

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



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From Digital Twins to Generative Digital Twins: Towards a Novel Approach in the IoT Edge-Cloud Continuum

Digital Twins (DTs) are software replicas that not only mirrors physical entities but can also proactively predict, control, optimize and simulate their behavior. Born in the manufacturing sector, this concept after an initial hype stayed untouched for decades. The rise of Internet of Things (IoT) and Artificial Intelligence (AI) enabled DT, respectively, to exchange real-world data and to fully exploit it for fulfilling its own goals. Very recently, Generative AI (Gen-AI) methods started being sporadically applied to DT in different contexts and with different targets. In this talk, starting from our experiences on design, implementation and evaluation of DTs and, more recently, of Opportunistic DTs, we first provide a definition for the Generative DT (GDT) which embraces main distinctive aspects and potential of current and future Gen-AI-aided DTs. In particular, we disclose the role of Gen-AI in conciliating the model- and the data-driven approach for the development of DTs. Then, we analyze the added value of main Gen-AI architectures for maximizing the performance of DTs operating in the IoT domain and deployed in the edge-cloud continuum. Finally, we illustrate the potential of a GDT in emblematic Smart City scenarios through a use case involving the prediction of vehicles' trajectories when, due to uncontrolled events, only partial information is accessible. The outlined solution conciliates accuracy and explainability in the trajectory prediction with overall system robustness and effectiveness.

Giancarlo Fortino is Full Professor of Computer Engineering at the Dept of Informatics, Modeling, Electronics, and Systems of the University of Calabria (Unical), Italy. He received a PhD in Computer Engineering from Unical in 2000. Since 2016, he is senior research fellow at the Italian ICAR-CNR Institute. Fortino is also distinguished professor and scientist of several chinese universities and research centers. Fortino is currently the scientific responsible of the UNICAL Digital Health group of the Italian CINI National Laboratory and of IEEE at Unical initiative. He is Highly Cited Researcher 2020-2024 in Computer Science by Clarivate. His research interests include wearable computing systems, e-Health, Internet of Things, agent-based computing, and, more recently, generative AI in Education. He is cofounder and CEO of SenSysCal S.r.l., a Unical spinoff focused on innovative IoT systems, and recently cofounder and vice-CEO of the spin-off Bigtech S.r.l, focused on big data, AI and IoT technologies.