models & Image Processing; Computer Graphics and Image Processing; Computer Vision, Graphics, and Image Processing)* | 1972 | 3.37 | 111 | 196 | 38 | 0.913 |
| 18 | A | Automatica: A Journal of IFAC, the International Federation of Automatic Control* | 1963 | 3.35 | 98 | 166 | 58 | 3.178 |
| 19 | A | AI Magazine* | 1980 | 3.33 | 84 | 152 | 72 | 0.691 |
| 20 | A | IEEE Transactions on Fuzzy Systems* | 1993 | 3.22 | 86 | 149 | 63 | 3.624 |
| 21 | A | IEEE Transactions on Audio, Speech and Language Processing (formerly IEEE Transactions on Speech and Audio Processing)* | 1993 | 3.21 | 83 | 142 | 67 | 1.848 |
| 22 | A | Computer Vision and Image Understanding (formerly CVGIP: Image Understanding)[d]* | 1939 | 3.20 | 91 | 160 | 53 | 2.220 |
| 23 | A | Journal of Machine Learning Research* | 2000 | 3.13 | 73 | 130 | 72 | 3.116 |
| 24 | A | Image and Vision Computing* | 1983 | 3.05 | 79 | 124 | 64 | 1.496 |
| 25 | A | Data Mining and Knowledge Discovery* | 1997 | 3.01 | 65 | 157 | 58 | 2.421 |
| 26 | A | Evolutionary Computation (MIT Press)* | 1993 | 2.92 | 67 | 145 | 54 | 3.000 |
| 27 | A | IEEE Transactions on Evolutionary Computation* | 1997 | 2.86 | 64 | 130 | 57 | 3.736 |
| 28 | A | Pattern Recognition Letters* | 1982 | 2.84 | 76 | 114 | 53 | 1.559 |
| 29 | A | Speech Communication* | 1982 | 2.74 | 71 | 110 | 50 | 1.229 |
| 30 | A | Medical Image Analysis* | 1996 | 2.66 | 59 | 111 | 52 | 3.602 |
| 31 | A | IEEE Intelligent Systems (formerly IEEE Intelligent Systems and their Applications; IEEE Expert)* | 1986 | 2.65 | 63 | 118 | 45 | 2.278 |
| 32 | A | Journal of Automated Reasoning* | 1985 | 2.64 | 67 | 101 | 48 | 1.691 |
| 33 | A | Autonomous Robots* | 1994 | 2.61 | 59 | 100 | 52 | 1.500 |
| 34 | A | Computational Intelligence: An International Journal* | 1985 | 2.56 | 62 | 111 | 41 | 3.310 |
| 35 | A | Journal of Logic and Computation* | 1990 | 2.55 | 60 | 100 | 46 | 0.536 |
| 36 | A | Data & Knowledge Engineering* | 1985 | 2.54 | 58 | 102 | 46 | 1.480 |
| 37 | A | Journal of Artificial Intelligence Research* | 1993 | 2.51 | 59 | 105 | 42 | 1.611 |
| 38 | A | Robotics and Autonomous Systems (formerly Robotics)* | 1985 | 2.49 | 61 | 91 | 44 | 1.214 |
| 39 | A | The Visual Computer: International Journal of Computer Graphics* | 1985 | 2.45 | 61 | 96 | 39 | 1.061 |
| 40 | A | Knowledge Engineering Review* | 1984 | 2.42 | 46 | 125 | 36 | 1.588 |
| 40 | A | User Modeling & User-Adapted Interaction: The Journal of Personalization Research* | 1991 | 2.42 | 52 | 100 | 42 | 1.483 |
| 42 | A | Autonomous Agents and Multi-Agent Systems* | 1998 | 2.40 | 48 | 98 | 44 | 2.125 |
| 42 | A | Network: Computation in Neural Systems* | 1990 | 2.40 | 51 | 91 | 44 | 1.333 |
| 44 | A | Journal of Computational and Graphical Statistics* | 1992 | 2.39 | 51 | 110 | 36 | 1.505 |

Table 1 (*Continued* )

