UniBa | UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

Unione Matematica Italiana

GRUPPO UMI «MATEMATICA PER L'INTELLIGENZA ARTIFICIALE E IL *MACHINE LEARNING*»

Mathematics for Artificial Intelligence and Machine Learning

Math4AIML

Bari, Italy

29-31 January 2025

Organizing Commitee: Nicoletta Del Buono, Flavia Esposito.

Local Staff: Nicoletta Del Buono, Flavia Esposito, Laura Selicato, Grazia Gargano, Gaetano Settembre, Serena Grazia De Benedictis

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Project PRIN-2022 PNRR, P2022BLN38 Computational Approaches for the integration of Multi-Omics Data CUP: H53D23008870001, funded by MUR, Missione 4 Istruzione e Ricerca, PI N. Del Buono

ERC Seeds UniBA Project Biomes Data Integration with Low-Rank Models, CUP H93C23000720001, PI F. Esposito

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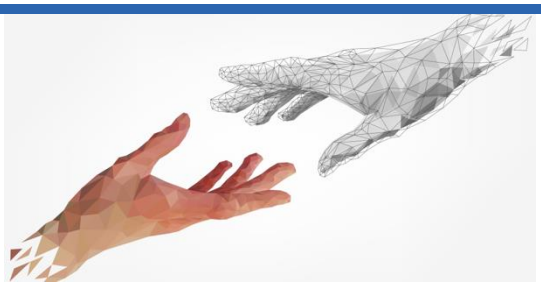

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University of Bari Aldo Moro, Bari, Italy

29 January 2025 **14:30-18:00** **Aula Magna Aldo Cossu** **Palazzo di Ateneo**	**30 January 2025** **9:00-18:30** **Aula I & Aula VI** **Department of Mathematics**	**31 January 2025** **9:00-16:00** **Aula I & Aula VI** **Department of Mathematics**
13:30-14:30 ***Registration***	8:30-9:00 ***Registration***	8:30-9:00 ***Registration***
14:30-15:00 Welcome and Opening	9:00-10:25 Parallel Sessions (**Keynote** and Contributed talks)	9:00-9:40 Parallel Sessions (Contributed talks)
15:00-16:00 Plenary: **Prof. Yurii Nesterov**	10:25-11:00 *Coffee break* and **Poster Session**	9:40-10:40 Plenary: **Prof. Claudia Angelini**
16:00-16:25 Keynote: Dr. Monica Pragliola	11:00-11:40 Parallel Sessions	10:40-11:10 *Coffee break* and **Poster Session**
16:30-17:30 Plenary: **Prof. Tommaso Di Noia**	11:45-13:00 ***Round Table*** *(Plenary Speakers, Pirelli, Planetek, IRCSS Giovanni Paolo II, representatives of UMI group)* *Exploring the interactions between MATHS, ML and AI to address challenges and innovative applications in industry and science*	11:10-12:55 Parallel Sessions (**Keynote** and Contributed talks)
17:30-17:55 Keynote: Prof. Giacomo De Palma	13:00-14:15 *Lunch* and **Poster Session**	13:00-14:15 *Lunch* and **Poster Session**
18:00 Closure of the day	14:15-15:35 Parallel Sessions (Contributed talks)	14:20-15:40 Parallel Sessions (Contributed talks)
	15:35-16:00 *Coffee break* and **Poster Session**	15:40-16:00 **Closure of workshop**
	16:25-18:05 Parallel Sessions (**Keynote** and Contributed talks)	

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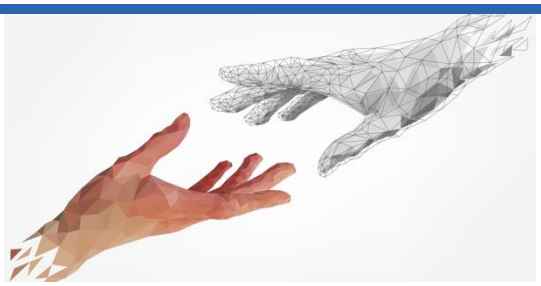

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29 January 2025 Aula Magna Aldo Cossu Palazzo di Ateneo, Piazza Umberto I, Bari		
13:30-14:30	*Registration and Welcome Break*	
14:30-15:00	Welcome and Opening	**Chair** Prof. N. Del Buono Institutional and Company welcome
15:00-16:00	Plenary talk: **Prof. Yurii Nesterov**	**Optimization, the philosophical background of artificial intelligence**
16:00-16:25	Keynote talk: Dr. Monica Pragliola	Whiteness-based learning of parameters in inverse imaging problems
16:30-17:30	Plenary talk: **Prof. Tommaso Di Noia**	**Current and future Trends in Recommender Systems**
17:30-17:55	Keynote talk: Prof.Giacomo De Palma	Trained quantum neural networks are Gaussian processes
18:00	Closure of the day	

