Neural Networks is the archival journal of the world’s three oldest neural modeling societies: the International Neural Network Society (INNS), the European Neural Network Society (ENNS), and the Japanese Neural Network Society (JNNS). A subscription to the journal is included with membership in each of these societies.

Neural Networks provides a forum for developing and nurturing an international community of scholars and practitioners who are interested in all aspects of neural networks and related approaches to computational intelligence. Neural Networks welcomes high quality submissions that contribute to the full range of neural networks research, from behavioral and brain modeling, learning algorithms, through mathematical and computational analyses, to engineering and technological applications of systems that significantly use neural network concepts and techniques. This uniquely broad range facilitates the cross-fertilization of ideas between biological and technological studies, and helps to foster the development of the interdisciplinary community that is interested in biologically-inspired computational intelligence. Accordingly, Neural Networks editorial board represents experts in fields including psychology, neurobiology, computer science, engineering, mathematics, and physics. The journal publishes articles, letters and reviews, as well as letters to the editor, editorials, current events, software surveys, and patent information. Articles are published in one of five sections: Cognitive Science, Neuroscience, Learning Systems, Mathematical and Computational Analysis, Engineering and Applications.

The journal is published twelve times a year. Neural Networks can be accessed electronically via Science Direct (http://www.sciencedirect.com/science/journal/08936080), which is used by over eight million individuals world-wide.

Benefits to authors
We also provide many author benefits, such as free PDFs, a liberal copyright policy, special discounts on Elsevier publications and much more. Please click here for more information on our author services.

Please see our Guide for Authors for information on article submission. If you require any further information or help, please visit our Support Center.
AUDIENCE

Computer scientists, artificial intelligence developers, electronic engineers, neuroscientists and psychologists.

IMPACT FACTOR

2018: 5.785 © Clarivate Analytics Journal Citation Reports 2019

ABSTRACTING AND INDEXING

Information Science Abstracts
Artificial Intelligence Abstracts
Bioengineering Abstracts
Cambridge Scientific Abstracts
Elsevier BIOBASE
Operations Research & Management Science
BIOSIS Citation Index
Current Contents
CMCI
Current Contents - Engineering, Technology & Applied Sciences
Scopus
INSPEC
Zentralblatt MATH

EDITORIAL BOARD

Co-Editors-in-Chief
Kenji Doya, Okinawa Institute of Science and Technology Graduate University Neural Computation Unit, Kunigami-gun, Japan
DeLiang Wang, OHIO STATE UNIVERSITY, Columbus, Ohio, United States

Current Events Editor
Paul Pang, Federation University Australia, Ballarat, Victoria, Australia

Action Editors
Toru Aonishi, Tokyo Institute of Technology - Suzukakedai Campus, Yokohama, Japan
Fields of specialization: Statistical mechanics, computational neuroscience, coupled oscillators, neural data analysis
Sabri Arik, Istanbul University-Cerrahpasa Department of Computer Engineering, Istanbul, Turkey
Fields of specialization: Computational neuroscience, neurodynamics, recurrent neural network learning architectures, nonlinear systems, stability theory
Pierre Baldi, University of California Irvine, Irvine, California, United States
Fields of specialization: Supervised and unsupervised learning, recursive neural networks, deep architectures, bioinformatics applications
Bonny Banerjee, University of Memphis, Institute for Intelligent Systems, Department of Electrical & Computer Engineering, Memphis, Tennessee, United States
Fields of specialization: Computational models of perception-action loop, multimodal models, neural network models for reasoning and explanation
Michael Basin, Autonomous University of Nuevo Leon Faculty of Mathematics and Physical Sciences, San Nicolas De Los Garza, Mexico
Fields of specialization: Signal processing, control of nonlinear systems, variable structure systems, sliding mode control
Roman Borisyyuk, University of Exeter Department of Mathematics, Exeter, United Kingdom
Fields of specialization: Computational neuroscience, nonlinear systems, oscillations and synchronization, neural network models of cognitive functions
Steven Bressler, Florida Atlantic University, Boca Raton, Florida, United States
Fields of specialization: Neurocognitive networks, cerebral cortex, event-related potentials, EEG, MEG, local field potentials
Jérémie Cabessa, University Paris 2 Panthéon-Assas, Laboratory of Mathematical Economics and Applied Microeconomics (LEMA), Paris, France
Fields of specialization: Theoretical neural networks, neuro-inspired implementation of finite state machines, neural P systems, analog computation, dynamical systems