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 45 | A | Chemometrics and Intelligent Laboratory Systems: An International Journal Sponsored by the Chemometrics Society (incorporating Laboratory Automation & Information Management)* | 1986 | 2.38 | 62 | 97 | 32 | 1.940 |
| 46 | B | Neurocomputing* | 1989 | 2.35 | 53 | 96 | 37 | 1.234 |
| 47 | B | Annals of Mathematics and Artificial Intelligence* | 1990 | 2.34 | 52 | 80 | 43 | 0.722 |
| 48 | B | Journal of Intelligent Information Systems (integrating Artificial Intelligence and Database Technologies)* | 1992 | 2.29 | 46 | 95 | 37 | 1.075 |
| 49 | B | Journal of Computational Neuroscience* | 1994 | 2.28 | 49 | 75 | 42 | 2.750 |
| 50 | B | Adaptive Behavior* | 1992 | 2.23 | 48 | 82 | 36 | 1.152 |
| 50 | B | Computer Speech and Language* | 1986 | 2.23 | 48 | 96 | 31 | 1.413 |
| 52 | B | Applied Artificial Intelligence: An International Journal* | 1987 | 2.22 | 44 | 82 | 38 | 0.795 |
| 53 | B | Artificial Intelligence in Medicine* | 1989 | 2.20 | 48 | 71 | 38 | 1.960 |
| 54 | B | Artificial Life* | 1994 | 2.18 | 45 | 83 | 34 | 1.164 |
| 54 | B | Natural Language Engineering | 1995 | 2.18 | 43 | 75 | 38 | |
| 56 | B | Complex Systems | 1987 | 2.14 | 47 | 99 | 23 | |
| 57 | B | Expert Systems with Applications: An International Journal* | 1990 | 2.13 | 48 | 69 | 33 | 2.596 |
| 57 | B | Journal of Visual Communication and Image Representation* | 1990 | 2.13 | 42 | 81 | 33 | 1.342 |
| 59 | B | Artificial Intelligence Review: An International Science and Engineering Journal* | 1986 | 2.12 | 43 | 82 | 31 | 0.119 |
| 59 | B | International Journal of Artificial Intelligence in Education | 1989 | 2.12 | 45 | 80 | 30 | |
| 59 | B | Journal of Heuristics* | 1995 | 2.12 | 42 | 68 | 37 | 1.064 |
| 62 | B | International Journal of Approximate Reasoning* | 1987 | 2.11 | 48 | 75 | 29 | 1.708 |
| 62 | B | Journal of Mathematical Imaging and Vision* | 1992 | 2.11 | 44 | 63 | 37 | 1.331 |
| 64 | B | Connection Science* | 1989 | 2.10 | 42 | 76 | 32 | 0.884 |
| 65 | B | Journal of Visual Languages and Computing* | 1990 | 2.09 | 42 | 75 | 32 | 0.863 |
| 66 | B | International Journal of Intelligent Systems* | 1986 | 2.07 | 45 | 68 | 31 | 0.860 |
| 66 | B | Journal of Field Robotics (formerly Journal of Robotic Systems)* | 1984 | 2.07 | 47 | 79 | 25 | 2.684 |
| 68 | B | Machine Vision and Applications: An International Journal* | 1988 | 2.05 | 41 | 73 | 30 | 1.485 |
| 69 | B | Knowledge-Based Systems* | 1987 | 2.04 | 41 | 68 | 31 | 0.924 |
| 70 | B | Automated Software Engineering: An International Journal | 1994 | 1.97 | 35 | 59 | 33 | |
| 71 | B | Constraints: An International Journal* | 1996 | 1.96 | 37 | 56 | 32 | 0.879 |
| 71 | B | Journal of Experimental & Theoretical Artificial Intelligence* | 1989 | 1.96 | 34 | 72 | 28 | 0.341 |
| 73 | B | IEEE Robotics and Automation Magazine* | 1994 | 1.89 | 38 | 59 | 25 | 3.000 |
| 74 | B | Cybernetics and Systems: An International Journal* | 1971 | 1.88 | 35 | 72 | 21 | 0.494 |
| 75 | B | Advanced Engineering Informatics (formerly Artificial Intelligence in Engineering)* | 1986 | 1.85 | 37 | 49 | 26 | 1.848 |
| 75 | B | International Journal of Cooperative Information Systems* | 1992 | 1.85 | 34 | 54 | 26 | 0.714 |
| 75 | B | International Journal of Neural Systems* | 1989 | 1.85 | 35 | 65 | 21 | 0.901 |
| 78 | B | International Journal of Pattern Recognition and Artificial Intelligence* | 1987 | 1.84 | 37 | 58 | 22 | 0.660 |
| 78 | B | International Journal of Systems Science* | 1970 | 1.84 | 37 | 62 | 20 | 0.634 |
| 80 | B | Robotics and Computer-Integrated Manufacturing (formerly Computer-Integrated Manufacturing Systems)* | 1984 | 1.82 | 40 | 52 | 20 | 1.371 |
| 81 | B | AI Communications* | 1988 | 1.80 | 31 | 52 | 25 | 0.608 |
| 81 | B | Journal of Intelligent Manufacturing* | 1990 | 1.80 | 34 | 52 | 23 | 1.018 |
| 83 | B | IEEE Transactions on Intelligent Transportation Systems* | 2000 | 1.79 | 30 | 49 | 26 | 2.844 |
| 84 | B | Pattern Analysis and Applications* | 1998 | 1.76 | 27 | 61 | 21 | 1.367 |
| 85 | B | Engineering Applications of Artificial Intelligence: The International Journal of Intelligent Real-Time Automation* | 1988 | 1.73 | 32 | 43 | 22 | 1.397 |
| 85 | B | Intelligent Data Analysis: An International Journal* | 1997 | 1.73 | 28 | 53 | 21 | 0.426 |
| 85 | B | International Journal of Software Engineering and Knowledge Engineering* | 1991 | 1.73 | 28 | 52 | 22 | 0.447 |
| 85 | B | Mechatronics: The Science of Intelligent Machines* | 1991 | 1.73 | 33 | 47 | 20 | 1.434 |
| 89 | B | Applied Intelligence* | 1970 | 1.72 | 31 | 46 | 21 | 0.775 |
| 89 | B | International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems* | 1993 | 1.72 | 30 | 54 | 19 | 1.000 |
| 89 | B | Neural Processing Letters* | 1994 | 1.72 | 26 | 53 | 22 | 0.942 |

