



The Abdus Salam
**International Centre
for Theoretical Physics**
www.ictp.it
Trieste, Italy



UNIVERSIDAD
NACIONAL
DE TUCUMÁN



WELCOME TO THE

INTERNATIONAL WORKSHOP ON MACHINE LEARNING FOR SPACE WEATHER: FUNDAMENTALS, TOOLS AND FUTURE PROSPECTS

Buenos Aires, 7-11 November 2022

WHAT IS THE ICTP

- ✘ The Abdus Salam International Centre for Theoretical Physics was founded in 1964, by the late Nobel Laureate Abdus Salam
- ✘ It is a United Nations Educational, Scientific and Cultural Organization (UNESCO) Category 1 Institute
- ✘ It receives the majority of its funding from the Italian government and is administered by the UNESCO and the International Atomic Energy Agency (IAEA)



ICTP'S MANDATE

- ✘ The ICTP has the mandate
 - ✘ to foster the growth of advanced studies and research in physical and mathematical sciences, especially in support of excellence in developing countries
 - ✘ to provide an international forum of scientific contact for scientists from all countries

“Scientific thought is the common heritage of mankind”

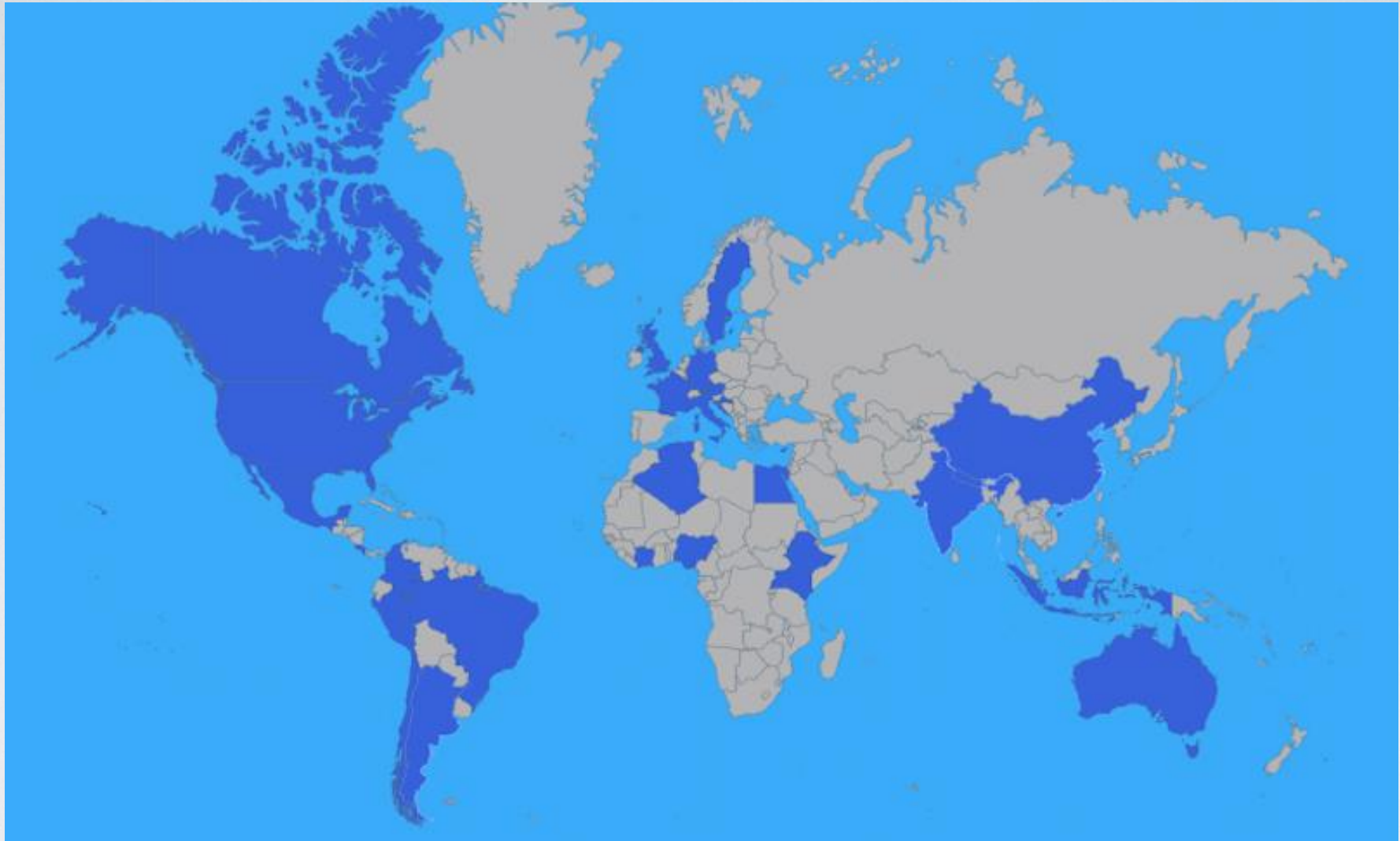
International Workshop on Machine Learning for Space Weather: Fundamentals, Tools and Future Prospects



