TEACHING NEWSLETTER

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TEACHING is an EU-funded project that designs a computing platform and the associated software toolkit supporting the development and deployment of autonomous, adaptive, and dependable CPSoS applications, allowing them to exploit sustainable human feedback to drive, optimize and personalize the provisioning of their services.

This issue provides a grasp of the main project developments during November 2021 – February 2022. It also provides facts on the results achieved, as well as links to the latest dissemination activities.

During the reference project period TEACHING has progressed considerably by implementing a version of the TEACHING platform with core functionalities (MS4) and showcasing its operation in a demo scenario. We are very pleased to register this progress which gives credit to hard work of the TEACHING partners and provides motivation for reaching the next milestones. We are going to demonstrate these results during the upcoming b2b Interim Technical Consortium Meeting to be held in mid-March 2022.

TEACHING HIGHLIGHTS M23 – M26

WHAT HAS BEEN DONE?

WP1

During the reference period the work in WP1 was focused on the following fronts: (a) understanding the requirements of the TEACHING Platform; (b) providing its design and implementation specifications; (c) implementing a version of it; (d) showcasing the operation of the TEACHING Platform in a demo scenario; and (e) optimizing the platform to support more use case scenarios. Among the challenges that were faced, was the integration of the work from WP2-4, either in the form of software components or in the form of concepts and processes. To this end, the work included a formal integration meeting that was conducted online and numerous ad-hoc meetings, often bilateral. The outcome was a version of the TEACHING Platform and a demo scenario implementation. These are now used as a baseline for further developments to support more use case scenarios as well as tests to validate the satisfaction of the requirements considered originally.

WP2

In the scope of WP2, the tools for supporting offloading of computationally demanding streaming computations on integrated GPUs are available and ready-to-be used by the rest of the project Tasks/WPs. The activities of T2.2 are going in the direction to refine the developed tools by introducing further performance and usability optimizations during the most intensive experimental activities that will be conducted in the next

months. The tools for stream analysis (T2.3) are going to be usable for the rest of the project with a clear API and stable performances. Task 2.4 has developed the high-level communication and computing architecture and is testing the same with a relevant application scenario that is Federated Learning. T2.6 is contributing to the definition and implementation of the deployment mechanisms for the TEACHING platform. The evaluation and analysis of existing technologies for universal deployment of services in distributed platforms (Cloud-based nodes, near-Edge ones and far-Edge, mobile ones), for orchestration and management of AI powered applications is periodically updated according to new implementation and integration issues. Current status of the research is summarized in D2.2. Task 2.7 ensured the integrability and partners worked in close collaboration with WP4 to integrate the hardware accelerators into the Teaching platform.

In the fourth reporting period, WP3 continued to work on dependability engineering approaches for AI-based and mission critical systems. The remaining three running tasks are therefore focusing on different viewpoint towards covering dependable development. In this manner, the three tasks run in parallel and approach the topic of (a) dependability for AI-based systems and (b) dependability for adaptive systems. To continue progressing with these contradicting concepts the task ran individual online workshops and activities for exchange; while their alignment was ensured by monthly WP3 calls and exchange of activity progress. Task 3.3 covered the viewpoint of ensuring dependability measures for AI-based systems. In this manner cybersecurity engineering approaches as well as safety approaches for AI-based systems have been elaborated and discussed with WP leaders, TEACHING partners, and wider audience. Task 3.4 covered the viewpoint of ensuring dependability measures via AI-based systems. In this manner mainly the consideration of AI-systems for ensuring cybersecurity concepts have been elaborated and discussed. Task 3.5 covered the viewpoint of ensuring dependability measures for cloud-based and runtime adaptive systems, not necessarily only AI-based systems. To that aim, runtime adaptation and cloud service integration approaches in the context of mission critical systems has been focused. Partners engaged in the activities of other WPs and cross-fertilized the activities of the related tasks.

The main WP4 effort has been directed to the design, development and subsequent integration of the AIaaS software system at the level of mockup. To this aim, the work in the individual tasks has been organized and monitored by means of (mostly) weekly-based online meetings, with a specific focus on Task 4.1, which played a key role in this phase of technology building. T4.1 mainly focused on two tracks, namely the development of the key scientifical challenges in the design of the AI toolkit (the core AI component of the AIaaS), and the development of the AI-Toolkit API, integrated mock-up, applications scenarios definition, evaluation tests, demonstrators as well as the integration of T4.2, T4.3, and T4.4 developed components. Task 4.2 efforts were placed to the realization of MS2 objectives, in particular by contributing to both the integration meeting in July 2021 (M19), as well as the realization of the demo for the review meeting in October 2021 (M22), which showcased the functionalities of the Human State Monitoring modules. Concerning the avionics UC, a model for performing on-device anomaly detection on hardware data was successfully developed and evaluated, and a further evaluation on real data provided by the METRICS application is planned. Further advancements on the automotive use case delayed due to the limitations from the COVID-19 pandemic. In parallel, activities for performing