Table 1 (*Continued* )

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 92 | B | Artificial Intelligence and Law | 1992 | 1.71 | 29 | 50 | 20 | |
| 92 | B | Genetic Programming and Evolvable Machines | 2000 | 1.71 | 29 | 43 | 23 | |
| 94 | B | Machine Translation | 1986 | 1.70 | 28 | 44 | 22 | |
| 94 | B | Minds and Machines: Journal for Artificial Intelligence, Philosophy and Cognitive Science* | 1991 | 1.70 | 29 | 43 | 22 | 0.340 |
| 96 | B | International Journal of Lexicography* | 1988 | 1.68 | 27 | 65 | 13 | 0.091 |
| 96 | B | Journal of Intelligent and Robotic Systems* | 1988 | 1.68 | 29 | 47 | 19 | 0.560 |
| 98 | B | Robotica* | 1983 | 1.67 | 29 | 42 | 20 | 0.781 |
| 99 | B | Design Automation for Embedded Systems: An International Journal* | 1996 | 1.65 | 26 | 43 | 20 | 0.909 |
| 99 | B | Journal of East Asian Linguistics* | 1992 | 1.65 | 28 | 47 | 17 | 0.375 |
| 101 | B | Cognitive Systems Research* | 1999 | 1.64 | 24 | 40 | 22 | 1.581 |
| 101 | B | International Journal on Artificial Intelligence Tools* | 1992 | 1.64 | 24 | 42 | 21 | 0.667 |
| 101 | B | International Journal on Document Analysis and Recognition* | 1998 | 1.64 | 25 | 40 | 21 | 0.909 |
| 104 | B | Advanced Robotics: The International Journal of the Robotics Society of Japan* | 1986 | 1.63 | 26 | 39 | 20 | 0.737 |
| 105 | B | Literary and Linguistic Computing | 1986 | 1.62 | 27 | 45 | 16 | |
| 106 | B | Artificial Intelligence for Engineering Design, Analysis and Manufacturing* | 1987 | 1.58 | 28 | 45 | 12 | 0.477 |
| 107 | B | Journal of Interactive Learning Research | 1990 | 1.56 | 24 | 38 | 16 | |
| 108 | B | Automation and Remote Control (Avtomatika i Telemekhanika)[e]* | 1936 | 1.55 | 28 | 48 | 9 | 0.236 |
| 108 | B | Expert Systems: The Journal of Knowledge Engineering* | 1984 | 1.55 | 25 | 43 | 13 | 0.717 |
| 110 | B | Journal of Computer Science and Technology* | 1986 | 1.54 | 21 | 42 | 15 | 0.576 |
| 111 | B | ACM Journal of Experimental Algorithmics | 1996 | 1.52 | 19 | 31 | 19 | |
| 111 | B | Neural Computing and Applications* | 1993 | 1.52 | 23 | 34 | 15 | 0.767 |
| 113 | B | Kybernetes* | 1972 | 1.51 | 25 | 36 | 12 | 0.235 |
| 113 | B | Kybernetika (International Journal Published by Institute of Information Theory and Automation)* | 1965 | 1.51 | 24 | 41 | 11 | 0.281 |
| 115 | B | Information Visualization | 2002 | 1.49 | 18 | 35 | 16 | |
| 116 | B | Applied Soft Computing: The Official Journal of the World Federation on Soft Computing* | 2001 | 1.48 | 19 | 27 | 18 | 1.909 |