TOPICS:

- Space Weather fundamentals.
- Space Weather Gaps and applications that can be tackled with ML.
- Machine Learning Basic Concepts and Tools.
- Deep Learning and current trends
- Machine Learning techniques applied to Space Weather and their main challenges
- R2O, XAI, trustworthiness and ethics in ML.
- Open source tools for ML (Python, scikit-learn, Keras, etc).

WORKSHOP PARTICIPANTS & SPEAKERS









80 participants (19 onsite 61 online) and **23** speakers
We represent **32** Countries


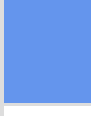
WORKSHOP PARTICIPANTS & SPEAKERS




Algeria, Argentina, Australia, Austria, Brazil, Canada, Chile, China, Colombia, Costa Rica, Cote d'Ivoire, Croatia, Cyprus, Egypt, Ethiopia, France, Ghana, Germany, India, Indonesia, Italy, Kenya, Mexico, Nepal, Nigeria, Peru, Sweden, Turkey, Uganda, United Kingdom, USA, Zimbabwe.

PARTICIPANTS DISTRIBUTION

(INSTITUTES)

Africa		21	26%
Asia		14	18%
Europe		5	6%
Mid. East		0	0%
Latin Am.		36	45%
North Am.		2	3%
Oceania		2	3%

Female		37	46%
Male		43	54%
N/A		0	0%

Developing		70	88%
Least dev.		5	6%
Developed		5	6%

WORKSHOP AGENDA

<https://indico.ictp.it/event/9840/overview>

Monday, 7 November 2022

08:00 - 16:00

08:00 **REGISTRATION** 1h0' (CONAE (Buenos Aires, Argentina))

09:00 **Welcome and Opening Remarks** 30'

09:30 **The Role of Sun in Space Weather** 40'

Speaker: Nat Gopalswamy (NASA (USA))

10:10 **Coffee Break** 20'

10:30 **Developing Space Weather Indices for Latin America: Magnetic and Ionospheric Scales** 40'

Speaker: Clezio Denardin (INPE (Brazil))

11:10 **Ionosphere variations** 40'

Speaker: Sandro Radicella (Boston College (USA))

11:50 **Classifying Radio Wave Distortions** 40'

Speaker: Keith Groves (Boston College (USA))

12:30 **Lunch** 1h30'

14:00 **Hands-on session** 2h0'

Speaker: Jorge Namour (FACET-UNT (Argentina))

WORKSHOP AGENDA

Tuesday, 8 November 2022

09:00 - 18:00

- 09:00 **Machine Learning Fundamentals 1h0'**
Speaker: Maria G. Molina (FACET-UNT (Argentina))
- 10:00 **Coffee Break 30'**
- 10:30 **State of the art and open challenges of Machine Learning in Space weather 1h0'**
Speaker: Enrico Camporeale (CIRES, University of Colorado, Boulder/NOAA (USA))
- 11:30 **Classification of interplanetary structures near Earth and their impact on space weather conditions 40'**
Speaker: Sergio Dasso (UBA-CONICET (Argentina))
- 12:10 **Characterizing the Meteoroid Environment 20'**
Speaker: Diego Janches (NASA (USA))
- 12:30 **Lunch 1h30'**
- 14:00 **Hands-on session 2h0'**
Speaker: Jorge Namour (FACET-UNT (Argentina))
- 16:00 **Welcome Icebreaker 2h0'**

