Tutorial at ICSOC

Distributed Computing Continuum Systems and AI - Opportunities and Research Challenges

In this tutorial we will discuss the opportunities and open research challenges of distributed computing continuum systems (IoT, Edge, Fog, and Cloud) and the utilization of AI techniques for this field. We will discuss multiple methods and techniques and select a few to present in more detail.

Introduction & Basics (~30min):
- What are Distributed Continuum Computing Systems (DCCS) + Motivation + System's candidate representations and definitions.
- What is Edge Intelligence and how it relates to DCCS + Motivation + AI interpretation (what is AI from our perspective and for the needs of DCCS) and learning opportunities (what can be learnt).
- Transversal example - Ideally we could always follow the same.
- Introduction and overview on candidate technologies/concepts (we need a logical order to present them).

General (or not AI specific) techniques/concepts for DCCS (~1h):
- DeepSLO
- FEP
- Markov Blanket
- Operational Equilibrium
- Elastic Strategies
- Semantic Communication
- Self-Reference

Learning/AI techniques for DCCS (~1h):
- Deep Reinforcement Learning
- Global Workspace Theory
- Graph Knowledge representation
- Active inference
- Distributed learning
- Causal inference
- Generative models
- Frontiers of AI in DCCS

Conclusions (~30min):
- Wrap-up of techniques/concepts, what are they relations (and maybe a taxonomy relating challenges of the DCCS/AI and the mapping to the techniques) - Get back to the example (in case it has not been follow for each technique/concept)
- Research roadmap (what are our priorities and why)

Short Bios:

Victor Casamayor Pujol is a project assistant (Postdoc) in the Distributed Systems Group at TU Wien. In 2020 he obtained his PhD in ICT by Universitat Pompeu Fabra in Barcelona, Spain. He has a master in Intelligent Interactive Systems (MIIS) by UPF in Barcelona, Spain and a specialized master in space systems engineering (TAS-Astro) by ISAE in Toulouse, France. He has also worked in space propulsion at the CNES in Paris, France. His current research interest relates self-adaptive systems and the methodologies for computing continuum systems. Contact him at v.casamayor@dsg.tuwien.ac.at

Praveen Kumar Donta is a University Assistant (Postdoc) at Distributed Systems Group, TU Wien, Austria, since July 2021. He received his Ph. D. at the Indian Institute of Technology (Indian School of Mines), Dhanbad, from the Department of Computer Science and Engineering in June 2021. From July 2019 to Jan 2020, he is a visiting Ph.D. fellow at Mobile & Cloud Lab, Institute of Computer Science, Faculty of Science and Technology, University of Tartu, Estonia, under the Dora plus grant provided by the Archimedes Foundation, Estonia. He received his Master in Technology and Bachelor in Technology from the Department of Computer Science and Engineering at JNTUA, Ananthapuramu, with Distinction in 2014 and 2012. He is a Technical Editor and Guest Editor for Computer Communications, Elsevier. He is a senior member of IEEE (Young professional, Computers Society, Communications Society, Sensors Council, Systems Council, etc.), Professional member of ACM. His current research includes learning-driven Distributed computing continuum systems.

Andrea Morichetta joined the Distributed Systems Group of the Institute of Information Systems Engineering in January 2020, as University assistant. He received his Doctoral degree in Electrical, Electronics and Communications Engineering in January 2020, in Politecnico di Torino in the Telecommunication Network Group. He worked under the supervision of Prof. Marco Mellia, with a grant fully funded by the Big-DAMA project. From 2017 to 2020 he collaborated with the SmartData@PoliTO center for data science and big data. In 2017 he visited, for a summer internship, Cisco in San Jose, CA. From January 2019 to July 2019 he was a visiting student at AIT, in Vienna, Austria. His research focuses on AI for predictive/Proactive scaling in the cloud, Edge intelligence, Serverless Computing and Security for distributed systems.

Schahram Dustdar is Full Professor of Computer Science heading the Research Division of Distributed Systems at the TU Wien, Austria. He holds several honorary positions: Francqui Chair Professor at University of Namur, Belgium (2021-2022), University of California (USC) Los Angeles; Monash University in Melbourne, Macquarie University in Sydney, University Pompeu Fabra, Barcelona, Spain. From Dec 2016 until Jan 2017 he was a Visiting Professor at the University of Sevilla, Spain and from January until June 2017 he was a Visiting Professor at UC Berkeley, USA.

He is founding co-Editor-in-Chief of ACM Transactions on Internet of Things (ACM TIoT) as well as Editor-in-Chief of Computing (Springer). He is an Associate Editor of IEEE Transactions on Services Computing, IEEE Transactions on Cloud Computing, ACM Computing Surveys, ACM Transactions on the Web, and ACM Transactions on Internet Technology, as well as on the editorial board of IEEE Internet Computing and IEEE Computer. Dustdar is recipient of multiple awards: TCI Distinguished Service Award (2021), IEEE TCSVC Outstanding Leadership Award (2018), IEEE TCSC Award for Excellence in Scalable Computing (2019), ACM Distinguished Scientist (2009), ACM Distinguished Speaker (2021), IBM Faculty Award (2012). He is an elected member of the Academia Europaea: The Academy of Europe, where he is chairman of the Informatics Section, as well as an IEEE Fellow (2016), an Asia-Pacific Artificial Intelligence Association (AAIA) President (2021) and Fellow (2021). He is an EAI Fellow (2021) and an I2CICC Fellow (2021). He is a Member of the 2022 IEEE Computer Society Fellow Evaluation Committee (2022).