Artificial Intelligence (AI) is playing a major role in the fourth industrial revolution and we are seeing a lot of evolution in various machine learning methodologies. AI techniques are widely used by the practicing engineer to solve a whole range of hitherto intractable problems. This journal provides an international forum for rapid publication of work describing the practical application of AI methods in all branches of engineering. Submitted papers should report some novel aspects of AI used for a real world engineering application and also validated using some public data sets for easy replicability of the research results.

Focal points of the journal include, but are not limited to innovative applications of: Internet–of–things and cyber-physical systems Intelligent transportation systems & smart vehicles Big data analytics, understanding complex networks Neural networks, fuzzy systems, neuro-fuzzy systems Deep learning and real world applications Self-organizing, emerging or bio-inspired system Global optimization, Meta-heuristics and their applications: Evolutionary Algorithms, swarm intelligence, nature and biologically inspired meta-heuristics, etc. Architectures, algorithms and techniques for distributed AI systems, including multi-agent based control and holonic control Decision-support systems Aspects of reasoning: abductive, case-based, model-based, non-monotonic, incomplete, progressive and approximate reasoning Applications of chaos theory and fractals Real-time intelligent automation, and their associated supporting methodologies and techniques, including control theory and industrial informatics Knowledge processing, knowledge elicitation and acquisition, knowledge representation, knowledge compaction, knowledge bases, expert systems Perception, e.g. image processing, pattern recognition, vision systems, tactile systems, speech recognition and synthesis Aspects of software engineering, e.g. intelligent programming environments, verification and validation of AI-based software, software and hardware architectures for the real-time use of AI techniques, safety and reliability Intelligent fault detection, fault analysis, diagnostics and monitoring Industrial experiences in the application of the above techniques, e.g. case studies or benchmarking exercises

Engineering Applications of Artificial Intelligence publishes: Survey papers/tutorials Contributed papers — detailed expositions of new research or applications Case studies or software reviews — evaluative and descriptive reviews of existing available AI software systems, discussing the experience gained and lessons learnt from using or developing AI systems for engineering applications IFAC EAAI Forum — problems arising from engineering practice, needing to be solved by somebody; solutions to problems discussed in this forum or elsewhere; critiques of a position or claim found in the literature
For more details on the International Federation of Automatic Control (IFAC), visit their home page at http://www.ifac-control.org

AUDIENCE
Automation and control engineers, electronic and electrical engineers.

IMPACT FACTOR
2018: 3.526 © Clarivate Analytics Journal Citation Reports 2019

ABSTRACTING AND INDEXING
Cambridge Scientific Abstracts
Current Contents - Engineering, Technology & Applied Sciences
EBSCOhost
Engineering Index Monthly
Ei Compendex
Gale Academic OneFile
Gale Infotrac Custom
INSPEC
Science Citation Index Expanded
PubMed/Medline
Scopus
Web of Science
TEMA - Technik und Management
Zentralblatt MATH

EDITORIAL BOARD

Editor-in-Chief
Ajith Abraham, Machine Intelligence Research Labs (MIR Labs), Scientific Network for Innovation and Research Excellence, P.O. Box 2259, Auburn, Washington, 98071-2259, United States

Deputy Editor-in-Chief
Patrick Siarry, University Paris-Est Créteil Val de Marne, 61 Av. du General de Gaulle, 94010, Creteil, France

Emeritus Editor
Leo Mõtus, Tallinn University of Technology, Tallinn, Estonia
Rob A. Vingerhoeds, Graduate School of Aeronautics and Space Science, Toulouse, France