Jinde Cao, Southeast University Department of Mathematics, Nanjing, China
Fields of specialization: Collective Intelligence; Dynamic Systems; Neural networks

Gail Carpenter, Boston University, Boston, Massachusetts, United States
Fields of specialization: Machine learning, memory, vision, ART

Jonathan Chan, King Mongkut's University of Technology Thonburi, Bangkok, Thailand
Fields of specialization: Data science, machine learning, intelligent systems, cognitive computing, and biomedical informatics

Ke Chen, The University of Manchester, Manchester, United Kingdom
Fields of specialization: Machine Learning, speech processing

Zhe S. Chen, NEW YORK UNIVERSITY SCHOOL OF MEDICINE, New York, New York, United States
Fields of specialization: Machine learning and computational statistics, computational neuroscience, statistics in neuroscience, neural spike train analysis

Bo Du, Wuhan University School of Computer Science, Wuhan, China
Fields of specialization: Deep learning, pattern recognition, bioinformatics, machine learning

Mounya Elhilali, Johns Hopkins University, Baltimore, Maryland, United States
Fields of specialization: Auditory perception, sound processing, models of attention, computational neuroscience, neural decoding

Mauro Forti, University of Siena, Siena, Italy
Fields of specialization: Nonlinear dynamics, theoretical neural networks (convergence, stability, complex dynamics, chaos), memristor circuits

Gregory Francis, Purdue University, West Lafayette, Indiana, United States
Fields of specialization: Visual perception, cognitive psychology, human factors

Tamás (Tom) Gedeon, Australian National University School of Computer Science, Canberra, Australia
Fields of specialization: Neural networks for physiological signals and human internal state prediction, bidirectional neural networks

Ashish Ghosh, Indian Statistical Institute Machine Intelligence Unit, Kolkata, India
Fields of specialization: Machine learning, deep neural networks, cognitive computing, data mining, pattern recognition, applications to image & video analysis, streaming data analysis

Giorgio Stefano Gnecco, IMT School for Advanced Studies, AXES Research Unit, Lucca, Italy
Fields of specialization: Approximate dynamic programming, Approximation theory, Kernel methods, Statistical learning theory

Faustino Gomez, Dalle Molle Institute for Artificial Intelligence, Manno, Switzerland
Fields of specialization: Machine learning, neuroevolution, reinforcement learning, recurrent neural networks

Xiaodong Gu, Fudan University, Shanghai, China
Fields of specialization: Spatial-temporal coding neural networks, pulse coupled neural networks, oscillations and synchronization

Masahiko Haruno, National Institute of Information and Communications Technology Center for Information and Neural Networks, Suita, Japan
Fields of specialization: Computational neuroscience, social neuroscience, decision making

Sebastien Helie, Purdue University, West Lafayette, Indiana, United States
Fields of specialization: Cognitive neuroscience, computational neuroscience, fMRI, reinforcement learning, and unsupervised learning

Daniel W.C. Ho, City University of Hong Kong Department of Mathematics, Kowloon, Hong Kong
Fields of specialization: Control systems, distributed optimization, distributed dynamical networks, wavelet neural networks, adaptive learning systems

Zeng-Guang Hou, Chinese Academy of Sciences, Beijing, China
Fields of specialization: Intelligent control, robotic systems, biomedical engineering

Dewen Hu, National University of Defense Technology College of Mechatronic Engineering and Automation, Changsha, China
Fields of specialization: Neural networks, Identification and control, cognitive neuroscience, robotics

De-Shuang Huang, Tongji University, Shanghai, China
Fields of specialization: Feedforward networks, pattern recognition, bioinformatics

