### **GREECE AT THE FOREFRONT OF EUROPEAN RESEARCH**

### Online Workshop - 25 February 2021



Six leading Greek research institutions join forces to showcase how Machine Learning can unlock the potential of Big Earth Observation Data for socio-environmental good

### Join us to learn about

- The main research trends and challenges in AI4EO, proposed by excellent European scientists
- The leading role of the Greek research community in addressing scientific questions with direct socio-environmental implications
- How Artificial Intelligence and Earth Observation data are used to assess & understand the impact of climate change
- New technology enablers that propel the deployment of AI pipelines on big satellite data, at scale

### Registration link: https://forms.gle/Hmqordk66VGppWa16















HELLENIC REPUBLIC National and Kapodistrian University of Athens EST 1837

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### ARTIFICIAL INTELLIGENCE FOR BIG SATELLITE DATA Online Workshop - 25 February 2021

### **SPEAKERS**



#### MARKUS REICHSTEIN

#### Biogeochemical Integration Department, Max-Planck-Institute for Biogeochemistry

Markus Reichstein is Director of the Biogeochemical Integration Department at the Max-Planck-Institute for Biogeochemistry. His main research interests revolve around the response and feedback of ecosystems (vegetation and soils) to climatic variability with a Earth system perspective, considering coupled carbon, water and nutrient cycles. Of specific interest is the interplay of climate extremes with ecosystem and societal resilience. These topics are addressed via a model-data integration approach, combining data-driven machine learning with systems modelling of experimental, ground- and satellite-based observations. Since 2013 Markus Reichstein is Professor for Global Geoecology at the FSU Jena, and founding Director at the Michael-Stifel-Center Jena for Data-driven and Simulation Science. He has been serving as lead author of the IPCC special report on Climate Extremes (SREX), as member of the German Commitee Future Earth on Sustainability Research, and the Thuringian Panel on Climate. Recent awards include the Piers J. Sellers Mid-Career Award by the American Geophysical Union (2018), an ERC Synergy Grant (2019) and the Gottfried Wilhelm Leibniz Preis (2020).



#### GUSTAU CAMPS-VALLS

#### Department of Electrical Engineering, University of Valencia

Gustau Camps-Valls (IEEE Fellow'18, IEEE Distinguished lecturer, PhD in Physics) is currently a Full professor in Electrical Engineering and head of the Image and Signal Processing (ISP) group, http://isp.uv.es. He is interested in the development of machine learning algorithms for geosciences and remote sensing data analysis. He is an author of around 250 journal papers, more than 300 conference papers, 30 international book chapters, and editor of 6 books on kernel methods and deep learning. He holds a Hirsch's index h=70, entered the ISI list of Highly Cited Researchers in 2011 and has received two European Research Council (ERC) grants: an ERC Consolidator grant on "Statistical learning for Earth observation data analysis" (2015) and an ERC Synergy grant on "Understanding and Modelling the Earth system with machine learning" (2019). In 2016 he was included in the prestigious IEEE Distinguished Lecturer program of the GRSS.