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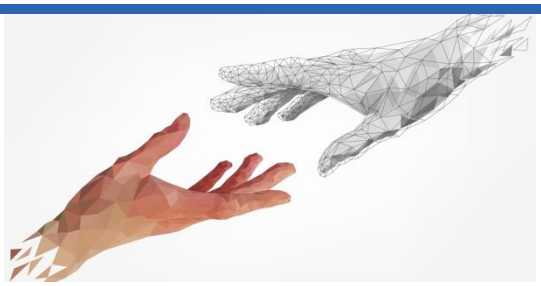

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30 January 2025
Morning Talk Sessions
Aula I & Aula VI, Department of Mathematics, via E. Orabona 4, Bari

	Aula I	Aula VI
8:30-9:00	*Registration*	
9:00-9:20	**Danilo Pezzi** Linesearch-Enhanced Forward-Backward Methods for Inexact Nonconvex Scenarios	**Moreno Pintore** The Neural Approximated Virtual Element Method on general polygons
9:20-9:40	**Ilaria Trombini** Variable metric proximal stochastic gradient methods with additional sampling	**Nunzio Dimola** A Neural Preconditioner for the Numerical Solutions of Parametrised PDEs
9:40-10:05 (keynote talk)	**Dr. Andersen Ang** MGProx: A nonsmooth multigrid proximal gradient method with adaptive restriction for strongly convex optimization	**Dr. Stefania Fresca** Latent Dynamics Models
10:05-10:25	**Nicola Rares Franco** Deep orthogonal decomposition: an adaptive basis approach to dimensionality reduction	**Arturo De Marinis** Approximation properties of neural ODEs
10:25-11:00	*Coffee break* and **Poster Session**	
11:00-11:20	**Cristiano Tamborrino** A Deep-QLP Decomposition Algorithm and Applications	**Nicola Farenga** On latent dynamics learning in nonlinear reduced order modeling
11:20-11:40	**Flavia Esposito** Low-rank approximation methods for real data analysis and integration	**Davide Carrara** Implicit Neural Field Reconstruction on Complex Shapes from Scattered Data
11:45-13:00 Aula I	***Round Table*** Plenary Speakers, Pirelli, Planetek, IRCSS Giovanni Paolo II, UMI group representatives *Exploring the interactions between MATHS, ML and AI to address challenges and innovative applications in industry and science*	
13:00-14:15	*Lunch* and **Poster Session**	

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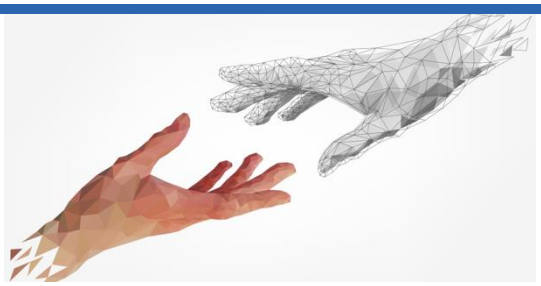

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30 January 2025, h 11:45-13:00
ROUND TABLE
AULA I Department of Mathematics, via E. Orabona 4, Bari

Topic

Exploring the interactions between MATHS, ML and AI to address challenges and innovative applications in industry and science

Moderators:
Anna Maria Candela (Head of the Department of Mathematics, UniBA)
Nicoletta Del Buono (Chair of MATH4AIML)

Speakers
Cristoforo Abbattista (Head of SpaceStream Strategic Business Unit, Planetek Italia S.r.l)
Claudia Angelini (CNR Research Director Istituto per le Applicazioni del Calcolo "Mauro Picone")
Mattia Bolzoni (AI manufacturing data science manager, Pirelli & C. S.p.A)
Sabino Ciavarella (Istituto Tumori "Giovanni Paolo II" IRCCS di Bari)
Tommaso Di Noia (Polytechnic University of Bari)
Yurii Nesterov (Louvain School of Engineering)
Francesca Mazzia (Coordinator PhD Programme in Computer Science and Mathematics, UniBA)
Sandra Pieraccini (UMI Group Mathematics for AI and ML)

