

COMPUTER AND CONTROL ENGINEERING

MUR DM 117/Stellantis - ML4VECA: Machine Learning for in-VEhicle Context Awareness

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Context of the research activity	<p>Innovative machine learning solutions are needed to enable new mobility applications by enriching vehicles with cognitive capabilities to make contextual decisions tailored to users' needs.</p> <p>The research challenge is to characterize relevant vehicle contexts through a multimodal sensing approach (onboard sensors, environmental data, offboard information, user profile data, and external and internal vehicle context) to provide data-driven, personalized, and safe services to drivers and passengers.</p> <p>Progetto finanziato nell'ambito del PNRR - MUR DM 117/2023 - CUP E14D23002000004</p>
Objectives	<p>This study will use machine learning to study innovative data analysis services for in-vehicle context awareness. Several but strongly interrelated research objectives (RO) should be pursued to achieve this goal.</p> <p>RO1. Automatically process raw data collected from an in-vehicle or fleet with information describing the external environment to augment cognitive capabilities of vehicles in support of contextual decision making, i.e.:</p> <ul style="list-style-type: none">++ RO1a. How can novel data fusion techniques be defined to provide a global view of vehicles?++ RO1b. How to model automotive contexts using a multimodal sensing approach (on-board sensors, environmental data, off-board information, user profile data, etc.) to provide relevant content and functionality to the driver and passengers.++ RO1c. Whether machine learning algorithms can overcome data cleaning issues and provide opportunistic and specific results to support in-vehicle context-aware applications++ RO1d. To what extent are in-vehicle data collections suitable for learning pre-trained models that can be conveniently tuned to specific tasks (e.g., context modeling and categorization, predictive maintenance based on

vehicle activities and driving situations).
RO2. Improve learning capabilities by leveraging end-user feedback.
RO3. Study a conversational interface to explore the capabilities of proposed machine learning tools for in-vehicle context awareness and user feedback.
RO4. Benchmark and evaluate the proposed system with different vehicles/fleets.
The above objectives open a broad multidisciplinary research landscape that touches on core aspects of machine learning research for Industry 4.0 applications and the automotive sector. The study will advance the application of a machine learning methodology for processing raw input text, categorizing application context, modeling vehicle contexts, and supporting decision-making.
A further focus is continuously learning from user feedback and interactions to improve the system's adaptability using new data to enhance the ability of the proposed data-driven approach to improve overall performance.

Skills and competencies for the development of the activity

Strong background in data science and deep learning.