Algorithms for decentralized Machine Learning Control

The project is developing advanced methods and algorithms for decentralized Machine Learning Control (MLC) for Networked Cyber-Physical Systems, and complex, spatially distributed and networked autonomous multi-agent dynamical systems. The methodological solutions cross the traditional boundaries between (deep) machine learning, control systems (reinforcement learning), and decentralization of functions.

> The mini competition was well organized by OCRE. The whole process lasted about 2 months with 4 offers from leading global cloud service and infrastructure providers.
>
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FIELD OF STUDY
Engineering & Technology

LOCATION
Serbia

OCRE RESOURCES USED
Cloud Services

CHALLENGE

Algorithmic solutions for autonomous drone swarms

The specific focus of the project is to create algorithmic solutions that enable a system of autonomous Micro-Aerial Vehicles (Cooperative Swarm), to safely perform complex tasks in unknown environments using on-board sensors and inter-drone communication. To do this they must automatically perform environmental mapping, localization, path planning, target detection/tracking and flight control.

The possible applications of this technology are many, including prevention and assistance with natural disasters (e.g., floods, earthquakes, wildfires etc.), inspection and maintenance of industrial infrastructure, assistance with search and rescue operations, and tracking the spread of disease. Drone swarms will be able to do these tasks efficiently and accurately faster than humans, with no risk of physical harm to people.

The project requires specialized computing resources to perform complex and computationally heavy processing when dealing with complex CPS including training of the algorithms and the compute heavy simulations of real-life environments.

SOLUTION

OCRE Cloud Adoption Funding for Research

The grant was awarded in December 2020 for cloud vouchers of up to €100,000. The main requirements of the project were virtual machines with both strong CPUs and GPUs (including both visualization and machine learning), as well as machine learning toolsets (deep learning, reinforcement learning). A mini competition was run to find the best supplier under the Framework to fulfill these requirements.

IMPACT

Scalable Commercial Cloud for Research

Having access to commercial cloud resources has huge beneficial impacts for the project such as:

- Access to state-of-the-art technology (e.g., the latest GPU technology and high scale compute technology)
- Agility (flexible experiments without investing significant funds and the ability to pivot to the types of resources optimal for the specific AI applications)
- Speed of implementation (the time savings from not having to acquire, provision, implement and configure the necessary resources)
- IT know-how (the research team can focus more on the scientific applications of the project, without the need for IT experts or training)
- Cost (no investment in the compute infrastructure, which will soon become obsolete)

The project will now efficiently use the obtained cloud resources. The future research and exploitation plans are ambitious and foresee the need for even further cloud resources as the project evolves.