Board of Editors
Maysam Abbod, Brunel University College of Engineering Design and Physical Sciences, Uxbridge, United Kingdom
Saso Blažič, University of Ljubljana, Ljubljana, Slovenia
Christian Blum, Artificial Intelligence Research Institute, Bellaterra, Spain
Lucian Busoniu, Technical University of Cluj-Napoca, Cluj-Napoca, Romania
Jian Cao, Shanghai Jiao Tong University, Shanghai, China
Oscar Castillo, Technological Institute of Tijuana Division of Graduate Studies and Research, Tijuana, Mexico
Christine Chan, University of Regina, Regina, Saskatchewan, Canada
Amitava Chatterjee, Jadavpur University, Kolkata, India
Francisco Chicano, University of Málaga, Málaga, Spain
Raymond Chiong, The University of Newcastle Faculty of Science, Newcastle, New South Wales, Australia
Swagatam Das, Indian Statistical Institute Electronics and Communication Sciences Unit, Kolkata, India
Leandro Dos Santos Coelho, Pontifical Catholic University of Parana, CURITIBA, Brazil
Andries Engelbrecht, University of Pretoria, Pretoria, South Africa
César Ferri-Ramírez, Polytechnic University of Valencia, Valencia, Spain
Giancarlo Fortino, University of Calabria Department of Computer Engineering Modelling Electronics and Systems, Rende, Italy
Kevin Guelton, Reims Champagne-Ardenne University, Reims, France
Inan Güler, Gazi University, Ankara, Turkey
Thomas Hanne, Fachhochschule Nordwestschweiz, Inst. für Wirtschaftsinformatik, Brugg, Switzerland
Enrique Herrera-Viedma, University of Granada Department of Computer Science and Artificial Intelligence, Granada, Spain
Tzung-Pei Hong, National University of Kaohsiung, Kaohsiung, Taiwan
Hesam Izakian, Alberta Motor Association, Edmonton, Alberta, Canada
Tabitha James, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, United States
Dong-Sheng Jeng, Griffith University School of Engineering and Built Environment, Southport, Queensland, Australia
Arturas Kaklauskas, Vilnius Gediminas Technical University, Vilnius, Lithuania
Juš Kocijan, Jožef Stefan Institute, Ljubljana, Slovenia
Peter Kopacek, TU Wien University, Wien, Austria
Zsofia Lendek, Technical University of Cluj-Napoca, Cluj-Napoca, Romania
Sean McLoone, Queen's University Belfast, Belfast, United Kingdom
Ghita Mezzour, International University of Rabat, Rabat, Morocco
Pranab Muhuri, South Asian University, New Delhi, India
Yong Ping Pan, National University of Singapore, Singapore, Singapore
Mili Pant, Indian Institute of Technology Roorkee, Roorkee, India
Sheela Ramanna, University of Winnipeg, Winnipeg, Manitoba, Canada
Seibei Ren, TEXAS TECH UNIVERSITY, Lubbock, Texas, United States
Matilde Santos, Complutense University of Madrid, Madrid, Spain
Esteban Tlelo-Cuautle, National Institute of Optical Astrophysics and Electronics, Puebla, Mexico
Damien Trentesaux, Polytechnic University Hauts-de-France, Valenciennes, France
Elif Derya Ubeyli, TOBB Economics and Technology University, Ankara, Turkey
Sebastian Ventura, University of Cordoba, Cordoba, Spain
Mao Ye, University of Electronic Science and Technology of China, Chengdu, China
Hong Yue, University of Strathclyde, Glasgow, United Kingdom
Mengjie Zhang, Victoria University of Wellington, School of Engineering and Computer Science, Wellington, New Zealand

Industrial Board Members
Nabil Belgasmi, Banque de Tunisie, Tunis, Tunisia
Alécio P. D. Binotto, IBM Research Brazil, RIO DE JANEIRO, Brazil
Pietari Pulkkinen, Amazon.com Inc, Seattle, Washington, United States
INTRODUCTION

A journal of IFAC, the International Federation of Automatic Control

Artificial Intelligence (AI) techniques are now being used by the practicing engineer to solve a whole range of hitherto intractable problems. This journal provides an international forum for rapid publication of work describing the practical application of AI methods in all branches of engineering.

Focal points of the journal include, but are not limited to innovative applications of:

- Real-time intelligent automation, and their associated supporting methodologies and techniques, including control theory and industrial informatics,
- Architectures, algorithms and techniques for distributed AI systems, including multi-agent based control and holonic control,
- Decision-support systems,
- Aspects of reasoning: abductive, case-based, model-based, non-monotonic, incomplete, progressive and approximate reasoning,
- Applications of chaos theory and fractals,
- Metaheuristics and their applications in intelligent automation: Genetic Algorithms, Ant Colony Optimization, Particle Swarm Optimization, etc.,
- Knowledge processing, knowledge elicitation and acquisition, knowledge representation, knowledge compaction, knowledge bases, expert systems,
- Neural networks, fuzzy systems, neuro-fuzzy systems,
- Perception, e.g. image processing, pattern recognition, vision systems, tactile systems, speech recognition and synthesis,
- Aspects of software engineering, e.g. intelligent programming environments, verification and validation of AI-based software, software and hardware architectures for the real-time use of AI techniques, safety and reliability,
- Intelligent fault detection, fault analysis, diagnostics and monitoring,
- Self-organizing, emerging or bio-inspired system,
- Industrial experiences in the application of the above techniques, e.g. case studies or benchmarking exercises.

Engineering Applications of Artificial Intelligence publishes:

- Survey papers/tutorials.
- Contributed papers — detailed expositions of new research or applications.
- Case studies or software reviews — evaluative and descriptive reviews of existing available AI software systems, discussing the experience gained and lessons learnt from using or developing AI systems for engineering applications.
- IFAC EAAI Forum — problems arising from engineering practice, needing to be solved by somebody; solutions to problems discussed in this forum or elsewhere; critiques of a position or claim found in the literature.