| 116 | B | Journal of Computational Acoustics* | 1993 | 1.48 | 21 | 33 | 14 | 0.585 |
| 118 | B | Integrated Computer-Aided Engineering* | 1994 | 1.47 | 20 | 33 | 14 | 0.617 |
| 118 | B | International Journal of Parallel, Emergent and Distributed Systems | 1993 | 1.47 | 19 | 32 | 15 | |
| 118 | B | Journal of Intelligent and Fuzzy Systems: Applications in Engineering and Technology* | 1993 | 1.47 | 19 | 43 | 11 | 0.649 |
| 121 | B | AI and Society: Journal of Knowledge, Culture and Communication | 1987 | 1.46 | 19 | 35 | 13 | |
| 121 | B | Journal of Automata, Languages and Combinatorics (formerly Journal of Information Processing and Cybernetics) | 1996 | 1.46 | 23 | 35 | 10 | |
| 123 | B | ACM Transactions on Asian Language Information Processing | 2002 | 1.40 | 16 | 25 | 14 | |
| 123 | B | Neural Network World* | 1991 | 1.40 | 21 | 28 | 9 | 0.395 |
| 125 | B | Computing and Informatics (formerly Computers and Artificial Intelligence)* | 1982 | 1.39 | 20 | 33 | 7 | 0.492 |
| 125 | B | International Journal of Corpus Linguistics | 1996 | 1.39 | 19 | 27 | 10 | |
| 125 | B | Journal of Neural Engineering* | 2004 | 1.39 | 15 | 26 | 14 | 2.737 |
| 128 | B | Fuzzy Optimization and Decision Making | 2002 | 1.37 | 16 | 24 | 12 | |
| 128 | B | International Journal of Speech Technology | 1995 | 1.37 | 17 | 24 | 11 | |
| 128 | B | Journal of Applied Non-Classical Logics | 1991 | 1.37 | 18 | 26 | 10 | |
| 128 | B | Mathware & Soft Computing | 1994 | 1.37 | 17 | 28 | 10 | |
| 132 | B | International Journal of Humanoid Robotics* | 2004 | 1.34 | 12 | 25 | 12 | 0.542 |
| 133 | B | Journal of Japanese Society for Artificial Intelligence | 1986 | 1.33 | 14 | 32 | 7 | |
| 133 | B | Machine Graphics and Vision: International Journal | 1992 | 1.33 | 14 | 25 | 10 | |
| 135 | C | Intelligent Automation & Soft Computing* | 1995 | 1.31 | 14 | 26 | 8 | 0.224 |
| 135 | C | International Journal of Information Technology & Decision Making* | 2002 | 1.31 | 13 | 19 | 11 | 0.953 |
| 135 | C | Journal of Quantitative Linguistics | 1994 | 1.31 | 13 | 22 | 10 | |
| 135 | C | Soft Computing: A Fusion of Foundations, Methodologies and Applications* | 1997 | 1.31 | 11 | 27 | 10 | 0.984 |
| 139 | C | Artificial Life and Robotics | 1997 | 1.30 | 14 | 19 | 10 | |
| 139 | C | Web Intelligence and Agent Systems: An International Journal | 2003 | 1.30 | 12 | 20 | 11 | |

Table 1 (*Continued* )