WORKSHOP AGENDA

Wednesday, 9 November 2022

09:00 - 16:00

- 09:00 **Natural Language AI for Forecasting Ionosphere by Analogy: Concept Study 30'**
Speaker: Ivan Galkin (University of Massachusetts Lowell (USA))
- 09:30 **Specification and forecasting ionospheric total electron content (TEC) using advanced statistical and machine learning methods 30'**
Speaker: Shasha Zou (University of Michigan (USA))
- 10:00 **Coffee Break 30'**
- 10:30 **Deep Learning fundamentals 1h0'**
Speaker: Maria G. Molina (FACET-UNT (Argentina))
- 11:30 **Toward automatic detection of travelling ionospheric disturbances (TIDs) of different origins in near-real-time 30'**
Speaker: Elvira Astafayeva (IPGP (France))
- 12:00 **Using Clustering Techniques to Classify Secondary Particle Contributions in Water Cherenkov Detectors of the LAGO Collaboration 30'**
Speaker: Ticiano Torres-Peralta (FACET-UNT (Argentina))
- 12:30 **Lunch 1h30'**
- 14:00 **Hands-on Session 2h0'**
Speaker: Jorge Namour (FACET-UNT (Argentina))

WORKSHOP AGENDA

Thursday, 10 November 2022

09:00 - 23:15

- 09:00 **Transferable Lessons Learnt at the Interface of AI and NanoBio Technology** 30'
Speaker: Natalio Krasnogor (Newcastle University (UK))
- 09:30 **Ethics IA** 30'
Speaker: Dagmar Monett-Diaz (HWR BERLIN (Germany))
- 10:00 **Coffee Break** 30'
- 10:30 **AfriTEC: A neural network based model of the African regional ionospheric Total Electron Content** 30'
Speaker: Daniel Okoh (NARSDA (Nigeria))
- 11:00 **On performance assessment of machine learning-based GNSS ionospheric delay correction model based on space weather predictors in immediate positioning environment** 30'
Speaker: Renato Filjar (University of Rijeka (Croatia))
- 11:30 **Ionosphere forecasting for space weather using deep learning** 30'
Speaker: Maria G. Molina (FACET-UNT (Argentina))
- 12:00 **Clustering of ROTI maps for ionospheric irregularities geolocation** 30'
Speaker: Yenca Migoya-Orué (ICTP (Italy))
- 12:30 **Lunch** 1h30'
- 14:00 **Hands-on Session** 45'
Speaker: Jorge Namour (FACET-UNT (Argentina))
- 21:00 **Dinner (TBC)** 2h15'

WORKSHOP AGENDA

Friday, 11 November 2022

09:00 - 16:40

- 09:00 **Software Development for Machine Learning** 30'
Speaker: Pablo Alcaín (WTPC (Argentina))
- 09:30 **Trustworthiness** 30'
Speaker: Maria Molina (University of Maryland (USA))
- 10:00 **Coffee Break** 30'
- 10:30 **Introduction to Bayesian stats, with Python & PyMC** 1h0'
Speaker: Alex Andorra (PyMC Labs (France))
- 11:30 **ICG Development and its Activities"** 20'
Speaker: Sharafat Gadimova (UNOOSA (Austria))
- 11:50 **Participants Presentations** 40'
Speaker: Selected Participants
- 12:30 **Lunch** 1h30'
- 14:00 **Hands-on Session** 2h0'
Speaker: Felipe Meza-Obando (Tecnologico de Costa Rica (Costa Rica))
- 16:00 **Event Closure** 40'



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Directors

- S. Gadimova, UNOOSA-ICG
- K. Groves, Boston College
- Y. Migoya-Orué, ICTP
- M. Graciela Molina, FACET-UNT/CONICET

ICTP Contact

- B. Nava, ICTP

WORKSHOP LOGISTICS

The workshop will not be recorded.

The presentations and lectures will be made available in the workshop website.