#### LORENZO BRUZZONE

#### Department of Information Engineering and Computer Science, University of Trento

Lorenzo Bruzzone is currently a Full Professor of telecommunications at the University of Trento where he is the founder and the director of the Remote Sensing Laboratory (https://rslab.disi.unitn.it/) in the Department of Information Engineering and Computer Science. His current research interests are in the areas of remote sensing, radar and SAR, signal processing, machine learning and pattern recognition. He promotes and supervises research on these topics within the frameworks of many (40+) national and international projects. Among the others, he is currently the Principal Investigator of the Radar for icy Moon exploration (RIME) instrument in the framework of the JUICE mission of the European Space Agency (ESA) and of the High Resolution Land Cover project in the framework of the Climate Change Initiative of ESA. He is the author (or coauthor) of 294 publications in referred international journals, more than 340 papers in conference proceedings, and 22 book chapters. He is editor/co-editor of 18 books/conference proceedings and 1 scientific book. His papers are highly cited, as proven from the total number of citations (36000+) and the value of the h-index (88) (source: Google Scholar). He was invited as keynote speaker in many (40+) international conferences and workshops. Since 2019 he has been Vice-President for Professional Activities of the IEEE Geoscience and Remote Sensing Society (GRSS). Dr. Bruzzone is the recipient of many international awards. He is the co-founder of the IEEE International Workshop on the Analysis of Multi-Temporal Remote-Sensing Images (MultiTemp). Since 2003 he has been the Chair of the SPIE Conference on Image and Signal Processing for Remote Sensing. He has been the founder of the IEEE Geoscience and Remote Sensing Magazine for which he has been Editor-in-Chief between 2013-2017. He has been Distinguished Speaker of the IEEE GRSS between 2012-2016. He is IEEE Fellow.

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### **SPEAKERS**



#### IOANNIS PAPOUTSIS

Institute for Astronomy, Astrophysics, Space Applications & Remote Sensing, National Observatory of Athens

Ioannis Papoutsis is an Associate Researcher at the Institute of Astronomy, Astrophysics, Space Applications & Remote Sensing of the National Observatory of Athens (IAASARS-NOA). He holds a PhD in Remote Sensing from the National Technical University of Athens (NTUA), an MBA from ALBA Graduate Business School, a MSc in Telecommunications from the Department of Electronic and Electrical Engineering of the University College London and a Meng in Electrical and Computer Engineering from NTUA. He heads the IAASARS-NOA AI4EO research group, which focuses on the exploitation of big volumes of satellite and geospatial data with novel artificial intelligence/deep learning technologies. He has a deep understanding of the Copernicus flagship programme, being the Operations Manager of the Greek node of European Space Agency Hubs that distribute Sentinel data, as well as being a Copernicus Emergency Management Services Manager for Risk and Recovery. Ioannis has participated to several research H2020, ESA and Copernicus projects, and he is currently the coordinator of the H2020 project DeepCube that focuses on developing innovative AI pipelines for big Copernicus data.

#### **NEKTARIOS CHRYSOULAKIS**

# Institute of Applied and Computational Mathematics, Foundation for Research and Technology Hellas

Dr. Nektarios Chrysoulakis is a Director of Research at FORTH and Head of the Remote Sensing Lab (http://rslab.gr). He holds a BSc in Physics, a MSc in Environmental Physics and PhD in Remote Sensing from the University of Athens. He has been involved in R&D projects funded by the European Union, the European Space Agency and the Ministries of Environment, Development, Culture and Education. His main research interests include climate change and urbanization, urban climate, urban energy balance, urban resilience, urban planning and metabolism, natural and technological hazards, surface temperature and albedo, environmental monitoring and change detection. Dr. Chrysoulakis is cPI of the European Research Council (ERC) Synergy project urbisphere focusing on coupling dynamic cities and climate. He is the coordinator of the H2020-Space project CURE, focusing on Copernicus services exploitation in the domain of urban resilience. He has coordinated the projects URBANFLUXES (H2020), SEN4RUS (ERA.Net-RUS Plus), BRIDGE (FP7) GEOURBAN (FP7). He has also participated in H2020 projects CoCO2, HARMONIA, ECOPOTENTIAL, and THINKNATURE, and in LIFE projects IGIC and FLIRE. Dr. Chrysoulakis is a member of the Board of Directors of the Eratosthenes Centre of Excellence in Earth Observation, space technology and geospatial analysis. Dr. Chrysoulakis is a Visiting Professor at the Department of Physics of the University of Créte, teaching the course "Principles and Applications of Satellite Remote Sensing"; and at the CIHEAM-MAICh, teaching the course "Remote sensing of Urban Environments". He is involved in GEO Climate Change Working Group, as well as in GEO Programme Board Urban Resilience Subgroup. He has more than 250 publications in peer-review journals and conference proceedings.



