IAEA
International Atomic Energy Agency
Atoms for Peace and Development

Technical Meeting on Artificial Intelligence for Nuclear Technology and Applications

Virtual Event

25–29 October 2021

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Information Sheet

Introduction

Artificial Intelligence (AI) refers to a collection of technologies that combine numerical data, algorithms and continuously increasing computing power to develop systems capable of tracking complex problems in ways similar to human logic and reasoning. AI technologies can analyse large amounts of data to learn how to complete a particular task, a technique called machine learning.

AI is advancing exponentially and can already sort and interpret massive amounts of data from various sources to carry out a wide range of tasks, and help tackle many of the world's most urgent challenges.

For example, AI's ability to recognize data patterns and analyse high-resolution images from satellites, drones or medical scans can improve responses to humanitarian emergencies, signal drought or floods by detecting global hydro-climatic changes, help doctors identify cancers and other diseases, increase agricultural productivity, track animal and marine migrations. In fact, AI will be an integral part of the Agency's new ZODIAC project helping to identify and contain future zoonotic disease outbreaks.

In addition, AI is used in the nuclear industry to augment automation, for refuelling and maintenance planning, to train nuclear personnel for normal and abnormal operation, for in-service inspections, evaluation and characterization of cracks and flaws, in reactor design, safety, security, real-time risk assessment, long term operation/lifetime applications, to enhance workplace safety and for on-line dosimetry based on computer simulations. However, the transformative power of AI also comes with challenges, including issues of transparency, trust and security, and other ethical concerns.

The IAEA, as the global focal point for nuclear cooperation, is backing AI and its enormous potential to help accelerate the safe, secure and peaceful uses of nuclear technologies and aid progress towards the United Nations' Sustainable Development Goals.

Objectives

The event aims to provide an international, cross-cutting forum to discuss and foster cooperation on artificial intelligence applications, methodologies, tools and enabling infrastructure that have the potential to advance nuclear technology and applications, while taking into account existing mandates and programmatic priorities.

Target Audience

The event aims to bring together junior and senior nuclear and data scientists, together with nuclear and data engineers, earth scientists and experts from nuclear sites, the industry and the medical field, as well as from technical support organizations and international organizations active in the field of artificial intelligence and related domains, including ethics.

Working Language

The working language of the event will be English. All communication and papers must be sent to the IAEA in English. No simultaneous interpretation will be provided.

Expected Outputs

The results of the event will be summarized in a report that will serve as a roadmap for possible future collaboration under the aegis of IAEA where artificial intelligence applications, methodologies, tools and enabling infrastructure can have transformative impacts in nuclear science, technology and applications. It is expected that much of the results will be produced during the working group sessions.

Structure

The event programme will consist of plenary cross-cut sessions dedicated to invited talks, posters and discussions, and working group sessions dedicated to identifying topics of collaboration where AI can have impacts in the thematic areas outlined below. The Organizers of the Sessions will be responsible for the overall scientific content, including selecting the talks and posters, organizing the technical and discussion sessions, as well as establishing the working groups.

Topics

The plenary cross-cut sessions will cover some of the following topics:

- **Enabling Infrastructure**

  Keywords: artificial intelligence; machine learning; open data science; standardized frameworks; comprehensive data management; uncertainty quantification; data curation; high performance computing; advanced manufacturing; educational and training activities; ethics.

- **Advanced Modelling and Simulation Methodologies**

  Keywords: integrated modelling; multi-physics multiscale modelling; virtual systems/digital twin technology; optimized system design; improved system performance and user experience.

The working group sessions – whose participants and talks will be established by the Organizers of the Sessions – will focus on the following thematic areas:

- **Ethics**

  Keywords: trustworthiness; human rights; sustainability objectives; AI ethics (water ethics, climate ethics, ethics and health, AI and nuclear safety, AI-energy ethics).

- **Food and Agriculture**

  Keywords: food authentication; food safety early warning systems; soil type prediction; insect screening; plant viability screening.

- **Human Health**

  Keywords: diagnosis and treatment of cancer; image interpretation; treatment plans and contouring; adaptive radiotherapy; medical processes.

- **Nuclear Data**

  Keywords: nuclear, atomic and molecular data; data analysis; verification; uncertainty quantification; anomaly detection; information discovery.

- **Nuclear Fusion**

  Keywords: plasma prediction; control system; model generation.

- **Nuclear Physics**

  Keywords: data analysis; data management; experimental design and optimization; facility operation.

- **Nuclear Power**

  Keywords: outage; maintenance; planning; scheduling; inspection; training; engineering assessment; risk assessment; machine learning.

- **Nuclear Security**

  Keywords: anomaly detection; data analysis (flow, sensor, image); data integration; data management; defensive computer security (network) architecture; internet of things – cloud services; information protection; performance assessment; systems design analysis; threat analysis; training; vulnerability management.

- **Radiation Protection**

  Keywords: computer simulations including work simulations; processes including radiation exposure with algorithms; health and safety in workplaces; radiological data across machines; radiation

protection programmes; online dosimetry; optimization; planning and training; validation by measurements; instrumentation; robotics.