For more details on the International Federation of Automatic Control (IFAC), visit their home page at http://www.ifac-control.org

Types of paper

Engineering Applications of Artificial Intelligence publishes

- Survey papers/tutorials.
- Contributed papers - detailed expositions of new research or applications.
- Brief papers - short discussions of new technical concepts or developments, or new applications of existing techniques.
- Case studies or software reviews - evaluative and descriptive reviews of existing available AI software systems, discussing the experience gained and lessons learnt from using or developing AI systems for engineering applications.
- IFAC EAAI Forum - problems arising from engineering practice, needing to be solved by somebody; solutions to problems discussed in this forum or elsewhere; critiques of a position or claim found in the literature.
Papers from IFAC technical meetings

Papers submitted to IFAC journals with prior publication in any copyrighted conference proceedings must be substantially different from the conference publication. Authors should indicate in the cover letter in detail how the journal paper differs from the relevant conference paper or papers. In particular, the additional original contribution in the journal paper has to be pointed out explicitly. In the journal paper, the conference paper has to be cited and discussed as any other paper in the list of references.

Submission checklist
You can use this list to carry out a final check of your submission before you send it to the journal for review. Please check the relevant section in this Guide for Authors for more details.

Ensure that the following items are present:

One author has been designated as the corresponding author with contact details:
- E-mail address
- Full postal address

All necessary files have been uploaded:

Manuscript:
- Include keywords
- All figures (include relevant captions)
- All tables (including titles, description, footnotes)
- Ensure all figure and table citations in the text match the files provided
- Indicate clearly if color should be used for any figures in print

Graphical Abstracts / Highlights files (where applicable)

Supplemental files (where applicable)

Further considerations
- Manuscript has been 'spell checked' and 'grammar checked'
- All references mentioned in the Reference List are cited in the text, and vice versa
- Permission has been obtained for use of copyrighted material from other sources (including the Internet)
- A competing interests statement is provided, even if the authors have no competing interests to declare
- Journal policies detailed in this guide have been reviewed
- Referee suggestions and contact details provided, based on journal requirements

For further information, visit our Support Center.

BEFORE YOU BEGIN

Ethics in publishing
Please see our information pages on Ethics in publishing and Ethical guidelines for journal publication.

Declaration of interest
All authors must disclose any financial and personal relationships with other people or organizations that could inappropriately influence (bias) their work. Examples of potential conflicts of interest include employment, consultancies, stock ownership, honoraria, paid expert testimony, patent applications/registrations, and grants or other funding. Authors should complete the declaration of interest statement using this template and upload to the submission system at the Attach/Upload Files step. If there are no interests to declare, please choose: 'Declarations of interest: none' in the template. This statement will be published within the article if accepted. More information.

Submission declaration and verification
Submission of an article implies that the work described has not been published previously (except in the form of an abstract, a published lecture or academic thesis, see 'Multiple, redundant or concurrent publication' for more information), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in
English or in any other language, including electronically without the written consent of the copyright-holder. To verify originality, your article may be checked by the originality detection service Crossref Similarity Check.

**Preprints**
Please note that preprints can be shared anywhere at any time, in line with Elsevier's sharing policy. Sharing your preprints e.g. on a preprint server will not count as prior publication (see 'Multiple, redundant or concurrent publication' for more information).

**Use of inclusive language**
Inclusive language acknowledges diversity, conveys respect to all people, is sensitive to differences, and promotes equal opportunities. Articles should make no assumptions about the beliefs or commitments of any reader, should contain nothing which might imply that one individual is superior to another on the grounds of race, sex, culture or any other characteristic, and should use inclusive language throughout. Authors should ensure that writing is free from bias, for instance by using 'he or she', 'his/her' instead of 'he' or 'his', and by making use of job titles that are free of stereotyping (e.g. 'chairperson' instead of 'chairman' and 'flight attendant' instead of 'stewardess').

**Changes to authorship**
Authors are expected to consider carefully the list and order of authors before submitting their manuscript and provide the definitive list of authors at the time of the original submission. Any addition, deletion or rearrangement of author names in the authorship list should be made only before the manuscript has been accepted and only if approved by the journal Editor. To request such a change, the Editor must receive the following from the corresponding author: (a) the reason for the change in author list and (b) written confirmation (e-mail, letter) from all authors that they agree with the addition, removal or rearrangement. In the case of addition or removal of authors, this includes confirmation from the author being added or removed.

Only in exceptional circumstances will the Editor consider the addition, deletion or rearrangement of authors after the manuscript has been accepted. While the Editor considers the request, publication of the manuscript will be suspended. If the manuscript has already been published in an online issue, any requests approved by the Editor will result in a corrigendum.

**Copyright**
Upon acceptance of an article, authors will be asked to complete a 'Journal Publishing Agreement' (see more information on this). An e-mail will be sent to the corresponding author confirming receipt of the manuscript together with a 'Journal Publishing Agreement' form or a link to the online version of this agreement.

Subscribers may reproduce tables of contents or prepare lists of articles including abstracts for internal circulation within their institutions. Permission of the Publisher is required for resale or distribution outside the institution and for all other derivative works, including compilations and translations. If excerpts from other copyrighted works are included, the author(s) must obtain written permission from the copyright owners and credit the source(s) in the article. Elsevier has preprinted forms for use by authors in these cases.