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 141 | C | Journal of Robotics and Mechatronics | 1989 | 1.29 | 14 | 21 | 8 | |
| 142 | C | International Journal of Computational Cognition | 2003 | 1.28 | 12 | 19 | 10 | |
| 142 | C | International Journal of Robotics and Automation* | 1986 | 1.28 | 15 | 21 | 7 | 0.409 |
| 144 | C | International Journal of Computational Intelligence and Applications | 2001 | 1.27 | 12 | 18 | 9 | |
| 145 | C | International Journal of Intelligent Systems in Accounting, Finance & Management | 1992 | 1.23 | 10 | 22 | 6 | |
| 146 | C | Industrial Robot: An International Journal* | 1974 | 1.22 | 11 | 20 | 5 | 0.404 |
| 146 | C | Journal of Computer and Systems Sciences International* | 1962 | 1.22 | 10 | 19 | 6 | 0.082 |
| 148 | C | Journal of Multiple-Valued Logic and Soft Computing* | 1995 | 1.21 | 9 | 12 | 9 | 0.308 |
| 149 | C | IEEE Computational Intelligence Magazine* | 2006 | 1.19 | 9 | 15 | 6 | 2.535 |
| 149 | C | International Journal of Advanced Robotic Systems | 2004 | 1.19 | 8 | 12 | 8 | |
| 151 | C | International Journal of Knowledge-Based and Intelligent Engineering Systems | 1997 | 1.18 | 9 | 14 | 6 | |
| 152 | C | International Journal of Hybrid Intelligent Systems | 2004 | 1.16 | 7 | 11 | 7 | |
| 152 | C | Journal of Advanced Computational Intelligence and Intelligent Informatics | 1997 | 1.16 | 7 | 11 | 7 | |
| 152 | C | Journal of Chinese Information Processing | 1986 | 1.16 | 9 | 12 | 5 | |
| 155 | C | Journal of Computational Methods in Sciences and Engineering | 2001 | 1.15 | 7 | 10 | 6 | |
| 156 | C | International Journal of Innovative Computing, Information and Control* | 2005 | 1.14 | 6 | 10 | 6 | 2.791 |
| 156 | C | Journal of Uncertain Systems | 2007 | 1.14 | 5 | 12 | 6 | |
| 158 | C | Control and Intelligent Systems | 1973 | 1.13 | 7 | 10 | 5 | |
| 158 | C | International Journal of Engineering Intelligent Systems for Electrical Engineering and Communications[f]* | 1993 | 1.13 | 6 | 11 | 5 | not used |
| 160 | C | 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) | 1991 | 1.12 | 6 | 8 | 5 | |
| 160 | C | International Journal of Computational Intelligence | 2005 | 1.12 | 6 | 8 | 5 | |
| 160 | C | International Journal of Computational Intelligence Research | 2005 | 1.12 | 5 | 10 | 5 | |
| 160 | C | International Journal of Intelligent Systems, Technologies and Applications | 2005 | 1.12 | 5 | 8 | 6 | |
| 164 | C | International Journal of Cognitive Informatics & Natural Intelligence | 2007 | 1.10 | 4 | 6 | 6 | |
| 165 | C | International Journal of Intelligent Information Technologies | 2005 | 1.09 | 4 | 7 | 5 | |
| 165 | C | Journal of Real-Time Image Processing | 2006 | 1.09 | 5 | 5 | 5 | |
| 165 | C | Journal of Systemics, Cybernetics and Informatics | 2003 | 1.09 | 6 | 6 | 4 | |
| 168 | C | Journal of Automation and Information Sciences | 1969 | 1.08 | 6 | 6 | 3 | |
| 169 | C | Computational Intelligence and Neuroscience | 2007 | 1.06 | 3 | 5 | 4 | |
| 170 | C | International Journal of Innovative Computing and Applications | 2007 | 1.05 | 3 | 5 | 3 | |
| 171 | C | Journal of Pattern Recognition Research | 2006 | 1.03 | 2 | 3 | 3 | |
| 172 | D | Evolutionary Intelligence | 2008 | 1.02 | 2 | 3 | 2 | |
| 172 | D | Intelligent Decision Technologies: An International Journal | 2007 | 1.02 | 2 | 4 | 2 | |
| 172 | D | International Journal of Medical Robotics and Computer Assisted Surgery | 2004 | 1.02 | 2 | 3 | 2 | |
| 172 | D | Journal of Automation, Mobile Robotics & Intelligent Systems | 2007 | 1.02 | 2 | 3 | 2 | |
| 176 | D | IET Computer Vision* | 2007 | 1.01 | 2 | 2 | 2 | 0.667 |
| 176 | D | International Journal of Soft Computing | 2006 | 1.01 | 2 | 2 | 2 | |
| 176 | D | Journal of Artificial Evolution and Applications | 2008 | 1.01 | 1 | 2 | 2 | |
| 179 | D | Journal of Cybernetics and Informatics (Slovak Society for Cybernetics and Informatics) | 2003 | 1.00 | 2 | 2 | 1 | |
| 180 | D | Advances in Fuzzy Sets and Systems | 2006 | 0.99 | 1 | 1 | 1 | |
| 180 | D | International Journal of Advanced Intelligence Paradigms | 2008 | 0.99 | 1 | 1 | 1 | |