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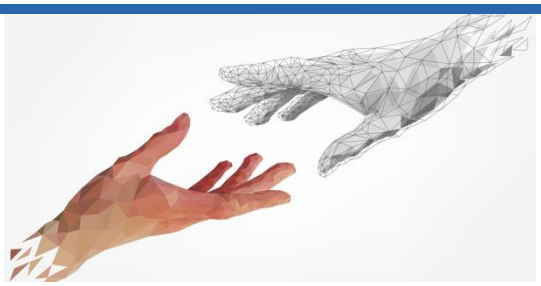

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Aula I & Aula VI, Department of Mathematics, via E. Orabona 4, Bari

	Aula I	Aula VI
14:15-14:35	**Filippo Camellini** Majorization-Minimization for multiclass classification in a big data scenario	**Paolo Conti** Multi-fidelity reduced-order surrogate modelling
14:35-14:55	**Cristian Belfiore** An efficient matheuristic for nurse rostering problems	**Sofia Imperatore** Data-driven parameterization for adaptive spline model reconstruction
14:55-15:15	**Alessandro Scagliotti** Trade-off Invariance Principle for regularized functionals	**Giovanni Pagano** Step-by-Step Time-Discrete Physics Informed Neural Networks for PDEs models
15:15-15:35	**Ben William Gerriety Cullen** GANs through the Lens of Topological Data Analysis	**Luca San Mauro** On the complexity of infinite argumentation
15:35-16:00	*Coffee break* and **Poster Session**	
16:00-16:25 (keynote talk)	**Dr. Cesare Molinari** Stochastic (but structured) zeroth order optimization	**Dr. Alessandro Gianola** Formal Analysis of Data-Aware Processes via Symbolic AI
16:25-16:45	**Antonioreneè Barletta** Exploring Deep Learning in Seismology for Early Warning systems	**Andrea Alessandrelli** Networks of neural networks: disentanglement of overlapping inputs
16:45-17:05	**Vittorio Bauduin** Simulations of Water Distribution Systems via Radial Basis Function Networks	**Simone Brivio** Mitigating the adverse effects of data scarcity through pre-trained physics-informed DL-ROMs
17:05-17:25	**Giulia Lombardi** Hexagonal Grid-Based Reinforcement Learning Environments for Marine Biodiversity Monitoring	**Alberto Fachechi** A random matrix approach to Hopfield-like neural networks: addressing generalization and overfitting
17:25-17:45	**Nicolò Taggio - Planetek s.r.l** Data, Math, and Machine Learning: Revolutionizing Earth Observation Technologies	**Francesco Della Santa** Learning Variably Scaled Kernels and Scaling Functions via Discontinuous Neural Network
17:45-18:05	**Mattia Beretta – Pirelli S.p.A** Pirelli pratical development of LLM application for risk prevention on the workplace	**Simmaco Di Lillo** Spectral Complexity of Deep Neural Networks

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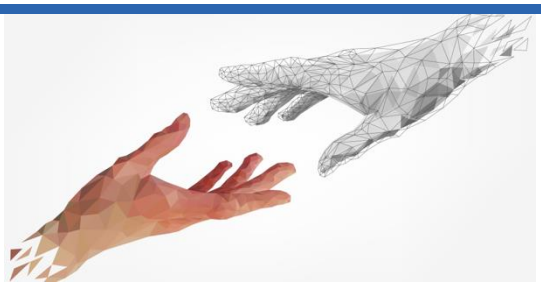

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8:30-9:00	*Registration*	
	Aula I	**Aula VI**
9:00-9:20	**Edoardo Centofanti** Operator Learning Techniques in Computational Cardiology	**Anderson Melchor Hernandez** Convergence of quantum neural networks at infinite width
9:20-9:40	**Ivan Cucchi** Integrating Molecular Dynamics and Machine Learning Algorithms to Predict the Functional Profile of Kinase Ligands	**Davide Pastorello** Training a quantum GAN with classical data
9:40-10:40 **Plenary Talk (Aula I)**	**Dr. Claudia Angelini** From single omics dataset to multi-omics and multi-datasets integration through a statistical learning perspective and beyond	
10:40-11:10	*Coffee break* and **Poster Session**	
11:10-11:30	**Marta Menci** An all-around perspective on hybrid coupled models and parameter calibration for collective cell dynamics	**Domenico Pomarico** Grokking as an entanglement transition in tensor network machine learning
11:30-11:50	**Davide Duma** Optimizing patient admission in the emergency department with machine learning-based survival models	**Vincenzo Schiano di Cola** Quantum Optimization in Environmental Resource Management: A Focus on Irrigation Scheduling
11:50-12:15 (Keynote Talk)	**Dr. Aikaterina Papagiannoulli** Bures-Wasserstein gradient-based learning of covariance operators in Gaussian processes	**Dr. Stefano Coniglio** Graph and Hypergraph Learning via Complex- and Quaternion-Valued Spectral Convolutional Operator
12:15-12:35	**Linda Albanese** Boolean SK model	**Stefania Ferrisi** Mathematical Transformations and Deep Learning Methodologies to enhance Tool Wear Monitoring using Audio Data
12:35-12:55	**Alessia Benevento** Semi-Supervised Learning for Time Series Clustering Using Copulas	**Samira Iscaro** A new mathematical model to analyze the spread of misinformation on Social Media
12:55-14:20	*Lunch* and **Poster Session**	