Guang Bin Huang, Nanyang Technological University, Singapore, Singapore
Fields of specialization: Support vector machines, feedforward networks, brain computer interface, human computer interface, EEG signal based machine learning

Kaizhu Huang, Xi'an Jiaotong-Liverpool University, Department of Electrical and Electronic Engineering, Suzhou, China
Fields of specialization: Deep learning, pattern recognition, cognitive computation, adversarial learning

**Tingwen Huang**, Texas A&M University at Qatar, Doha, Qatar
Fields of specialization: Dynamics of neural networks, optimization methods, intelligent control

**Abir Hussain**, Liverpool John Moores University, Computer Science Department, Liverpool, United Kingdom
Fields of specialization: Machine Learning, time series prediction, medical applications, recurrent neural networks, deep learning

**Kazushi Ikeda**, Nara Institute of Science and Technology Graduate School of Information Science, Nara, Japan
Fields of specialization: Learning theory, neurodynamics, adaptive systems

**Shin Ishii**, Kyoto University, Kyoto, Japan
Fields of specialization: Statistical learning, reinforcement learning, bioinformatics, dynamical systems

**Herbert Jaeger**, University of Groningen, Groningen, Netherlands
Fields of specialization: Reservoir computing, dynamical systems modeling of recurrent neural networks, neuromorphic computing technologies

**Jing Jin**, East China University of Science and Technology, Shanghai, China
Fields of specialization: Brain computer interface, Pattern recognition, Neural engineering

**Yoshinobu Kano**, Shizuoka University, Faculty of Informatics, Hamamatsu, Japan
Fields of specialization: Natural language processing, dialog system, text mining

**Hamid Reza Karimi**, Polytechnic of Milan Department of Mechanics, Milano, Italy
Fields of specialization: Control systems, adaptive learning, complex networks, neural dynamics, wavelet networks, soft computing, intelligent systems applications

**Nikola Kasabov**, Auckland University of Technology, Auckland, New Zealand
Fields of specialization: Novel connectionist learning methods, evolving connectionist systems, neuro-fuzzy systems, computational neuro-genetic modeling, EEG data analysis, bioinformatics, gene data analysis, quantum neuro-computation, spiking neural networks, multimodal information processing in the brain, multimodal neural network models for pattern recognition, connectionist-based decision support systems

**Matthias Kaschube**, Goethe University Frankfurt Faculty 12 Computer Science and Mathematics, Frankfurt am Main, Germany
Fields of specialization: Sensory cortex functional organization and development, neural population analysis and coding

**Yoshinobu Kawahara**, Kyushu University Institute of Mathematics for Industry, Fukuoka, Japan
Fields of specialization: Statistical machine learning, dynamical systems, optimization

**Motoaki Kawanabe**, Advanced Telecommunications Research Institute International, Soraku-gun, Japan
Fields of specialization: biomedical engineering, machine learning

**Irwin King**, The Chinese University of Hong Kong, Shatin, Hong Kong
Fields of specialization: Machine learning, social computing, data mining, information retrieval

**Keiichi Kitajo**, National Institute for Physiological Sciences, Okazaki, Japan
Fields of specialization: Neural dynamics, computational neuroscience, oscillations and synchrony, fluctuations and noise, EEG, TMS

**Christof Koch**, Allen Institute for Brain Science, Seattle, Washington, United States
Fields of specialization: Neuroscience, biophysics

**Robert Kozma**, The University of Memphis, Memphis, Tennessee, United States
Fields of specialization: Autonomous adaptive systems, mathematical and computational modeling of spatio-temporal dynamics of cognitive processes, chaos, neuro-fuzzy systems, computational intelligence

**Jeffrey Krichmar**, University of California Irvine, Irvine, California, United States
Fields of specialization: Embodied cognition, neuro robotics, computational neuroscience

**Vera Kurkova**, Institute of Computer Science Czech Academy of Sciences, Praha, Czech Republic
Fields of specialization: Mathematical theory of neurocomputing and learning