For gold open access articles: Upon acceptance of an article, authors will be asked to complete an 'Exclusive License Agreement' (more information). Permitted third party reuse of gold open access articles is determined by the author’s choice of user license.

**Author rights**
As an author you (or your employer or institution) have certain rights to reuse your work. More information.

Elsevier supports responsible sharing
Find out how you can share your research published in Elsevier journals.

**Role of the funding source**
You are requested to identify who provided financial support for the conduct of the research and/or preparation of the article and to briefly describe the role of the sponsor(s), if any, in study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the article for publication. If the funding source(s) had no such involvement then this should be stated.
Funding body agreements and policies
Elsevier has established a number of agreements with funding bodies which allow authors to comply with their funder's open access policies. Some funding bodies will reimburse the author for the gold open access publication fee. Details of existing agreements are available online.

Open access
This journal offers authors a choice in publishing their research:

Subscription
- Articles are made available to subscribers as well as developing countries and patient groups through our universal access programs.
- No open access publication fee payable by authors.
- The Author is entitled to post the accepted manuscript in their institution's repository and make this public after an embargo period (known as green Open Access). The published journal article cannot be shared publicly, for example on ResearchGate or Academia.edu, to ensure the sustainability of peer-reviewed research in journal publications. The embargo period for this journal can be found below.

Gold open access
- Articles are freely available to both subscribers and the wider public with permitted reuse.
- A gold open access publication fee is payable by authors or on their behalf, e.g. by their research funder or institution.

Regardless of how you choose to publish your article, the journal will apply the same peer review criteria and acceptance standards.

For gold open access articles, permitted third party (re)use is defined by the following Creative Commons user licenses:

Creative Commons Attribution (CC BY)
Lets others distribute and copy the article, create extracts, abstracts, and other revised versions, adaptations or derivative works of or from an article (such as a translation), include in a collective work (such as an anthology), text or data mine the article, even for commercial purposes, as long as they credit the author(s), do not represent the author as endorsing their adaptation of the article, and do not modify the article in such a way as to damage the author's honor or reputation.

Creative Commons Attribution-NonCommercial-NoDerivs (CC BY-NC-ND)
For non-commercial purposes, lets others distribute and copy the article, and to include in a collective work (such as an anthology), as long as they credit the author(s) and provided they do not alter or modify the article.

The gold open access publication fee for this journal is USD 2400, excluding taxes. Learn more about Elsevier's pricing policy: https://www.elsevier.com/openaccesspricing.

Green open access
Authors can share their research in a variety of different ways and Elsevier has a number of green open access options available. We recommend authors see our open access page for further information. Authors can also self-archive their manuscripts immediately and enable public access from their institution's repository after an embargo period. This is the version that has been accepted for publication and which typically includes author-incorporated changes suggested during submission, peer review and in editor-author communications. Embargo period: For subscription articles, an appropriate amount of time is needed for journals to deliver value to subscribing customers before an article becomes freely available to the public. This is the embargo period and it begins from the date the article is formally published online in its final and fully citable form. Find out more.

This journal has an embargo period of 24 months.

Language (usage and editing services)
Please write your text in good English (American or British usage is accepted, but not a mixture of these). Authors who feel their English language manuscript may require editing to eliminate possible grammatical or spelling errors and to conform to correct scientific English may wish to use the English Language Editing service available from Elsevier's Author Services.
Submission
Our online submission system guides you stepwise through the process of entering your article details and uploading your files. The system converts your article files to a single PDF file used in the peer-review process. Editable files (e.g., Word, LaTeX) are required to typeset your article for final publication. All correspondence, including notification of the Editor's decision and requests for revision, is sent by e-mail.

Note that authors should include figures, tables and captions embedded directly within the text of the paper submitted for review. This will assist with the reviewing process. Source files are still required for final publication and will be required should your paper be accepted for publication.

Submit your article
Upload one copy of the full paper including graphics and all figures as graphics file separately at the online submission site, accessed via http://ees.elsevier.com/eaai. The system automatically converts source files to a single Adobe Acrobat PDF version of the article, which is used in the peer-review process. Please note that even though manuscript source files are converted to PDF at submission for the review process, these source files are needed for further processing after acceptance. All correspondence, including notification of the Editor's decision and requests for revision, takes place by e-mail and via the Author's homepage, removing the need for a hard-copy paper trail.

Referees
Please submit the names and institutional e-mail addresses of several potential referees. For more details, visit our Support site. Note that the editor retains the sole right to decide whether or not the suggested reviewers are used.

PREPARATION

Peer review
This journal operates a single blind review process. All contributions will be initially assessed by the editor for suitability for the journal. Papers deemed suitable are then typically sent to a minimum of two independent expert reviewers to assess the scientific quality of the paper. The Editor is responsible for the final decision regarding acceptance or rejection of articles. The Editor's decision is final. More information on types of peer review.

