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Editorial

Publishing artificial intelligence research papers: A tale of three journals

With the growth in Artificial Intelligence in Medicine (AIM) research and the plethora of informatics journals, there is some confusion where to direct an AIM-related manuscript for peer review and possible publication. As editors for three Elsevier biomedical informatics journals that publish AI-related papers, plus the publisher who oversees all three of these journals, we are aware of such confusion and felt it would be helpful to provide some guidance to prospective authors. Accordingly, we present this joint editorial that is being published in all three of our journals. Although there is some overlap among the types of papers that we publish, we offer here some advice on how best to select a preferred publication venue for your medical AI research papers.

To inform this guidance, we have informally analyzed the papers published in our journals in recent years, assessing areas of overlap as well as distinctive characteristics. The journals have very different histories. The *Journal of Biomedical Informatics* (JBI) is the renamed publication that was founded in 1967 under the name *Computers and Biomedical Research*. The transition to the JBI title occurred in 2001 when the focus of the journal was redefined as *novel informatics methodology* – an emphasis that continues to the present. *Artificial Intelligence in Medicine* (AIIM), with a broad emphasis on AI methods applied in biomedicine, was introduced in 1989 and has continued under that title to the present. JBI and AIIM are both *hybrid* journals, available as subscription publications (no cost to authors) but with the option for authors to publish any paper with *open access* (for a fee). Now in its second year of publication, the third journal, *Intelligence-Based Medicine* (IBMED), is focused on the information and intelligence paradigm shift that is occurring in clinical medicine. This journal emphasizes data science and articles that are of interest to clinicians, although it also seeks to become of increasing interest to academic medical data scientists. IBMED is an *open access* journal, supported by author fees and therefore broadly available without subscription.

AIM is a rapidly growing subfield of biomedical informatics, characterized not only by a vibrant research community but also by impressive examples of successful applications and considerable interest both in the press and among those in the clinical community. Subareas of research include machine learning and the more recent explosion of interest in deep learning methods and their application. But AI also involves natural language processing (NLP), speech understanding, knowledge representation, reasoning, data or text mining, Bayesian networks, decision-support systems, computer vision, integration/interpretation with the Internet of Things (IoT), and many other areas of activity. There is considerable overlap between AI and the burgeoning field of data science, driven in part by the huge datasets that are produced in biomedicine, ranging from genomic data to large merged collections of clinical data (including images).

All three journals are generally interested in publishing papers that deal with these topics and there is a natural overlap among their audiences. However, the focus is different in each journal. In AIIM, the papers tend to address computer science issues while being motivated by challenges unique to medicine (or medically-oriented human biology). They may describe methodological AI research studies, investigative projects, or applications that are intended to support decision-based medical tasks through knowledge- and/or data-intensive computer-based solutions that ultimately support and improve the performance of a human care provider. AIIM looks for papers that have potential high impact in a medical or healthcare domain while offering strong novelty in the AI methods or theory being introduced. Topics are those of medical AI, dealing broadly with knowledge- and data-intensive AI-based issues in medicine. Papers may also address AI-related interpretation of medical images (e.g., radiographs, photographs) or signals (e.g., electrocardiography or other physiological data streams), intelligent devices and instruments, and the interpretation of human biological data if they have an impact on medicine or healthcare decision making. Review articles for AIIM may focus on an AI application domain in biomedicine or on a methodology with broad applicability.

JBI also publishes many AI papers, but its range of methodological topics is much broader than AI. JBI's focus is on the introduction of novel methodology that is biomedically motivated but that generalizes beyond a single motivating application domain. Thus AI papers published in JBI must introduce new methods that contribute to the science of biomedical informatics. Although those methods may have been motivated by specific application problems (in clinical medicine, public health, or translational bioinformatics), JBI expects discussions of how the methods generalize, their actual or potential range of applicability, and how they translate into useful biomedical applications. JBI does not publish papers that introduce applications unless they meet these criteria. In addition to AI papers, JBI publishes on topics such as cognitive informatics, human factors, human-computer interaction, and qualitative informatics research. It is interested in mobile health (mHealth) methods, usability research, statistical methods for clinical research, medical education, and approaches to support clinical databases and registries, health information exchange, and data privacy and security. However, it explicitly declines to publish papers dealing with image or signal processing (a notable difference from AIIM and IBMED). JBI publishes review articles that survey a novel methodology with broad potential applicability but not papers that review the status of a specific informatics application domain.

IBMED was introduced to create a meaningful synergy between practicing clinicians and others (e.g., computer scientists, data scientists, engineers, cognitive scientists, and entrepreneurs) in deploying

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methods of AI and human cognition in the practice of medicine and the delivery of health care. Thus there is an emphasis on novel clinical applications and their underlying AI or data science methods, with dimensions ranging from medical imaging, decision support and precision medicine to robotic process automation, augmented reality, embedded AI, and wearable technology. This journal is initially focused on practicing clinicians and is especially interested in AI-focused medical fields (such as oncology, radiology, surgery, genomic medicine, pathology, epidemiology, neurology, cardiology, and critical care medicine). It does publish papers that are focused on a specific novel application of established AI or data science techniques. It also publishes review papers in these areas of application.

This brief discussion aims to highlight both the distinctions and the overlap among the three journals. We trust it is clear that JBI addresses a broader range of methods than AI, whereas the other two journals are singularly focused on AI and data science. JBI and AIIM are primarily focused on novel methodology, whereas IBMED is motivated by the applications and their clinical import. Both AIIM and IBMED do publish application papers, with AIIM emphasizing methodological novelty, whereas JBI, while encouraging presentation of motivating applications, seeks an emphasis on new methodology and its generalizability. AIIM and IBMED both publish papers on medical image or signal analysis, but JBI does not. Yet, despite these distinctions, there will be occasional papers that are appropriate for two of the journals, or even for all three. The editors are not interested in "dividing the space" per se, but do recognize that the distinctions that exist, if understood well by authors, will assist in determining how a manuscript should be written and where it in turn should be submitted.

This overview should of course be complemented by a careful readings of each journal's *Aims & Scope* before a manuscript is written and submitted. One of the most common reasons for rejection of manuscripts without review occurs when an editor realizes that the authors did not first study the journal's editorial policies and publication foci. We accordingly hope that this editorial and our recommendations will be useful to prospective authors as you prepare papers and decide where you would like to submit them.

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