**James Kwok**, Hong Kong University of Science and Technology Department of Computer Science and Engineering, Hong Kong, Hong Kong
Fields of specialization: Machine learning, data mining

**Oh Min Kwon**, Chungbuk National University School of Electrical Engineering, Cheongju, Korea, Republic of Korea

**Minho Lee**, Kyungpook National University, Daegu, Korea, Republic of Korea
Fields of specialization: Deep learning, intention and emotion understanding, visual perception, and brain-computer interface

**Hongyi Li**, Guangdong University of Technology, School of Automation, Guangzhou, China
Fields of specialization: Intelligent control, fuzzy control, neural control, multi-agent systems, robotic systems

**Xuelong Li**, Northwestern Polytechnical University, Xian, China
Fields of specialization: Optical imagery, image analysis, pattern recognition

**Yu-Feng Li**, State Key Laboratory of Novel Software Technology, Nanjing, China
Fields of specialization: Weakly supervised learning, Semi-supervised learning

**Qinshan Liu**, Huazhong University of Science and Technology, Wuhan, China
Fields of specialization: Neurodynamics, recurrent neural networks, computational intelligence

**Shih-Chii Liu**, University of Zurich, Zurich, Switzerland
Fields of specialization: Neuromorphic systems, sensory systems, event-driven processing and hardware

**Teresa B Ludermir**, Federal University of Pernambuco Center for Informatics, RECIFE, Brazil
Fields of specialization: Hybrid intelligent systems, weightless (RAM) neural networks, machine learning

**Jordi Madrenas**, Polytechnic University of Catalonia, Barcelona, Spain
Fields of specialization: Bioinspired and neuromorphic implementations, integrated sensory systems, hardware architectures

**Ali Minai**, University of Cincinnati, Cincinnati, Ohio, United States
Fields of specialization: Computational neuroscience, neurodynamical models of cognition & behavior, attractor networks, sequence learning, semantic cognition, motor control

**Francesco Carlo Morabito**, Università degli Studi Mediterranea, Fac. of Engineering - DIMET, Italy
Fields of specialization: Engineering applications of computational intelligence (industrial inspection, biomedical signal processing, environmental data modeling), nonlinear systems and complexity

**Takashi Morie**, Kyushu Institute of Technology, Kitakyushu, Japan
Fields of specialization: Bioinspired and neuromorphic hardware, devices, VLSI architecture

**Jun Morimoto**, Advanced Telecommunications Research Institute International, Soraku-gun, Japan
Fields of specialization: Robot learning, humanoid robotics

**Hiroyuki Nakahara**, RIKEN Center for Brain Science Laboratory for Integrated Theoretical Neuroscience, Wako, Japan
Fields of specialization: Computational neuroscience, reinforcement learning, neural coding

**Arun Narayanan**, Google Inc, Mountain View, California, United States
Fields of specialization: Automatic speech recognition, deep neural networks for speech processing

**Tetsuya Ogata**, Waseda University, Tokyo, Japan
Fields of specialization: Cognitive robotics, neurodynamical models of cognition & behavior, recurrent neural network, deep architecture

**Juan-Pablo Ortega**, University of St Gallen Faculty of Mathematics and Statistics, St Gallen, Switzerland
Fields of specialization: Reservoir computing, Learning theory for dynamic processes, Nonlinear systems, Geometric mechanics, Financial econometrics, Time series analysis and forecasting

**Jaakko Peltonen**, Tampere University, Tampere, Finland
Fields of specialization: Exploratory data analysis, information visualization, nonlinear dimensionality reduction, machine learning

**Yuriy Pershin**, University of South Carolina, Columbia, South Carolina, United States
Fields of specialization: Memristive neural networks, memory, hardware implementation

**Tommaso Poggio**, Massachusetts Institute of Technology, Cambridge, Massachusetts, United States
Fields of specialization: Approximation theory, vision

**Robi Polikar**, Rowan University, Department of Electrical and Computer Engineering, Glassboro, New Jersey, United States
Fields of specialization: Adversarial machine learning, learning in nonstationary environments, concept drift, ensemble systems, transfer learning, incremental and continuous learning