Use of word processing software
It is important that the file be saved in the native format of the word processor used. The text should be in single-column format. Keep the layout of the text as simple as possible. Most formatting codes will be removed and replaced on processing the article. In particular, do not use the word processor's options to justify text or to hyphenate words. However, do use bold face, italics, subscripts, superscripts etc. When preparing tables, if you are using a table grid, use only one grid for each individual table and not a grid for each row. If no grid is used, use tabs, not spaces, to align columns. The electronic text should be prepared in a way very similar to that of conventional manuscripts (see also the Guide to Publishing with Elsevier). Note that source files of figures, tables and text graphics will be required whether or not you embed your figures in the text. See also the section on Electronic artwork.

To avoid unnecessary errors you are strongly advised to use the 'spell-check' and 'grammar-check' functions of your word processor.

Please Note: To help our reviewers to conduct the review process as quickly as possible papers should be submitted in the first instance in single-column format with figures, tables and associated captions included at the appropriate points in the text. All such figures and tables should be clearly legible for the reviewers.

The source files of figures, tables, text graphics and captions will also be required should your paper be accepted. These may be submitted with your paper at the time of submission or, should your paper be accepted, at the time of acceptance. You should note that since Elsevier needs to request these source files at the time of acceptance this may delay publication if you are unavailable and thus submitting them at the point of submission is recommended.

LaTeX
You are recommended to use the Elsevier article class elsarticle.cls to prepare your manuscript and BibTeX to generate your bibliography.
Our LaTeX site has detailed submission instructions, templates and other information.
Article structure

Subdivision - numbered sections
Divide your article into clearly defined and numbered sections. Subsections should be numbered 1.1 (then 1.1.1, 1.1.2, ...), 1.2, etc. (the abstract is not included in section numbering). Use this numbering also for internal cross-referencing: do not just refer to 'the text'. Any subsection may be given a brief heading. Each heading should appear on its own separate line.

Introduction
State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results.

Material and methods
Provide sufficient details to allow the work to be reproduced by an independent researcher. Methods that are already published should be summarized, and indicated by a reference. If quoting directly from a previously published method, use quotation marks and also cite the source. Any modifications to existing methods should also be described.

Results
Results should be clear and concise.

Discussion
This should explore the significance of the results of the work, not repeat them. A combined Results and Discussion section is often appropriate. Avoid extensive citations and discussion of published literature.

Conclusions
The main conclusions of the study may be presented in a short Conclusions section, which may stand alone or form a subsection of a Discussion or Results and Discussion section.

Appendices
If there is more than one appendix, they should be identified as A, B, etc. Formulae and equations in appendices should be given separate numbering: Eq. (A.1), Eq. (A.2), etc.; in a subsequent appendix, Eq. (B.1) and so on. Similarly for tables and figures: Table A.1; Fig. A.1, etc.

Essential title page information
• Title. Concise and informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible.
• Author names and affiliations. Please clearly indicate the given name(s) and family name(s) of each author and check that all names are accurately spelled. You can add your name between parentheses in your own script behind the English transliteration. Present the authors' affiliation addresses (where the actual work was done) below the names. Indicate all affiliations with a lower-case superscript letter immediately after the author's name and in front of the appropriate address. Provide the full postal address of each affiliation, including the country name and, if available, the e-mail address of each author.
• Corresponding author. Clearly indicate who will handle correspondence at all stages of refereeing and publication, also post-publication. This responsibility includes answering any future queries about Methodology and Materials. Ensure that the e-mail address is given and that contact details are kept up to date by the corresponding author.
• Present/permanent address. If an author has moved since the work described in the article was done, or was visiting at the time, a 'Present address' (or 'Permanent address') may be indicated as a footnote to that author's name. The address at which the author actually did the work must be retained as the main, affiliation address. Superscript Arabic numerals are used for such footnotes.

Highlights
Highlights are optional yet highly encouraged for this journal, as they increase the discoverability of your article via search engines. They consist of a short collection of bullet points that capture the novel results of your research as well as new methods that were used during the study (if any). Please have a look at the examples here: example Highlights.

Highlights should be submitted in a separate editable file in the online submission system. Please use 'Highlights' in the file name and include 3 to 5 bullet points (maximum 85 characters, including spaces, per bullet point).
Abstract
A concise and factual abstract is required. The abstract should state briefly the purpose of the research, the principal results and major conclusions. An abstract is often presented separately from the article, so it must be able to stand alone. For this reason, References should be avoided, but if essential, then cite the author(s) and year(s). Also, non-standard or uncommon abbreviations should be avoided, but if essential they must be defined at their first mention in the abstract itself.

Graphical abstract
Although a graphical abstract is optional, its use is encouraged as it draws more attention to the online article. The graphical abstract should summarize the contents of the article in a concise, pictorial form designed to capture the attention of a wide readership. Graphical abstracts should be submitted as a separate file in the online submission system. Image size: Please provide an image with a minimum of 531 x 1328 pixels (h x w) or proportionally more. The image should be readable at a size of 5 x 13 cm using a regular screen resolution of 96 dpi. Preferred file types: TIFF, EPS, PDF or MS Office files. You can view Example Graphical Abstracts on our information site. Authors can make use of Elsevier’s Illustration Services to ensure the best presentation of their images and in accordance with all technical requirements.