Table 1 (*Continued* )

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 180 | D | Open Cybernetics & Systemics Journal | 2007 | 0.99 | 1 | 1 | 1 |

[a] The year the first volume was published.
[b] 2008 Journal Impact Factors were not used in the development of this ranking.
[c] Since the 2008 JIF of IEEE Transactions on Systems, Man and Cybernetics is available for each part separately, its JIF was 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 many cases, 'Part' was missing in journal titles).
[d] CVGIP: Image Understanding's year was not used in analysis since this journal was not initially directed towards AI topics.
[e] 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.
[f] The 2008 JIF of International Journal of Engineering Intelligent Systems for Electrical Engineering and Communications was zero since this outlet was just added to the index. Therefore, its JIF was excluded from analysis.

**Table 2**
Spearman's rank correlations for indices and journal longevity (all values are significant at 0.001 level).

| Index | h-Index | g-Index | hc-Index | JIF |
|---|---|---|---|---|
| Longevity (years in print) | 0.610 ($p < .001$) | 0.596 ($p < .001$) | 0.500 ($p < .001$) | −0.089 n.s. |
| h-Index | 1.000 | 0.989 ($p < .001$) | 0.977 ($p < .001$) | 0.663 ($p < .001$) |
| g-Index | | 1.000 | 0.970 ($p < .001$) | 0.637 ($p < .001$) |
| hc-Index | | | 1.000 | 0.686 ($p < .001$) |

visual inspection of Table 1 reveals cases deviating from this rule. For instance, IEEE Transactions on Image Processing (1992) and Journal of Machine Learning Research (2002), which are relatively young outlets, were ranked as A+ and A, respectively. In contrast, the citation impact of two very old outlets (i.e., ranked as C): Journal of Computer and Systems Sciences International (1962) and Journal of Automation and Information Sciences (1969), has been virtually non-existent. This means that longevity is an important but not the only factor, and newer outlets may also enjoy high rankings if they publish novel, interesting and thought-provoking works that are well-cited. It was found that inclusion in Thomson's Journal Citation Reports is a must for a journal to be identified as a leading A+ or A level outlet. However, coverage by Thomson does not guarantee a high citation impact of an outlet.

There are various stakeholder groups that may benefit from using the suggested ranking list. These include but not limited to research managers, tenure and promotion applicants, university administrators, librarians making subscription decisions, graduate students looking for the most credible information sources, and researchers who prefer sending their works to highest ranked outlets available for their topic. At the same time, a careful examination of the obtained list reveals that a ranking of many outlets depends on their nature and objective. Specifically, it was observed that most interdisciplinary and niche AI outlets did not appear in the A+ and A clusters. Recall that the revealed preference method, which was employed in this project, considers only the number of citations; the more papers with the highest number of citations the journal has published, the higher its h- and g-indices are. It is noted that the AI field itself is fragmented and includes a number of sub-disciplines. Some of those niches may be very popular, and journals catering to these segments may have very large readerships. In contrast, other sub-disciplines may attract fewer scholars who generate a smaller number of citations. This, however, does not imply that papers appearing in niche AI outlets are less valuable to the scientific community even though they enjoy lower citation rates. Many AI journals are interdisciplinary in nature. They attract not only AI readers, but also people from different, sometimes unrelated domains, such as social sciences. Many readers from social sciences may be interested in various aspects of AI but they are less likely to publish on this topic and, therefore, cite interdisciplinary AI outlets. For example, Artificial Intelligence in Medicine is a niche journal appealing to a narrow group of researchers who