- **Radioisotopes and Radiation Technology**

  Keywords: radiopharmaceutical design and modelling; radiation dose distribution - animal models and irradiated samples; sediment transport calculations; heat transfer and cooling of targets.

- **Safeguards Verification**

  Keywords: nuclear measurements; surveillance; non-destructive assay; tampering detection; gamma spectroscopy; spent fuel verification; Cerenkov light; Dynamic calorimetry; fissile mass quantification.

- **Water and Environment**

  Keywords: water security and protection; complex data analysis – spatial and temporal; groundwater modelling; study of the hydrological cycle; climate models.

Participation and Registration

All persons wishing to participate in the event must be designated by an IAEA Member State or should be members of organizations that have been invited to attend.

In order to be designated by an IAEA Member State, participants are requested to send the **Participation Form (Form A)** to their competent national authority (e.g. Ministry of Foreign Affairs, Permanent Mission to the IAEA or National Atomic Energy Authority) for onward transmission to the IAEA by **19 July 2021**. Participants who are members of an organization invited to attend are requested to send the **Participation Form (Form A)** through their organization to the IAEA by the above deadline.

Selected participants will be informed in due course on the procedures to be followed with regard to administrative and technical matters.

Papers and Presentations

The IAEA encourages participants to give presentations on the work of their respective institutions that falls under the topics listed above.

Participants who wish to give presentations are requested to submit an abstract of their work. The abstract will be reviewed as part of the selection process for poster presentations. The abstract should be submitted through IAEA-INDICO by **4 July 2021**. Abstracts may contain figures and graphics.

Authors will be notified of the acceptance of their proposed poster presentations by **30 July 2021**.

In addition, participants have to submit the abstract together with the **Participation Form (Form A)** and the attached **Form for Submission of a Paper (Form B)** to their competent national authority (e.g. Ministry of Foreign Affairs, Permanent Mission to the IAEA or National Atomic Energy Authority) or their organization for onward transmission to the IAEA not later than **19 July 2021**.

An electronic copy of the proceedings, consisting of abstracts, presentation slides and posters will be made available to all participants on the IAEA Meeting Website.

Key Deadlines and Dates

4 July 2021	Deadline for submission of abstracts through IAEA-INDICO for contributed posters
19 July 2021	Deadline for submission of Participation Form (Form A) and Form for Submission of a Paper (Form B) through the official channels
30 July 2021	Notification of acceptance of abstracts
25 October 2021	Event begins
29 October 2021	Event ends

Organizers of the Sessions

Ethics	Ms Emma Ruttkamp-Bloem	South Africa
	Mr Behnam Taebi	Netherlands
	Mr Matteo Barbarino Mr Yaroslav Pynda	IAEA, Department of Nuclear Sciences and Applications
Food and Agriculture	Mr Simon Kelly	IAEA, Department of Nuclear Sciences and Applications
Human Health	Mr Jan Seuntjens	Canada
	Ms Miriam Mikhail Mr Alfredo Polo Rubio Mr Yaroslav Pynda Ms Debbie Van Der Merwe	IAEA, Department of Nuclear Sciences and Applications
Nuclear Data	Mr Christian Hill Ms Ludmila Marian Mr Georg Schnabel	IAEA, Department of Nuclear Sciences and Applications
Nuclear Fusion	Mr David Humphreys	United States of America
	Ms Cristina Rea	
	Mr Matteo Barbarino	IAEA, Department of Nuclear Sciences and Applications
Nuclear Physics	Ms Michelle Kuchera	United States of America
	Ms Stefanie Reichert	Germany
	Mr Matteo Barbarino	IAEA, Department of Nuclear Sciences and Applications
Nuclear Power	Mr Ed Bradley Mr Harri Varjonen Mr Pedro Dieguez Porras Mr Chirayu Batra	IAEA, Department of Nuclear Energy
Nuclear Security	Mr Mitchell Hewes Mr Robert Larsen Mr Charles Massey	IAEA, Department of Nuclear Safety and Security
Radiation Protection	Mr István Szőke	Norway
	Mr Filip Vanhavere	Belgium
	Mr Burcin Okyar	IAEA, Department of Nuclear Safety and Security
Radioisotopes and Radiation Technology	Mr Joao A. Osso Junior	IAEA, Department of Nuclear Sciences and Applications
Safeguards Verification	Mr Dimitri Finker	IAEA, Department of Safeguards
Water and Environment	Ms Astrid Harjung Ms Yuliya Vystavna	IAEA, Department of Nuclear Sciences and Applications

IAEA Contacts

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Subsequent correspondence on scientific matters should be sent to the Scientific Secretary and correspondence on other matters related to the event to the Administrative Secretary.

Meeting Web Page

Participants are encouraged to visit the meeting web page regularly to check for new or updated information regarding the meeting:

IAEA meeting web page:
https://www.iaea.org/events/evt2004304

IAEA-INDICO meeting web page:
https://conferences.iaea.org/event/245/