Keywords
Immediately after the abstract, provide a maximum of 6 keywords, using American spelling and avoiding general and plural terms and multiple concepts (avoid, for example, 'and', 'of'). Be sparing with abbreviations: only abbreviations firmly established in the field may be eligible. These keywords will be used for indexing purposes.

Classification codes
Please provide up to 6 standard INSPEC codes. The available codes may be accessed at INSPEC.

Abbreviations
Define abbreviations that are not standard in this field in a footnote to be placed on the first page of the article. Such abbreviations that are unavoidable in the abstract must be defined at their first mention there, as well as in the footnote. Ensure consistency of abbreviations throughout the article.

Acknowledgements
Collate acknowledgements in a separate section at the end of the article before the references and do not, therefore, include them on the title page, as a footnote to the title or otherwise. List here those individuals who provided help during the research (e.g., providing language help, writing assistance or proof reading the article, etc.).

Formatting of funding sources
List funding sources in this standard way to facilitate compliance to funder's requirements:

Funding: This work was supported by the National Institutes of Health [grant numbers xxxx, yyyy]; the Bill & Melinda Gates Foundation, Seattle, WA [grant number zzzz]; and the United States Institutes of Peace [grant number aaaa].

It is not necessary to include detailed descriptions on the program or type of grants and awards. When funding is from a block grant or other resources available to a university, college, or other research institution, submit the name of the institute or organization that provided the funding.

If no funding has been provided for the research, please include the following sentence:

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Units
Follow internationally accepted rules and conventions: use the international system of units (SI). If other units are mentioned, please give their equivalent in SI.

Math formulae
Please submit math equations as editable text and not as images. Present simple formulae in line with normal text where possible and use the solidus (/) instead of a horizontal line for small fractional terms, e.g., X/Y. In principle, variables are to be presented in italics. Powers of e are often more conveniently denoted by exp. Number consecutively any equations that have to be displayed separately from the text (if referred to explicitly in the text).
Footnotes
Footnotes should be used sparingly. Number them consecutively throughout the article. Many word processors can build footnotes into the text, and this feature may be used. Otherwise, please indicate the position of footnotes in the text and list the footnotes themselves separately at the end of the article. Do not include footnotes in the Reference list.

Artwork
General points
• Each figure and the associated caption should be embedded within the text in the initial submission. Should your paper be accepted, source files will still be required for typesetting.
• Make sure you use uniform lettering and sizing of your original artwork.
• Save text in illustrations as 'graphics' or enclose the font.
• Only use the following fonts in your illustrations: Arial, Courier, Times, Symbol.
• Number the illustrations according to their sequence in the text.
• Use a logical naming convention for your artwork files.
• Provide captions to illustrations separately.
• Produce images near to the desired size of the printed version.
• Submit each figure as a separate file.

A detailed guide on electronic artwork is available on our website: https://www.elsevier.com/artworkinstructions

You are urged to visit this site; some excerpts from the detailed information are given here.

Formats
Regardless of the application used, when your electronic artwork is finalised, please ‘save as’ or convert the images to one of the following formats (note the resolution requirements for line drawings, halftones, and line/halftone combinations given below):
EPS: Vector drawings. Embed the font or save the text as 'graphics'.
TIFF: Color or grayscale photographs (halftones): always use a minimum of 300 dpi.
TIFF: Bitmaped line drawings: use a minimum of 1000 dpi.
TIFF: Combinations bitmaped line/half-tone (color or grayscale): a minimum of 500 dpi is required.
If your electronic artwork is created in a Microsoft Office application (Word, PowerPoint, Excel) then please supply ‘as is’.

Please do not:
• Supply files that are optimised for screen use (e.g., GIF, BMP, PICT, WPG); the resolution is too low;
• Supply files that are too low in resolution;
• Submit graphics that are disproportionately large for the content.

Color artwork
Please make sure that artwork files are in an acceptable format (TIFF (or JPEG), EPS (or PDF), or MS Office files) and with the correct resolution. If, together with your accepted article, you submit usable color figures then Elsevier will ensure, at no additional charge, that these figures will appear in color online (e.g., ScienceDirect and other sites) regardless of whether or not these illustrations are reproduced in color in the printed version. For color reproduction in print, you will receive information regarding the costs from Elsevier after receipt of your accepted article. Please indicate your preference for color: in print or online only. Further information on the preparation of electronic artwork.

Figure captions
Ensure that each illustration has a caption. Supply captions separately, not attached to the figure. A caption should comprise a brief title (not on the figure itself) and a description of the illustration. Keep text in the illustrations themselves to a minimum but explain all symbols and abbreviations used.