**Table 3**
Journal tier comparison.

| Index/Tier | A+ | A | B | C | D |
|---|---|---|---|---|---|
| h-Index | | | | | |
| Average | 149 | 76 | 31 | 8 | 2 |
| Range | 77 | 78 | 41 | 13 | 1 |
| g-Index | | | | | |
| Average | 288 | 135 | 53 | 13 | 2 |
| Range | 148 | 119 | 75 | 24 | 3 |
| hc-Index | | | | | |
| Average | 113 | 54 | 22 | 7 | 2 |
| Range | 50 | 59 | 36 | 8 | 1 |
| Longevity (years in print) | | | | | |
| Average | 28 | 23 | 19 | 12 | 3 |
| Range | 32 | 39 | 48 | 45 | 5 |
| % of Thomson indexed journals | 100% | 100% | 75% | 27% | 9% |

are interested in the application of AI in medicine. AI and Law also targets a small cohort of academics. AI & Society is an interdisciplinary journal that is read by a specific segment of mostly interdisciplinary researchers. As a result, these outlets have fewer subscribers compared with their more general counterparts, their articles are cited less frequently, and therefore they obtained only a B level ranking in this study.

As such, the revealed preference journal ranking approach does not take into consideration the issue discussed above. In addition, the ranking of niche and interdisciplinary journals may be affected by the phenomenon known as the 'Matthew effect'. It originated from the seminal works by Merton (1968, 1988) and refers to the situation when an initial advantage gained by a specific journal, appealing to a general readership, places it high in the ranking lists. This, in turn, further increases the number of readers who are more likely to cite this specific outlet, which will surely secure this journal's dominant position in future citation-based ranking studies. In other words, an initial advantage leads to further advantage; whereas other less fortunate journals are unlikely to make it to the top of the list. This trend is alarming since it may negatively affect the development of a scientific domain.

There are also several other drawbacks of the revealed preference method. The number of citations generated by a publication does not automatically endorse its quality or acceptance by the scientific community. It may take years before the ideas expressed in someone's work gain recognition and start being cited. Self-citations may also distort the findings. Even though there is no evidence to suggest that authors from particular AI journals tend to self-cite more often, this issue needs to be considered. Negative references where someone's work is critiqued but not used inflate the indices. Google Scholar offers little information on its workings; it is possible that it does not cover all journals equally and some outlets are dramatically disadvantaged. Journals that publish more articles per year tend to enjoy higher citation rates because they often have more readers who find more useful articles that they may cite. This, however, does not endorse the journal's overall quality. Old papers that are no longer relevant are still included into both h- and g-indices. This, however, reflects only the past impact of the journal. As indicated in Table 3, Spearman's rank correlations between h- and hc-index, and g- and hc-index were 0.977 and 0.970, respectively, which demonstrates it was not an issue in this study. Nevertheless, extra care should be taken with respect to the interpretation of the proposed ranking. Even though it is entirely up to the reader how to apply the suggested list, the author warns that this list should not be interpreted literally. Moreover, it should never be considered a critical factor when assessing someone's academic credentials or merits, for example, for tenure and promotion decisions. There are many other important factors that are never identified in journal rankings. In fact, this study does not make any conclusions on the impact, prestige or overall quality of a specific AI outlet; it simply presents a journal ranking based on a particular methodology, which is recognized in the field of scientometrics. Nevertheless, this list may still offer some general guidance.

With respect to future research, several avenues may be followed. First, a follow-up investigation may employ the stated preference technique (i.e., expert survey) to re-validate the suggested list. It would be interesting to compare the results obtained by both methods to test this study's method validity. Second, future journal ranking projects should take into consideration the limitations of the revealed preference technique discussed in this paper. Specifically, it is alarming that interdisciplinary and niche AI journals are dramatically disadvantaged when they are compared to outlets appealing to general readerships or larger sub-disciplines. These outlets may never make it to the top simply because of fewer readers rather than because of lower contribution to AI research. It is possible that a recently developed Publication Power Approach (Holsapple, 2008, 2009) may address this limitation. This method considers the actual publication preferences of leading field scholars, rather than citation preferences of all authors. Therefore, the ranking obtained by this approach may more accurately reflect the unique position of interdisciplinary and niche outlets. Third, when new journals emerge, the proposed list will need to be updated. There are also other measures and indices that may be employed to develop AI journal rankings.

Artificial intelligence has become a well-recognized scientific discipline with its own identity. Understanding its outlets is critical for the future development of the field. The proposed ranking list may be consulted by various stakeholders, such as doctoral students, grant applicants, academics wishing to publish their works, university administrators and libraries in their budget allocation decisions. However, the author recommends that this ranking list be utilized with caution.

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