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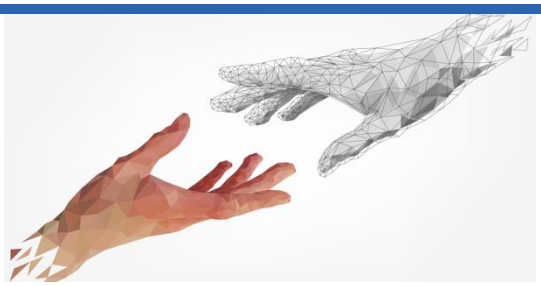

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	Aula I	Aula VI
14:20-14:40	**Giacomo Lancia** Constructing Interpretable Prediction Models with Semi-Orthogonal 1D DNNs: An Example in Irregular ECG Classification	**Giovanni Bocchi** Graph distinction through GENEOs and Permutants
14:40-15:00	**Maria Grazia Quarta** A CNN-LSTM approach for parameter estimation for lithium metal battery cycling model	**Bharath Krishnan Girishkumar** Penalized Maximum Likelihood and Loss Minimization for Classification
15:00-15:20	**Marc Hirschvogel** Learning Passive Left Ventricular Mechanics via Shape Encoding Neural Networks	**Dhruv Singhvi** A Framework Combining Machine Learning and Statistical
15:20-15:40 (Aula I)	***Closure of works***	

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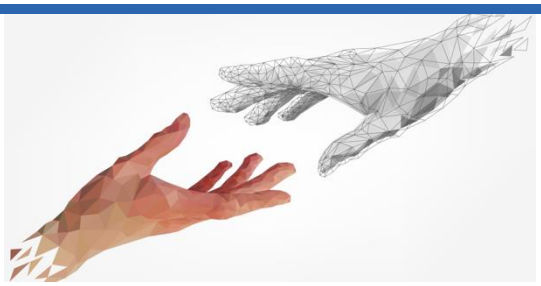

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List of Posters
Sala Lettura, Department of Mathematics, via E. Orabona 4, Bari

Carlo Abate MaxCutPool: Differentiable Feature-Aware MAXCUT for Pooling in Graph Neural Networks	**Grazia Gargano** A Low-Rank Multi-Factor Approach to Identify Differentially Expressed Genes Transcriptome Data
Sara Cambiaghi Distributional forecast approaches to stochastic optimization in healthcare appointment scheduling	**Letizia Lorusso** Analysis of Decision-Making Styles and Personality Traits in Women Undergoing Voluntary Termination of Pregnancy: A Bayesian Network Approach Using bnstruct
Anna Livia Croella Anticlustering for Large Scale Clustering	**Maura Mecchi** COSMONET 2.0: An R Package for Survival Analysis Using Screening-Network Methods
Serena Grazia De Benedictis ROI Image Identification via Topological Data Analysis: A Case Study of Brain Tumor MRI	**Giuseppina Monteverde** Efficiency-driven 3D CNN architectures for hyperspectral classification
Roberta De Fazio Inferring Failure Processes via Causality Analysis: from Event Logs to Predictive Fault Trees	**Laura Selicato** Bi-level algorithm for optimizing hyperparameters in penalized NMF
Anna De Magistris A line-search based SGD algorithm with Adaptive Importance Sampling	**Alessandra Serianni** Hybrid knowledge and data-driven approaches for Diffuse Optical Tomography reconstruction
Bernardo Forni Adapting SAM2 for Few-Shot Multi-Class Semantic Segmentation	**Gaetano Settembre** Spatial Informed Hierarchical Clustering for Hyperspectral Imagery via Total Variation
Caterina Gallegati GANs through the Lens of Topological Data Analysis	**Paolo Sorino** Empowering Clinicians with Explainable AI: Predicting Mortality Risk in MAFLD with Counter-factual Analysis
Daniela Gallo CAP: Copyright Audit via Prompt generation	

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