Tables
Please submit tables as editable text and not as images. Tables can be placed either next to the relevant text in the article, or on separate page(s) at the end. Number tables consecutively in accordance with their appearance in the text and place any table notes below the table body. Be sparing in the use of tables and ensure that the data presented in them do not duplicate results described elsewhere in the article. Please avoid using vertical rules and shading in table cells.

References
Citation in text
Please ensure that every reference cited in the text is also present in the reference list (and vice versa). Any references cited in the abstract must be given in full. Unpublished results and personal communications are not recommended in the reference list, but may be mentioned in the text. If these references are included in the reference list they should follow the standard reference style of the journal and should include a substitution of the publication date with either ‘Unpublished results’ or ‘Personal communication’. Citation of a reference as 'in press' implies that the item has been accepted for publication.

Web references
As a minimum, the full URL should be given and the date when the reference was last accessed. Any further information, if known (DOI, author names, dates, reference to a source publication, etc.), should also be given. Web references can be listed separately (e.g., after the reference list) under a different heading if desired, or can be included in the reference list.

Data references
This journal encourages you to cite underlying or relevant datasets in your manuscript by citing them in your text and including a data reference in your Reference List. Data references should include the following elements: author name(s), dataset title, data repository, version (where available), year, and global persistent identifier. Add [dataset] immediately before the reference so we can properly identify it as a data reference. The [dataset] identifier will not appear in your published article.

References in a special issue
Please ensure that the words 'this issue' are added to any references in the list (and any citations in the text) to other articles in the same Special Issue.

Reference management software
Most Elsevier journals have their reference template available in many of the most popular reference management software products. These include all products that support Citation Style Language styles, such as Mendeley. Using citation plug-ins from these products, authors only need to select the appropriate journal template when preparing their article, after which citations and bibliographies will be automatically formatted in the journal’s style. If no template is yet available for this journal, please follow the format of the sample references and citations as shown in this Guide. If you use reference management software, please ensure that you remove all field codes before submitting the electronic manuscript. More information on how to remove field codes from different reference management software.

Users of Mendeley Desktop can easily install the reference style for this journal by clicking the following link:
http://open.mendeley.com/use-citation-style/engineering-applications-of-artificial-intelligence
When preparing your manuscript, you will then be able to select this style using the Mendeley plug-ins for Microsoft Word or LibreOffice.

Reference style
Text: All citations in the text should refer to:
1. Single author: the author's name (without initials, unless there is ambiguity) and the year of publication;
2. Two authors: both authors' names and the year of publication;
3. Three or more authors: first author's name followed by 'et al.' and the year of publication.

Citations may be made directly (or parenthetically). Groups of references can be listed either first alphabetically, then chronologically, or vice versa.

Examples: 'as demonstrated (Allan, 2000a, 2000b, 1999; Allan and Jones, 1999).... Or, as demonstrated (Jones, 1999; Allan, 2000).... Kramer et al. (2010) have recently shown ...'

List: References should be arranged first alphabetically and then further sorted chronologically if necessary. More than one reference from the same author(s) in the same year must be identified by the letters 'a', 'b', 'c', etc., placed after the year of publication.

Examples:
Reference to a journal publication:
Reference to a journal publication with an article number:
Reference to a book:

Reference to a chapter in an edited book:

Reference to a website:

Reference to a dataset:

Journal abbreviations source
Journal names should be abbreviated according to the List of Title Word Abbreviations.

Video
Elsevier accepts video material and animation sequences to support and enhance your scientific research. Authors who have video or animation files that they wish to submit with their article are strongly encouraged to include links to these within the body of the article. This can be done in the same way as a figure or table by referring to the video or animation content and noting in the body text where it should be placed. All submitted files should be properly labeled so that they directly relate to the video file's content. In order to ensure that your video or animation material is directly usable, please provide the file in one of our recommended file formats with a preferred maximum size of 150 MB per file, 1 GB in total. Video and animation files supplied will be published online in the electronic version of your article in Elsevier Web products, including ScienceDirect. Please supply 'stills' with your files: you can choose any frame from the video or animation or make a separate image. These will be used instead of standard icons and will personalize the link to your video data. For more detailed instructions please visit our video instruction pages. Note: since video and animation cannot be embedded in the print version of the journal, please provide text for both the electronic and the print version for the portions of the article that refer to this content.

Data visualization
Include interactive data visualizations in your publication and let your readers interact and engage more closely with your research. Follow the instructions here to find out about available data visualization options and how to include them with your article.

Supplementary material
Supplementary material such as applications, images and sound clips, can be published with your article to enhance it. Submitted supplementary items are published exactly as they are received (Excel or PowerPoint files will appear as such online). Please submit your material together with the article and supply a concise, descriptive caption for each supplementary file. If you wish to make changes to supplementary material during any stage of the process, please make sure to provide an updated file. Do not annotate any corrections on a previous version. Please switch off the 'Track Changes' option in Microsoft Office files as these will appear in the published version.