#### **KONSTANTINOS KARANTZALOS**

#### School of Rural and Surveying Engineering, National Technical University of Athens

Konstantinos Karantzalos (http://users.ntua.gr/karank) received his engineering diploma from the National Technical University of Athens (NTUA, Greece) and his PhD (2007, NTUA) in collaboration with Ecole Nationale de Ponts et Chaussees (ENPC, France). In 2007, he joined the Department of Applied Mathematics at Ecole Centrale de Paris (ECP, France) as a postdoc. He is currently an Associate Professor of Remote Sensing at the National Technical University of Athens. His teaching and research interests include geoscience and remote sensing, big data, hyperspectral image analysis, computer vision and pattern recognition, environmental monitoring and precision agriculture. Several of his publications have been featured in top-ranking international journals and conferences. He has more than 15 years of research experience and has been involved with more than 14 EU and national excellence/competitive research projects.



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#### MANOLIS KOUBARAKIS

Department of Informatics & Telecommunications, National and Kapodistrian University of Athens

Manolis Koubarakis is a Professor and Director of Graduate Studies in the Dept. of Informatics and Telecommunications, National and Kapodistrian University of Athens. He leads the Artificial Intelligence team (http://ai.di.uoa.gr). He is also an Adjunct Researcher at the Institute of the Management of Information Systems (IMIS) of the "Athena" Research and Innovation Center. He holds a Ph.D. in Computer Science, from the National Technical University of Athens, an M.Sc. in Computer Science, from the University of Toronto, and a diploma (B.Sc.) in Mathematics, from the University of Crete. He is a Fellow of EurAI (European Association for Artificial Intelligence) since 2015 and President of the Hellenic Association for Artificial Intelligence. He is a member of the Advisory Board that implements the Hellenic National Strategy for Artificial Intelligence. He has published more than 200 papers that have been widely cited (6722 citations and h-index 42 in Google Scholar) in the areas of Artificial Intelligence (especially Knowledge Representation), Databases, Semantic Web and Linked Geospatial Data (especially Earth observation data). His research has been financially supported with a total amount exceeding 8 million Euros by the European Commission, the Hellenic Foundation for Research and Innovation, the Greek General Secretariat for Research and Technology, the European Space Agency and industry. Manolis is currently the coordinator of project ExtremeEarth (2019-2021) which develops deep learning and big data techniques for satellite data from the Copernicus program. He also participates in the projects AI4EU (2019-2021, the largest H2020 European project in the area of Artificial Intelligence), Al4Copernicus (2021-2023, as Technical Manager of this project which brings Copernicus data the the AI4EU platform) and DeepCube (2021-2023, where he leads the work on Semantic Data Cubes).



#### VANGELIS KARKALETSIS

#### Institute of Informatics & Telecommunications, National Centre for Scientific Research "Demokritos"

Vangelis Karkaletsis is the Director of the Institute of Informatics & Telecommunications at NCSR Demokritos (NCSR-D). His research interests are in the areas of artificial intelligence, big data management, content analysis, natural language interfaces and ontology engineering. He is currently coordinator of the H2020 Al4Copernicus project, the H2020 DARE project, site manager of the H2020 projects ExtremeEarth and Al4EU and the EuroHPC JU EuroCC project, member of the NCSR-D's Al Center of Excellence on Document Intelligence, and coordinator or site manager for national projects and projects with the industry. He is also leading NCSR-D's Digital Innovation Hub Ahedd which focuses on Al, Big Data and IoT technologies. He has also been site manager for the H2020 Big Data Europe project for the development of a Big Data Integrator platform, and coordinator of the H2020 Radio project on the use of robots in assisted living environments. He has organized international summer schools, workshops and conferences. He served for many years in the Board of the Hellenic Association on Al.



