

21-25 August 2022
San Diego, California, USA



Emerging Topics in Artificial Intelligence (ETAI) 2022 (OP110)

Conference Chairs: **Giovanni Volpe**, Göteborgs Univ. (Sweden); **Joana B. Pereira**, Karolinska Institute (Sweden); **Daniel Brunner**, Institut Franche-Comte Electronique Mecanique Thermique et Optique (France); **Aydogan Ozcan**, Univ. of California, Los Angeles (USA)

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The ETAI conference provides a forum for a highly interdisciplinary community combining artificial intelligence with photonics, microscopy, active matter, bio-medicine, and brain connectivity. Importantly, this conference includes topics outside the core expertise of optics and photonics. Photonics and machine learning have become decisively interdisciplinary, and we expect additional synergy and inspiration through this open-minded approach.

ETAI actively engages with industry to foster commercialization and provides networking opportunities for young and established researchers. By bringing experts from different fields and backgrounds together, ETAI provides new fundamental insights and identifies technological applications as well as commercialization opportunities.

The topics covered in ETAI include but are not limited to:

- data acquisition and analysis through photonic subsystems, e.g., time series, images, video feature tracking, optical signal processing
- simulation and design of photonic components and circuits
- adaptive control of experimental setups through more robust and resilient feedback cycles
- enhanced computational microscopy using artificial intelligence
- alternative computing concepts such as neural networks and Ising machines to overcome the end of Moore and Dennard scaling
- fundamental aspects of photonic non-digital computing
- integrated photonics and nonlinear optical components for next generation computing
- enhanced precision medicine, e.g., virtual tissue staining, early diagnosis, and personalized treatments
- artificial intelligence for analysis of brain connectivity
- biomimetic and neuromorphic computational architectures
- embodied intelligence in nature and technology

- evolution of adaptive behaviors in biological systems
- engineering collective behaviors in robotic swarms
- human brain haptic device interfaces
- physical insight and interpretability of artificial intelligence models
- limitations and criticism of the use of artificial intelligence.

The keynote and invited presentations will provide an exciting and broad view of this interdisciplinary research effort.

Abstracts are solicited on (but not restricted to) the following areas:

ARTIFICIAL INTELLIGENCE FOR PHOTONICS

- optical system design using machine learning
- machine learning-based solutions to inverse problems in optics
- spectroscopy enhancement using machine learning.

ARTIFICIAL INTELLIGENCE FOR MICROSCOPY

- computational microscopy
- data-driven optical reconstruction methods
- digital video microscopy
- generation of training datasets.

ARTIFICIAL INTELLIGENCE FOR OPTICAL TRAPPING

- particle detection
- optical trap calibration
- feedback control.

ARTIFICIAL INTELLIGENCE FOR SOFT AND ACTIVE MATTER

- data acquisition using machine learning
- data analysis using machine learning
- de-noising using machine learning
- reinforcement learning in physical systems
- dynamics of complex systems
- intelligent foraging
- navigation and search strategies.

Submit abstracts by 9 February 2022

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Emerging Topics in Artificial Intelligence (ETAI) 2022 (OP110)

ARTIFICIAL INTELLIGENCE FOR BIOMEDICINE

- machine learning-enhanced optical imaging and sensing
- image segmentation
- virtual tissue staining
- artificial intelligence as a tool to enhance decision-making in personalized medicine and drug screening
- multiple-sources data structuring and combination in complex biomedical decision-making
- legal and ethical aspects of the use of artificial intelligence as a tool for decision-making in medicine.

NEUROMORPHIC COMPUTING

- next generation materials for optical nonlinearity
- integration of ultra-parallel photonic architectures
- beyond 2D substrates
- physical substrates for machine learning applications.

OPTICAL NEURAL NETWORKS

- learning in optical systems
- applications for optical neural networks
- scalability of optical neural networks.