**Danil Prokhorov**, Toyota Technical Center Ann Arbor, Ann Arbor, Michigan, United States
Fields of specialization: Recurrent neural networks, gradient-based learning algorithms, approximate dynamic programming, intelligent control, diagnostics, computer vision, autonomous systems

**Asim Roy**, Arizona State University WP Carey School of Business, Tempe, Arizona, United States
Fields of specialization: Radial basis function networks, autonomous learning, semantic cognition, complexity of learning, machine learning

**Marcello Sanguineti**, University of Genoa Department of Computer Science Bioengineering Robotics and Systems Engineering, Genova, Italy
Fields of specialization: Mathematical theory of neural systems, kernel methods, optimization, machine learning, approximation, feedforward networks

**Sergio Savaresi**, Polytechnic of Milan, Milano, Italy
Fields of specialization: Sensory-motor control, robotics, spatial mapping and navigation, supervised learning

**Björn Schuller**, Imperial College London Department of Computing, London, United Kingdom
Fields of specialization: Speech Processing, Affective Computing, Deep Learning
Terrence Sejnowski, Salk Institute for Biological Studies, La Jolla, California, United States
Field of specialization: Neuroscience
Dinggang Shen, University of North Carolina at Chapel Hill Department of Computer Science, Chapel Hill, North Carolina, United States
Fields of specialization: Medical image analysis, computer vision, and pattern recognition
Hideaki Shimazaki, Kyoto University Graduate School of Informatics, Kyoto, Japan
Fields of specialization: Computational neuroscience, Statistics and Machine learning
Shohei Shimizu, Shiga University Faculty of Data Science Graduate School of Data Science, Hikone, Japan
Fields of specialization: Causal discovery, causal inference
Hidetoshi Shimodaira, Kyoto University, Kyoto, Japan
Fields of specialization: Image processing, pattern recognition, deep neural networks
Alessandro Sperduti, University of Padua, Padova, Italy
Fields of specialization: Learning in structured domains, recursive neural networks, deep architectures, kernel methods
Masashi Sugiyama, RIKEN, Chuo-ku, Tokyo, Japan / The University of Tokyo, Kashiwa-shi, Chiba, Japan
Fields of specialization: statistical machine learning, data mining
Ron Sun, Rensselaer Polytechnic Institute, Troy, New York, United States
Fields of specialization: Psychological modeling, cognitive architectures, neural network models of consciousness, skill acquisition, reasoning, neuro-symbolic models, social simulation
Taiji Suzuki, Tokyo Institute of Technology, Tokyo, Japan
Fields of specialization: Machine learning, statistics
Ying Tan, Peking University School of Electronics Engineering and Computer Science, Beijing, China
Deep Neural Networks, Deep Learning, Swarm Intelligence, Fireworks Algorithms, Data Mining, Financial Predication
Toshihisa Tanaka, Tokyo University of Agriculture and Technology Department of Electrical and Electronic Engineering, Tokyo, Japan
Fields of specialization: Biomedical signal processing, EEG (brain computer interfaces, cognitive science, and clinical applications), adaptive filters and systems
Huajin Tang, Zhejiang University College of Computer Science and Technology, Hangzhou, China
Fields of specialization: Neuromorphic computing, Spiking neural networks, Learning algorithms, Synaptic plasticity, Neural coding, Robotic cognition
Jun-nosuke Teramae, Kyoto University, Kyoto, Japan
Fields of specialization: Computational neuroscience, nonlinear physics
Taro Toyoizumi, Riken Center for Brain Science, Wako, Japan
Fields of specialization: Computational neuroscience, synaptic plasticity
Marley Vellasco, Pontifical Catholic University of Rio de Janeiro, Rio De Janeiro, Brazil
Fields of specialization: Hybrid intelligent systems (neuro-fuzzy, neuro-evolutionary, etc.), time series forecasting, neural architecture search, explainable AI, engineering applications of computational intelligence
Ding Wang, Beijing University of Technology Faculty of Information Technology, Beijing, China
Fields of specialization: Neural network control, reinforcement learning, adaptive critic, adaptive dynamic programming, intelligent control and optimization
Zidong Wang, Brunel University Department of Computer Science, Uxbridge, Middlesex, United Kingdom
Fields of specialization: Intelligent data analysis (bioinformatics, neural networks, etc.), signal processing (filter designs, etc.), real-time systems (control of nonlinear and multi-dimensional systems)
Herbert Werner, Hamburg University of Technology, Hamburg, Germany
Fields of specialization: Dynamic systems, nonlinear modeling and control, system identification, linear parameter-varying systems
Jia Wu, Macquarie University, Sydney, New South Wales, Australia
• Brain-inspired Intelligent Computing, • Graph Mining, • Neural Networks, • Computational Intelligence
Zenglin Xu, Harbin Institute of Technology Shenzhen, Shenzhen, China
Fields of specialization: Deep learning, statistical learning, health informatics
Keisuke Yamazaki, National Institute of Advanced Industrial Science and Technology Tokyo Bay Area Center, Koto-Ku, Japan
Fields of specialization: Statistical learning, Bayesian statistics, unsupervised learning
Tadashi Yamazaki, University of Electrocommunications Faculty of Informatics and Engineering Graduate School of Informatics and Engineering, Chofu, Japan
Fields of specialization: Cerebellum, numerical simulation, high-performance computing, neuroinformatics