#### STEFANOS VROCHIDIS

#### Information Technologies Institute - Centre for Research and Technology Hellas

Dr. Stefanos Vrochidis received his Diploma in Electrical Engineering from Aristotle University of Thessaloniki, his MSc in Radio Frequency Communication Systems from University of Southampton and his PhD in Electronic Engineering from Queen Mary University of London. He is a Senior Researcher (Grade C) with the Multimedia Knowledge and Social Media analytics Lab of ITI-CERTH and Head of the Multimodal Data Fusion and Analytics (M4D) Group. His research interests include multimedia analysis and retrieval, multimodal fusion, computer vision, multimodal analytics based on AI, semantic web, as well as media & arts, environmental, earth observation and security applications. Dr. Vrochidis has participated in more than 40 European and National research projects, in 5 as Project Coordinator (H2020 V4Design, MindSpaces, etc), in 2 as Deputy project Coordinator and in more than 5 as Scientific or Technical Manager (H2020 EOPEN, CALLISTO, etc.), dealing with semantic analysis, multimodal fusion and AI-based analytics. He has been member of the organization team of several conferences and workshops relevant to the aforementioned research areas. He has edited 2 books and authored more than 210 related scientific journal, conference and book chapter publications. He has served as a reviewer in several international Journals and as Technical program committee in well reputed conferences and workshops.

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PROJECTS



#### Explainable AI pipelines for big Copernicus data

DeepCube leverages on advances in Artificial Intelligence and semantic web to unlock the potential of big Copernicus data, address problems that imply high socio-environmental impact, and enhance our understanding of Earth's processes correlated with Climate Change. To achieve this, we bring mature and new ICT tools, such as the Earth System Data Cube, the Semantic Cube, the Hopsworks platform, and a state-of-the-art visualization tool tailored for linked Copernicus data, integrating them into an open interoperable platform that can be deployed in cloud infrastructures and HPC, including DIAS environments. DeepCube will develop Deep Learning architectures that extend to non-conventional data, apply hybrid modeling for data-driven AI models that respect physical laws, and open-up the Deep Learning black box with Explainable Artificial Intelligence and Causality. We will showcase the tools in six Use Cases: Forecasting localized extreme drought and heat impacts in Africa, Climate induced migration in Africa, Fire hazard short-term forecasting in the Mediterranean, Volcanic deformation detection and alerting & ground deformation detection for critical infrastructure monitoring, and Copernicus services for sustainable tourism. Funded by the European Union's Horizon 2020 programme under GA number 101004188.

For more information: https://cordis.europa.eu/project/id/101004188



## Copernicus Artificial Intelligence Services and data fusion with other distributed data sources and processing at the edge to support DIAS and HPC infrastructures

Large volumes of Copernicus data offer a basis for creating value-added products that go beyond the space sector. The analysis and fusion of all data streams need to exploit DIAS and HPC infrastructures, as well as Galileo-enabled mobile devices to deliver fully automated processes in decision support systems. The CALLISTO project integrates Copernicus data, already indexed in DIAS platforms such as ONDA-DIAS, utilising High Performance Computing infrastructures for enhanced scalability when needed. Complementary distributed sources involve Galileo data, content from UAVs, web and social media data, linking them with open geospatial and in-situ sensor data. AI is applied to extract meaningful knowledge such as concepts, events, 3D-models, and animations of the user community. This knowledge is analyzed semantically and analytics are delivered to end users (water utility operators, journalists for the media sector, EU agriculture & CAP policymakers, and security agencies) in non-traditional interfaces, including Augmented & Virtual Reality. Funded by the European Union's Horizon 2020 programme under GA number 101004152.