AUTONOMOUS ROBOTS

- swarming robots
- feedback control
- elaboration of sensorial inputs
- decision making.

BIOLOGICAL MODELS FOR ARTIFICIAL INTELLIGENCE

- physical foundations of biological intelligence
- translation of biological models to artificial intelligence
- collective motion in biological populations.

MACHINE LEARNING TO STUDY THE BRAIN

- machine learning methods for image segmentation
- supervised and unsupervised models
- multi-voxel pattern analysis
- predictive modelling approaches.

ARTIFICIAL INTELLIGENCE FOR BRAIN CONNECTIVITY

- measurement of brain activity and anatomy in humans and animals
- structural and functional connectomics
- graph theoretical tools
- clusters and subnetwork extraction
- dimensionality reduction techniques to identify brain networks.

MACHINE-BRAIN INTERFACES

- detection of brain activity
- haptic devices
- feedback control through brain waves.

LIMITATIONS OF ARTIFICIAL INTELLIGENCE

- the “black-box problem” of machine learning
- interpretability, explainability and uncertainty quantification of machine-learning models
- generalization power of machine-learning models
- model selection
- development of objective benchmarks.

Present your research at SPIE Optics + Photonics

Below are abstract submission instructions, the accompanying submission agreement, conference presentation guidelines, and guidelines for publishing in the Proceedings of SPIE on the SPIE Digital Library. Submissions subject to chair approval.

Important dates

Abstracts due	9 February 2022
Authors notified and program posts online	18 April 2022
Registration opens	May 2022
Submission system opens for manuscripts and poster videos/PDFs*	27 June 2022
Post-deadline abstracts due: Submit via conference listings	5 July 2022
Manuscripts due	27 July 2022
Poster videos/PDFs due for onsite preview	27 July 2022
Advance upload deadline for oral presentation slides**	19 August 2022

*Contact author or speaker must register prior to uploading

**After this date slides must be uploaded onsite at Speaker Check-In

What you will need to submit

- Title
- Author(s) information
- 250-word abstract for technical review
- 100-word summary for the program
- Keywords used in search for your paper (optional)
- Check the individual conference Call for Papers for additional requirements (for example, some conferences require 2- to 3-page extended summary for technical review, or have instructions for award competitions)

Note: Only original material should be submitted. Commercial papers, papers with no new research/development content, and papers with proprietary restrictions will not be accepted for presentation.

How to submit your abstract

- Visit the conference page: www.spie.org/op110call
- You may submit more than one abstract but submit each abstract only once.
- Click the "Submit An Abstract" button on the conference page.
- Sign in to your SPIE account or create an account if you do not already have one.
- Follow the steps in the submission wizard until the submission process is completed

Submission agreement

All presenting authors, including keynote, invited, oral, and poster presenters, agree to the following conditions by submitting an abstract:

- Register and pay the author registration fee
- Oral presenters: recording and publication of your onsite presentation (slides synched with voice), or submit a presentation video to be published instead of the onsite recording, for publication in the Proceedings of SPIE on the SPIE Digital Library
- Poster presenters: submit a poster PDF and optional preview video by the advertised due date, for viewing during the event and publication in the Proceedings of SPIE on the SPIE Digital Library
- Submit a 4-page-minimum manuscript, by the advertised due date, for publication in the Proceedings of SPIE on the SPIE Digital Library
- Obtain funding for registration fees, travel, and accommodations, independent of SPIE, through their sponsoring organizations
- Ensure that all clearances, including government and company clearance, have been obtained to present and publish. If you are a DoD contractor in the USA, allow at least 60 days for clearance
- Attend the meeting.
- Present at the scheduled time

Review and program placement

- To ensure a high-quality conference, all submissions will be assessed by the conference chair/editor for technical merit and suitability of content
- Conference chairs/editors reserve the right to reject for presentation any paper that does not meet content or presentation expectations
- Final placement in an oral or poster session is subject to chair discretion

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