Yun Yang, Yunnan University, Software School, Kunming, China
Fields of specialization: Ensemble Learning, Clustering, Temporal data mining, transfer learning, intelligent healthcare

Zhigang Zeng, Huazhong University of Science and Technology, Wuhan, China
Fields of specialization: Nonlinear dynamics, hybrid systems, associative memories

Lei Zhang, Chongqing University, School of Microelectronics and Communication Engineering, Chongqing, China
Fields of specialization: Deep neural networks, Transfer learning, Few-shot learning, Computer vision

Min-Ling Zhang, Southeast University, Nanjing, China
Fields of specialization: Machine learning, data mining, pattern recognition

Xiao-Lei Zhang, Northwestern Polytechnical University, Xian, China
Fields of specialization: Deep learning, unsupervised learning, speech signal processing, statistical signal processing

Yu-Dong (Eugene) Zhang, University of Leicester Department of Informatics, Leicester, United Kingdom
Fields of specialization: Medical image analysis, Data mining, Artificial intelligence, Deep learning

Liang Zhao, University of Sao Paulo, Sao Paulo, Brazil
Fields of specialization: Machine learning, graph based learning, oscillatory networks, chaotic neural networks, complex networks
GUIDE FOR AUTHORS

INTRODUCTION
The Official Journal of the International Neural Network Society, European Neural Network Society & Japanese Neural Network Society

Types of Paper
Articles
Original, full-length articles are considered with the understanding that they have not been published except in abstract form and are not concurrently under review elsewhere. Authors are welcome, but not required, to suggest an action editor from the editorial board to handle the review process. Authors need to specify one of the five Sections: Cognitive Science, Neuroscience, Learning Systems, Mathematical and Computational Analysis, Engineering and Applications.

Letters
Letters (up to 2500 words) are expected to contain important new research results for which rapid publication is justified. Each Letter should include an abstract (no more than 100 words), and a maximum of 25 references. Figures and tables together with their legends should occupy no more than one of the pages. Authors are welcome, but not required, to suggest an action editor from the editorial board to handle the review process. A Letter submission undergoes an expedited review cycle, and a major revision is not allowed. If a submission requires a substantial revision, the authors are encouraged to resubmit a revised version as an Article.

Reviews
Topical, comprehensive reviews that summarize significant advances in a broad area of research. Authors should contact the corresponding Editor-in-Chief with a review outline before submitting the full manuscript.

