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NEWSLETTER 11/2023

TALON PROJECT

TALON

Autonomous and self-organised artificial intelligent orchestrator for a greener industry 5.0

talon-project.eu

EDITORIAL

This newsletter presents a summary of the primary dissemination outcomes of the project, which include journal and conference publications, as well as organization of events. Specifically, one (1) deliverables were published and two (2) conference papers and two (2) journal papers were successfully accepted for publication.

Stylianos Trevlakis, InnoCube

DELIVERABLE PUBLISHED: “D3.1 - ARCHITECTURE & PLATFORM DESIGN BLUEPRINT”

Executive summary: The "Architecture & Platform Design Blueprint" details the core concept of TALON, an industry-defining project set to transform Industry 4.0/5.0. This deliverable highlights our commitment to innovative technologies, orchestration, and sustainability.

The document explores the conceptual architecture behind TALON's objectives, focusing on two pivotal planes: the Data Plane and the Control Plane. Our architecture coordinates compute, communication, AI models and data for improved performance and resource efficiency. This work aims to utilise AI for improving the energy efficiency of networks, addressing the crucial requirement for environmentally friendly AI networks as our planet experiences rapid climate change.

An essential element of our architectural design is the incorporation of the stakeholder requirements from previous assignments, as demonstrated by the Requirements Traceability Matrix. Every component described here sets the stage for the realization of a fully integrated and impactful TALON ecosystem.

You can find more information about this deliverable here.

PAPER PUBLISHED: "LOCALIZATION AS A KEY ENABLER OF 6G WIRELESS SYSTEMS: A COMPREHENSIVE SURVEY AND AN OUTLOOK"

When fully implemented, sixth generation (6G) wireless systems will constitute intelligent wireless networks that enable not only ubiquitous communication but also high-accuracy localization services. They will be the driving force behind this transformation by introducing a new set of characteristics and service capabilities in which location will coexist with communication while sharing available resources. To that purpose, this survey investigates the envisioned applications and use cases of localization in future 6G wireless systems, while analyzing the impact of the major technology enablers. Afterwards, system models for millimeter wave, terahertz and visible light positioning that take into account both line-of-sight (LOS) and non-LOS channels are presented, while localization key performance indicators are revisited alongside mathematical definitions. Moreover, a detailed review of the state of the art conventional and learning-based localization techniques is conducted. Furthermore, the localization problem is formulated, the wireless system design is considered and the optimization of both is investigated. Finally, insights that arise from the presented analysis are summarized and used to highlight the most important future directions for localization in 6G wireless systems.

You can find more information about this paper here.

You can refer to the paper as: "S. Trevlakis, A.-A. A. Boulogeorgos, D. Pliatsios, J. Querol, K. Ntontin, P. Sarigiannidis, S. Chatzinotas, and M. D. Renzo, "Localization as a key enabler of 6G Wireless Systems: A comprehensive survey and an outlook," in IEEE Open Journal of the Communications Society, Oct. 2023."

PAPER PUBLISHED: "TASK ALLOCATION METHODS AND OPTIMIZATION TECHNIQUES IN EDGE COMPUTING: A SYSTEMATIC REVIEW OF THE LITERATURE"

Task allocation in edge computing refers to the process of distributing tasks among the various nodes in an edge computing network. The main challenges in task allocation include determining the optimal location for each task based on the requirements such as processing power, storage, and network bandwidth, and adapting to the dynamic nature of the network. Different approaches for task allocation include centralized, decentralized, hybrid, and machine learning algorithms. Each approach has its strengths and weaknesses and the choice of approach will depend on the specific requirements of the application. In more detail, the selection of the most optimal task allocation methods depends on the edge computing architecture and configuration type, like mobile edge computing (MEC), cloud-edge, fog computing, peer-to-peer edge computing, etc. Thus, task allocation in edge computing is a complex, diverse, and challenging problem that requires a balance of trade-offs between multiple conflicting objectives such as energy efficiency, data privacy, security, latency, and quality of service (QoS). Recently, an increased number of research studies have emerged regarding the performance evaluation and optimization of task allocation on edge devices. While several survey articles have described the current state-of-the-art task allocation methods, this work focuses on comparing and contrasting different task allocation methods, optimization algorithms, as well as the network types that are most frequently used in edge computing systems.

You can find more information about this paper here.

You can refer to the paper as: "V. Patsias, P. Amanatidis, D. Karampatzakis, T. Lagkas, K. Michalakopoulou, and A. Nikitas, "Task Allocation Methods and Optimization Techniques in Edge Computing: A Systematic Review of the Literature," Future Internet, MDPI, vol. 15, no. 8, p. 254, Jul. 2023."

PAPER PUBLISHED: "CAN GRAPH NEURAL NETWORK-BASED DETECTION MITIGATE THE IMPACT OF HARDWARE IMPERFECTIONS?"

Until recently, researchers used machine learning methods to compensate for hardware imperfections at the symbol level, indicating that optimum radio-frequency transceiver performance is possible. Nevertheless, such approaches neglect the error correcting codes used in wireless networks, which inspires machine learning (ML)-approaches that learn and minimise hardware imperfections at the bit level. In the present work, we evaluate a graph neural network (GNN)-based intelligent detector's in-phase and quadrature imbalance (IQI) mitigation capabilities. We focus on a high-frequency, high-directional wireless system where IQI affects both the transmitter (TX) and the receiver (RX). The TX uses a GNN-based decoder, whilst the RX uses a linear error correcting algorithm. The bit error rate (BER) is computed using appropriate Monte Carlo simulations to quantity performance. Finally, the outcomes are compared to both traditional systems using conventional detectors and wireless systems using belief propagation based detectors. Due to the utilization of graph neural networks, the proposed algorithm is highly scalable with few training parameters and is able to adapt to various code parameters.

You can find more information about this paper here.

You can refer to the paper as: "L. Mitsiou, S. Trevlakis, A. Tsiolas, D. J. Vergados, A. Michalas and A. -A. A. Boulogeorgos, "Can graph neural network-based detection mitigate the impact of hardware imperfections?," 2023 International Balkan Conference on Communications and Networking (BalkanCom), Istanbul, Turkiye, 2023, pp. 1-5."

PAPER PUBLISHED: "COMPARATIVE EVALUATION BETWEEN ACCELERATED RISC-V AND ARM AI INFERENCE MACHINES"

You can find more information about this paper here.

You can refer to the paper as: "V. Christofas, P. Amanatidis, D. Karampatzakis, T. Lagkas, S. K. Goudos, K. E. Psannis, and P. Sarigiannidis, "Comparative Evaluation between Accelerated RISC-V and ARM AI Inference Machines," 6th World Symposium on Communication Engineering (WSCE 2023), Thessaloniki, Greece."

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