

The Seminars on “Information Technology Outlook” - PhD Program in Computer Science and Mathematics



Prof. Alda Kika

Head of the Department of Informatics
University of Tirana

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Sala Consiglio 7° floor
Dept. of Computer Science

Graph Neural Networks: Foundations, Architectures, and Applications in Complex Systems

Complex systems are defined by large scale networks of interconnected entities whose relationships evolve dynamically and often follow non linear patterns. Graph based learning is an important area of research for understanding complex systems. In many real world domains, entities do not exist in isolation but are linked through relationships that evolve over time and often display complex, non linear interactions. Graph Neural Networks (GNN) have emerged as an effective approach for modeling such data, combining structural information with feature based learning to capture patterns that are often difficult to identify using conventional machine learning methods.

The fundamental principles and key architectures of GNN will be presented, with particular emphasis on their application to complex systems. Applications will be illustrated through examples from recent studies in social network analysis, and prediction in healthcare. Case studies, including the analysis of COVID-19 vaccine-related tweets on Twitter (now X) and clinical outcome prediction models, illustrate the potential of GNNs to uncover meaningful relational patterns and support informed, explainable, and data driven decision making across disciplines.

Alda Kika is a Full Professor and Head of the Department of Informatics at the Faculty of Natural Sciences, University of Tirana, Albania, where she has been teaching and conducting research since 2001. She also leads the “Interactive Information Systems” research group and previously served as Vice Dean for pedagogical-scientific qualification and PhD studies. Prof. Kika obtained her PhD in Computer Science from the University of Tirana in 2011 and was a Fulbright Visiting Scholar at George Mason University, USA, conducting research in Human-Computer Interaction. Her research interests include artificial intelligence, digital health, human-computer interaction, graph neural networks, intelligent information systems, IoT, e-learning technologies, and AI applications in healthcare. She has authored numerous international scientific publications and has coordinated and participated in several interdisciplinary and international research projects related to AI, healthcare informatics, and digital transformation.