Contribution ID: **20** Type: **Demonstration/Tutorial (30 mins)**

A Reference Architecture for Data Analytics for Autonomous Systems

Thursday, 22 June 2023 13:00 (20 minutes)

In this demonstration we would like to present the improvements to our data analytics platform for autonomous systems [5]. It is a scalable, cloud-agnostic and fault-tolerant data analytics platform we built using open-source components composed as reusable building blocks [3]. It is used as a reference architecture in different research projects such as DIGITbrain [1] and within the National Laboratory for Autonomous Systems [2] (abbreviated as ARNL in Hungarian) and within the TKP2021-NVA-01 project in Hungary focusing on hydrogen-powered, cooperative and autonomous remote sensing devices and connected data processing framework research. The main use cases of our reference architecture include the areas of smart/autonomous production systems (collaborative robotic assembly) and autonomous vehicles (mobile robots with smart vehicle control). The improved capabilities of the platform include among others: (a) support for native Robot Operating System (ROS) based, Internet-of-Things (IoT) based and generic time-series (Apache Kafka) based data collection; (b) a native cloud-agnostic software container-based architecture; and (c) support for open science research data via uploading and sharing datasets via ELKH ARP [4].

Furthermore, we would like to demonstrate the capabilities of our reference architecture via a use case from ARNL: hardware-in-loop smart vehicle control [6]. This use case provides a hierarchical control for automated vehicles with which their safe and efficient motion in roundabouts can be guaranteed. The control hierarchy contains vehicle level and cloud level. The goal of the cloud level is to achieve enhanced control performances using the high computation capacity of the cloud. Thus, reinforcement learning on the cloud level for achieving maximum speed of the vehicles is implemented. Moreover, on the vehicle level the safety requirement, i.e., collision avoidance, is guaranteed. The advantage of the solution is that safe performance specifications even at the degradation of the communication in the network can be guaranteed. Significant novel content of this work is the implementation of the method using indoor test vehicle environment with cloud connection. [5]

Our demonstration will focus on (i) the custom use case and platform components, (ii) the data collection from the indoor test vehicle environment with smart vehicle control and (iii) the visualization capabilities of the platform at the different stages of the data collection and processing.

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Other key topic

Key Topic

Data analytics platforms and reproducible open science

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