For more information: <u>https://cordis.europa.eu/project/id/101004152</u>



#### From Copernicus Big Data to Extreme Earth Analytics

The geospatial data produced by the Sentinel satellites puts Copernicus at the forefront of the Big Data paradigm, giving rise to all the relevant challenges: volume, velocity, variety, veracity and value. ExtremeEarth develops technologies that will make Europe a pioneer in the area of Extreme Earth Analytics i.e., Remote Sensing and AI techniques that are needed for extracting knowledge out of the petabytes of Copernicus data. The ExtremeEarth consortium consists of Remote Sensing and AI researchers and technologists with outstanding scientific track records and relevant commercial expertise. The project's research and innovation activities will significantly advance the frontiers in Big Data, Earth Analytics and DL for Copernicus data and Linked Geospatial Data, making Europe a key player internationally in these areas. The ExtremeEarth technologies are demonstrated in two use cases: the Food Security and the Polar, bringing together their communities, and working with them to develop technologies that can be used in the respective application areas. The results of ExtremeEarth will be exploited commercially by the industrial partners of the consortium. Funded by the European Union's Horizon 2020 programme under GA number 825258.

Visit the project website for more information: <u>http://earthanalytics.eu/</u>

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**PROJECTS** 

ernicus



#### Copernicus for Urban Resilience in Europe

CURE exploits four Copernicus Core Services to develop an umbrella application for urban resilience, consisting of individual cross-cutting applications for climate change adaptation, energy & economy, as well as healthy cities and social environments. It uses DIAS to develop a system capable of supporting operational applications and downstream services across Europe. It is expected to increase the value of Copernicus Core Services for emerging urban resilience applications, exploiting the data quality, coverage and revisit times of future satellite missions, leading to more efficient urban planning activities with socioeconomic impact, as well as to more efficient resilience planning related to climate change mitigation, for improved thermal comfort, air quality, and energy efficiency. The benefit expected from CURE is related to transformed urban governance and quality of life, as it aims to provide integrated information to city administrators, effectively supporting strategies for resilience planning at local and city scales, towards the implementation of Sustainable Development Goals and the New Urban Agenda for Europe. Funded by the European Union's Horizon 2020 programme under GA number 870337.

Visit the project website for more information: <u>http://cure-copernicus.eu/</u>

## Reinforcing the AI4EU Platform by Advancing Earth Observation Intelligence, Innovation and Adoption

Al4Copernicus aims to make the Al4EU Al-on-demand platform the platform of choice for users of Copernicus data along the value chain (scientists, SMEs, non-tech sector). It will achieve this by exposing Al4EU resources on DIAS (Data and Information Access Services) platforms, making it easy to procure computing power and large EO data, as well as to access training material and expertise. Al4Copernicus proposes to optimize the Al4EU service offering with datasets, tools and services relevant to Copernicus data to facilitate the uptake of the platform in domains of high socioeconomic impact, such as Agriculture, Energy and Security. Four open calls have been planned, leading to 8 small-scale experiments and 9 use-cases. The open calls will necessitate the utilization of DIAS platforms, Copernicus data, the Al4EU platform and the resources that will be provided by Al4Copernicus. The project will enable the innovation cycle by incentivizing diverse Al4EU and Copernicus communities to solve real problems of business and societal value; and drive the uptake and impact of Al4EU and the DIAS platforms, especially WEKEO, CREODIAS and MUNDI. Funded by the European Union's Horizon 2020 programme under GA number 101016798.

For more information: https://cordis.europa.eu/project/id/101016798



#### Novel EOSC Services for Emerging Atmosphere, Underwater and Space Challenges

NEANIAS is an ambitious project that comprehensively addresses the Prototyping New Innovative Services' challenge set out in the recent Roadmap for EOSC' foreseen actions. NEANIAS will promote Open Science practices and play active role in the materialization of the EOSC ecosystem by efficiently engaging large scientific and professional communities; actively contributing to the technological, procedural, strategic and business development of EOSC. NEANIAS will drive the co-design and delivery of innovative thematic services, derived from state-of-the-art research assets and practices in three major sectors: Underwater research, Atmospheric research and Space research, each engaging multitudinous academic and business groups, numerous researchers, professionals and governmental entities. Funded by the European Union's Horizon 2020 programme under GA number 863448.

Visit the project website for more information: <u>https://www.neanias.eu/</u>