Research data
This journal encourages and enables you to share data that supports your research publication where appropriate, and enables you to interlink the data with your published articles. Research data refers to the results of observations or experimentation that validate research findings. To facilitate reproducibility and data reuse, this journal also encourages you to share your software, code, models, algorithms, protocols, methods and other useful materials related to the project.

Below are a number of ways in which you can associate data with your article or make a statement about the availability of your data when submitting your manuscript. If you are sharing data in one of these ways, you are encouraged to cite the data in your manuscript and reference list. Please refer to the "References" section for more information about data citation. For more information on depositing, sharing and using research data and other relevant research materials, visit the research data page.
**Data linking**

If you have made your research data available in a data repository, you can link your article directly to the dataset. Elsevier collaborates with a number of repositories to link articles on ScienceDirect with relevant repositories, giving readers access to underlying data that gives them a better understanding of the research described.

There are different ways to link your datasets to your article. When available, you can directly link your dataset to your article by providing the relevant information in the submission system. For more information, visit the database linking page.

For supported data repositories a repository banner will automatically appear next to your published article on ScienceDirect.

In addition, you can link to relevant data or entities through identifiers within the text of your manuscript, using the following format: Database: xxxx (e.g., TAIR: AT1G01020; CCDC: 734053; PDB: 1XFN).

**Mendeley Data**

This journal supports Mendeley Data, enabling you to deposit any research data (including raw and processed data, video, code, software, algorithms, protocols, and methods) associated with your manuscript in a free-to-use, open access repository. During the submission process, after uploading your manuscript, you will have the opportunity to upload your relevant datasets directly to Mendeley Data. The datasets will be listed and directly accessible to readers next to your published article online.

For more information, visit the Mendeley Data for journals page.

**Data in Brief**

You have the option of converting any or all parts of your supplementary or additional raw data into one or multiple data articles, a new kind of article that houses and describes your data. Data articles ensure that your data is actively reviewed, curated, formatted, indexed, given a DOI and publicly available to all upon publication. You are encouraged to submit your article for Data in Brief as an additional item directly alongside the revised version of your manuscript. If your research article is accepted, your data article will automatically be transferred over to Data in Brief where it will be editorially reviewed and published in the open access data journal, Data in Brief. Please note an open access fee of 600 USD is payable for publication in Data in Brief. Full details can be found on the Data in Brief website. Please use this template to write your Data in Brief.

**MethodsX**

You have the option of converting relevant protocols and methods into one or multiple MethodsX articles, a new kind of article that describes the details of customized research methods. Many researchers spend a significant amount of time on developing methods to fit their specific needs or setting, but often without getting credit for this part of their work. MethodsX, an open access journal, now publishes this information in order to make it searchable, peer reviewed, citable and reproducible. Authors are encouraged to submit their MethodsX article as an additional item directly alongside the revised version of their manuscript. If your research article is accepted, your methods article will automatically be transferred over to MethodsX where it will be editorially reviewed. Please note an open access fee is payable for publication in MethodsX. Full details can be found on the MethodsX website. Please use this template to prepare your MethodsX article.

**Data statement**

To foster transparency, we encourage you to state the availability of your data in your submission. This may be a requirement of your funding body or institution. If your data is unavailable to access or unsuitable to post, you will have the opportunity to indicate why during the submission process, for example by stating that the research data is confidential. The statement will appear with your published article on ScienceDirect. For more information, visit the Data Statement page.

**AFTER ACCEPTANCE**
Online proof correction
Corresponding authors will receive an e-mail with a link to our online proofing system, allowing annotation and correction of proofs online. The environment is similar to MS Word: in addition to editing text, you can also comment on figures/tables and answer questions from the Copy Editor. Web-based proofing provides a faster and less error-prone process by allowing you to directly type your corrections, eliminating the potential introduction of errors.
If preferred, you can still choose to annotate and upload your edits on the PDF version. All instructions for proofing will be given in the e-mail we send to authors, including alternative methods to the online version and PDF.
We will do everything possible to get your article published quickly and accurately. Please use this proof only for checking the typesetting, editing, completeness and correctness of the text, tables and figures. Significant changes to the article as accepted for publication will only be considered at this stage with permission from the Editor. It is important to ensure that all corrections are sent back to us in one communication. Please check carefully before replying, as inclusion of any subsequent corrections cannot be guaranteed. Proofreading is solely your responsibility.

Offprints
The corresponding author will, at no cost, receive a customized Share Link providing 50 days free access to the final published version of the article on ScienceDirect. The Share Link can be used for sharing the article via any communication channel, including email and social media. For an extra charge, paper offprints can be ordered via the offprint order form which is sent once the article is accepted for publication. Both corresponding and co-authors may order offprints at any time via Elsevier's Author Services. Corresponding authors who have published their article gold open access do not receive a Share Link as their final published version of the article is available open access on ScienceDirect and can be shared through the article DOI link.

AUTHOR INQUIRIES
Visit the Elsevier Support Center to find the answers you need. Here you will find everything from Frequently Asked Questions to ways to get in touch.
You can also check the status of your submitted article or find out when your accepted article will be published.