detection of cybersecurity attacks on autonomous vehicles are in progress. The planned work for the following semester consists in assessing the current modules on real data from both the use cases and refining the integration on the available SoC boards. The Reinforcement-Learning (RL) learning module (LM) has been modified to better fit users' feedback, and the research results have been presented in a published conference paper. Within T4.4 the basic learning modules have been defined: training with differential privacy, anomaly detection for cybersecurity, and RNN robustness via POPQORN. They currently have implementations ready to be integrated in the AIaaS toolkit in the next semester and are already present in the AIaaS as mockups (MS2 and D4.2). Finally, the experimental assessment of RNN with differential privacy will help in the next steps of the project.

WP5 activities focused on the design and specification of the Avionics and Autonomous Driving use-cases by tailoring the core AI technologies of the AIaaS system to their development. UNIPI focused on the design and implementation of secure and privacy-aware methodologies for continual federated learning on streams on non-stationary physiological data for human state monitoring. Scientific advances in this direction have been contextualized within the development of the AIaaS system mockup / API design and a live demonstration in the context of autonomous driving. TUG integrated into WP5 concepts from WP3 that have been applied for the analysis and implementation of the TEACHING automotive UC. Specific WP3 outcomes have been tailored for the application on the TEACHING platform. Also concepts for security and safety engineering have been adapted and applied to the TEACHING UC. Marelli contributed by implementing the concepts developed in WP3 about the safety and cybersecurity of the use case, starting with the definition of a method for assess the safety of the automotive UC, based on the standard ISO 26262 and ISO 21488 integrated. HUA contributed to the specification of the technology bricks especially those linked to devOps and cloud/edge computing and in bridging the WP5 work with WP1. ITML has been working on improving the generalization of the technology bricks used in the Anomaly Detection Learning Module to broaden its scope in terms of the applicability to different datasets and application scenarios. I&M works have been carried out on two sides. The first one regards the integration of the HW platform with the driving simulator and avionic software. For the automotive application, tracing points have been added to check the timing dependability of execution and having a baseline for the optimization. On the other hand, the SW developed from other WP is being integrated with the platform, in collaboration with the other partners.

TEACHING Dissemination and Communication

TEACHING partners have intensively disseminated the project results by participating in online events sharing and raising awareness not only about the project's objectives and scope but also presenting some tangible results and achievements. TEACHING partners have expanded the project visibility via submitting several scientific articles in high-ranked academic journals and conference proceedings ensuring the long-lasting scientific impact beyond project duration. TEACHING internal workshops have been organized aiming at sharing knowledge and expertise among the project partners. In this regard, ITML participated in EFECS 2021 online event sharing project's results and outcomes so far and networking with relevant projects. AVL participated in online EARPA FORM Forum 2021 while also presented TEACHING on online Data Science Conference 2021 highlighting "Dependable autonomous driving" with a focus on Leveraging humanistic intelligence to optimize services". UNIPI, participated in online APREcon 2021 event and in the 29th European Symposium on Artificial Neural Networks (ESANN 2021) with a

relevant publication. Visibility of the project and transferability of the project outcomes has been promoted through the generation of promotional material (blog post, videos, online podcast sessions) and by regular dissemination to the public through social media channels.

TEACHING Publications

The TEACHING project also had an active performance via journal and conference paper publication by presenting the research work carried out in the frame of the project. The list of the presented articles produced in the reference project period is shown below:

Philipp Clement, Omar Veledar, Clemens Könczöl, Herbert Danzinger, Markus Posch, Arno Eichberger and Georg Macher "Enhancing Acceptance and Trust in Automated Driving through Virtual Experience on a Driving Simulator", MDPI, 2022

Davide Bacciu, Patrizio Dazzi and Alberto Gotta “Supporting Privacy Preservation by Distributed and Federated Learning on the Edge”, ERCIM News, No 127, 2021

ESANN 2021

A. Cossu, D. Bacciu, A. Carta, C. Gallicchio, V. Lomonaco, "Continual Learning with Echo State Networks"

TEACHING Consortium

Key Facts

Project Coordinator: Dr. Davide Bacciu
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Start: 1-1-2020
Duration: 36 months
Participating organisations: 10
Number of countries: 5

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