Decide Doctoral School

Introduction and Research outlines

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Who am I?

- **Name**: Mohammad Rahmani
- **Education**:
  - **Bachelor**: Applied Mathematics, Shiraz University
  - **Masters**: Computer science (Expert systems), Tehran Polytechnic

Who am I? Previous experience

Professional experience in

- Data science
- Computer vision
- Deep learning
- Reinforcement learning
- statistical inference

Decision making in Self-aware Single Robot Systems

- **Self-awareness definition**: The capacity that an Intelligent Agent becomes the object of its own attention that is:
  - Contextually placing externally and internally perceived data together by a robot and deduct learning models out of it.

Example Single Robot Systems

- Sample training data $v_{t_1} = 100kmph$, $s_{35^\circ - 20m}$, $v_{t_2} = 60kmph$ (Here the model should learn to increase speed by 40kmph after such a slope)

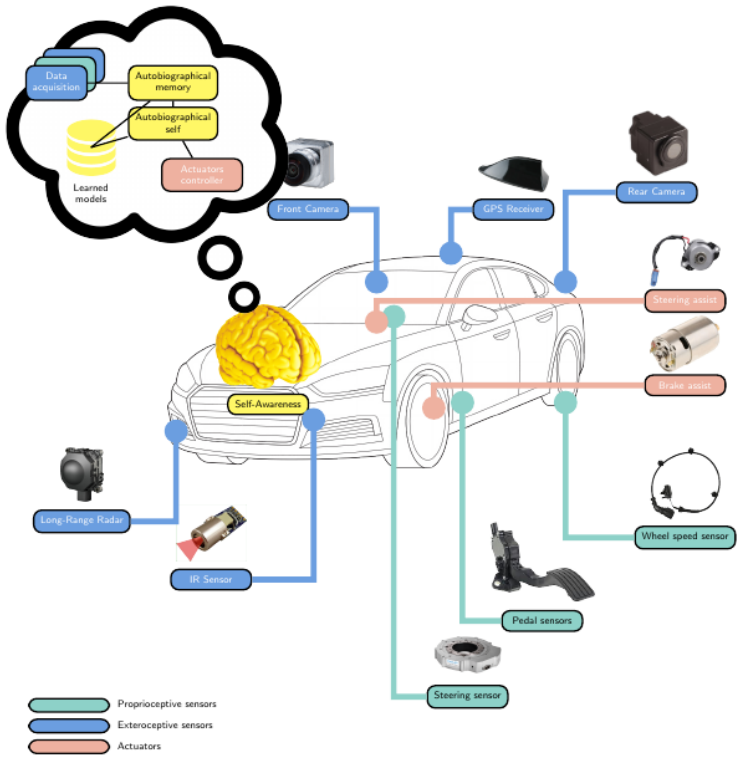

Figure: Ref: Regazzoni, Marcenaro, Campo, Rinner. Multi-sensorial generative and descriptive self-awareness models for autonomous systems. 2020 IEEE

Decision making notion in self-aware systems

- **Decision making in SA systems**: refers to the ability to generate signals that can be employed by the agents control system such that its actions are self-monitored dynamically.
- **Topical literature**:
  - Lewis, Platzner, Rinner, Torresen. Self-aware Computing systems, an engineering approach. 2016. Springer
  - Kounev, Kephart, Milenkoski, Zhu. Self-aware Computing systems. Springer
  - The Proceedings of IEEE on Self-Awareness for Autonomous Systems in July 2020

What we plan to do?

Extending self-aware decision making to MRS:

- Global system state information to control it's decisions has a natural, distributive nature.
- **But** the system can **collectively** use this information to have a **sense** of the best **state** it should take in **future**.

Examples

- **In nature**: Bee and ant colonies. The human immune system
- **In robotics**: The COCORO project in which a group of robots with simple behavioral rules and local interactions may achieve collective awareness of a global state, distributed across the individual units.
- **URL**: http://zool33.uni-graz.at/artlife/cocoro

Even simpler example, our probable start point

- A follower vehicle learns 4 times a trajectory from a leader vehicle by generating models from its speed and steering angle data it receives.
- A pedestrian comes across the normal trajectory. The leading vehicle's camera detects him and stops. The follower detects anomaly in the flow of speed/steering data and stops as well.

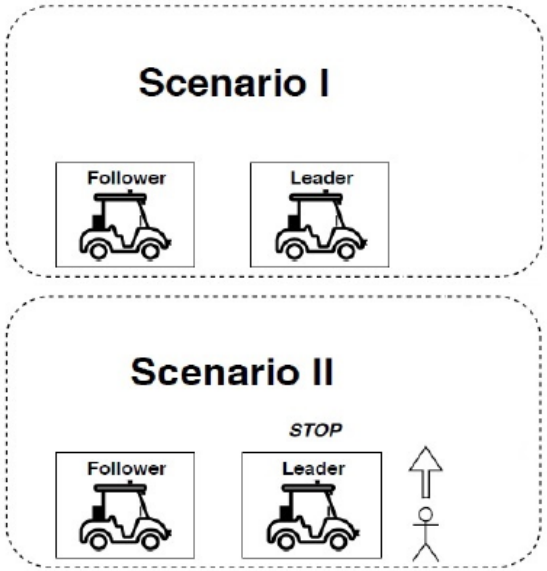

Figure: Ref: Kanapram, Patrone, Plaza, Marchese, Bodanese, Marcenaro, Gomez, Regazzoni. Collective Awareness for Abnormality Detection in Connected Autonomous Vehicles, 2020, IEEE