CS PhD Seminar Series

June 17th | 14:30-15:30 | Room 214

A Runtime Verification Approach for Safe PLC Systems

Programmable Logic Controllers (PLCs) are widely used in industrial automation where safety is critical. Static verification techniques often fall short in industrial contexts due to complexity, limited observability, and integration barriers. In this seminar, I will present a runtime verification approach for monitoring Program Organisation Units (POUs) in PLC systems. Our approach synthesises C-based monitors that are tightly integrated into the PLC development environment and runtime, enabling real-time safety enforcement without disrupting scan-cycle execution. We demonstrate how this architecture supports safety property enforcement at the POU level and discuss practical integration into industrial PLC programming workflows.

Speaker: Hisham Unniyankal

Hisham Unniyankal is a second-year PhD student in Computer Science at the University of Genoa, supervised by Prof. Davide Ancona, Prof. Angelo Ferrando, and Fabio Parodi. His research focuses on runtime verification for safety-critical Programmable Logic Controller (PLC) systems within an industrial PhD program in collaboration with Technoleader Srl and COBO S.p.a. He holds a master's degree in computer science specializing in Artificial Intelligence and Data Science from the University of Genoa. Previously, he earned a bachelor's and a master's degrees in computer applications from the University of Calicut and Anna University, respectively. He also has professional experience as a software engineer in big data systems. His academic interests span foundational computer science, artificial intelligence, formal verification, and their integration into reliable industrial automation systems.

Evaluate the Accuracy of Monocular 3D Pose Estimation for Gait Analysis

Human gait analysis is essential for diagnosing and monitoring neuromuscular and musculoskeletal conditions. While traditional marker-based optical motion capture systems provide accurate biomechanical measurements, their high cost, complexity, and dependence on controlled lab environments limit accessibility. This study evaluates the accuracy of monocular 3D pose estimation using MediaPipe—a lightweight, single-camera solution—by comparing it against AdaFuse, a multi-view fusion method serving as the gold standard. Gait data were collected from 16 participants across three camera viewpoints, and joint kinematics (hip, knee, and ankle angles) were computed using OpenSim. Results show that monocular estimation exhibits promising performance, particularly in frontal views, but still lags behind multi-view methods in accuracy. These findings support the feasibility of monocular 3D pose estimation for scalable gait analysis and motivate future improvements using biomechanically informed models such as SMPL and HybrIK. Ultimately, this work bridges clinical needs with AI-driven, low-cost motion analysis technologies for real-world healthcare and rehabilitation applications.

Speaker: Xiaolin Xing

Xiaolin Xing is a Ph.D. second-year student in Computer Science at the University of Genoa. She received her B.S. degree in Internet of Things from the School of Information Engineering, Soochow University, China, and her M.S. degree in Data Science from the University of Aberdeen, Scotland, United Kingdom. In 2023. Her research focuses on human motion analysis through monocular 3D pose estimation, with a particular interest in evaluating the accuracy of monocular 3D pose estimation for gait analysis. Her broader research interests include 2D/3D human pose estimation, 3D pose reconstruction, and machine learning. She is currently working at the MaLGa Laboratory under the supervision of Prof. Francesca Odone and Prof. Matteo Moro.