Letters to the Editor
Short communications that comment on, point out errors in, or express a significant disagreement with a previously published paper in this journal. An author of the original paper will be asked to review the submission along with independent reviewers. In the case of substantive disagreement between the authors of a Letter to the Editor and the authors of the original paper, the Editor may invite to a rebuttal from the latter authors. Such letters should be as concise as possible, not exceeding 2 formatted pages. If both the Letter to the Editor and the Rebuttal are accepted, they will be published in the same issue.

It is acceptable for conference papers to be extended to a journal submission. However, authors are required to cite their related prior work and the extension must be substantial, such as new experimental results or analyses. The journal submission should clearly specify how the journal paper differs from or goes beyond the cited prior work.

Contact Details for Submission
All manuscripts must be submitted through the Elsevier online system: http://ees.elsevier.com/neunet/

Authors should specify the Editor-in-Chief in the corresponding geographic area:
Europe, North and South America: Prof. DeLiang Wang (dwang@cse.ohio-state.edu)
Africa, Asia and Australia: Prof. Kenji Doya (nneo@oist.jp)

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.

**Open access**
Please visit our Open Access page for more information.

**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.

**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.

**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.

**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 which should not exceed 250 words.

**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.

**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.

**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**

**Electronic artwork**

**General points**

- Make sure you use uniform lettering and sizing of your original artwork.
- Embed the used fonts if the application provides that option.
- Aim to use the following fonts in your illustrations: Arial, Courier, Times New Roman, Symbol, or use fonts that look similar.
- Number the illustrations according to their sequence in the text.
- Use a logical naming convention for your artwork files.
- Provide captions to illustrations separately.
• Size the illustrations close to the desired dimensions of the published version.
• Submit each illustration as a separate file.
• Ensure that color images are accessible to all, including those with impaired color vision.

A detailed guide on electronic artwork is available.

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

**Formats**

If your electronic artwork is created in a Microsoft Office application (Word, PowerPoint, Excel) then please supply 'as is' in the native document format.

Regardless of the application used other than Microsoft Office, when your electronic artwork is finalized, 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 (or PDF): Vector drawings, embed all used fonts.
- TIFF (or JPEG): Color or grayscale photographs (halftones), keep to a minimum of 300 dpi.
- TIFF (or JPEG): Bitmapped (pure black & white pixels) line drawings, keep to a minimum of 1000 dpi.
- TIFF (or JPEG): Combinations bitmapped line/half-tone (color or grayscale), keep to a minimum of 500 dpi.

**Please do not:**

- Supply files that are optimized for screen use (e.g., GIF, BMP, PICT, WPG); these typically have a low number of pixels and limited set of colors;
- 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/neural-networks
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: Citations in the text should follow the referencing style used by the American Psychological Association. You are referred to the Publication Manual of the American Psychological Association, Sixth Edition, ISBN 978-1-4338-0561-5, copies of which may be ordered online or APA Order Dept., P.O.B. 2710, Hyattsville, MD 20784, USA or APA, 3 Henrietta Street, London, WC3E 8LU, UK.
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:
Reference to a conference paper or poster presentation:
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.

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).

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.

AFTER ACCEPTANCE

Proofs

One set of page proofs (as PDF files) will be sent by e-mail to the corresponding author (if we do not have an e-mail address then paper proofs will be sent by post) or a link will be provided in the e-mail so that authors can download the files themselves. To ensure a fast publication process of the article, we kindly ask authors to provide us with their proof corrections within two days. Elsevier now provides authors with PDF proofs which can be annotated; for this you will need to download the free Adobe Reader, version 9 (or higher). Instructions on how to annotate PDF files will accompany the proofs (also given online). The exact system requirements are given at the Adobe site. If you do not wish to use the PDF annotations function, you may list the corrections (including replies to the Query Form) and return them to Elsevier in an e-mail. Please list your corrections quoting line number. If, for any reason, this is not possible, then mark the corrections and any other comments (including replies to the Query Form) on a printout of your proof and scan the pages and return via e-mail. 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. We will do everything possible to get your article published quickly and accurately. 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.

© Copyright 2018 Elsevier | https://www.elsevier.com