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PhD Position: Distributed learning on connected devices

1 - Context and funding

This PhD topic is proposed in the context of a collaboration between IMT Atlantique (Brest, France) and The University of Adelaide through IRL CROSSING Lab (Adelaide, Australia). The funding is granted through ANR AI@IMT program (50%) and The University of Adelaide (50%).

2 - Research project

Autonomous systems can benefit from growing embedded computing capacities that allow decision making based on multi-sensor fusion and/or complex visual navigation based on semantic recognition [MOU19] and joint mapping and planning [GUP17]. Current challenges are related to learning issues for both object recognition based on offline training of Deep Neural Networks and navigation tasks based on Reinforcement Learning [KUL19]. First offline supervised learning and online inference are efficient but require huge labelled data-sets that hardly represent all cases to be experienced by autonomous agents in real-life or at a price in energy and time that can be prohibitive [STR20]. Therefore, new training phases with updated data-sets may be required according to edge/cloud computing paradigm [WAN19]. Navigation tasks can be based on pre-trained models but are more efficient if they can learn online from their actions [WOR19] while detecting/identifying obstacles and targets. In both cases, self-adaptivity is required to improve autonomy. The PhD question is then: how to improve learning on a set of distributed embedded systems (e.g. CPU-GPU) by favouring unsupervised methods such as Reinforcement Learning to improve the autonomy of autonomous systems evolving in groups.

3 -Team supervision and PhD registration

The PhD will be supervised by Amer Baghdadi (IMT Atlantique), Damith Ranasinghe (The University of Adelaide) and Jean-Philippe Diguet (CNRS IRL CROSSING). It is a cotutelle, where the candidate will be registered for his PhD in both IMT Atlantique and The University of Adelaide and will work 18 months in each institution.

4 - Candidate profile

The candidate should have a MSc or an engineering degree and confirmed skills in computer science, ideally with a specialization in artificial intelligence and embedded systems.

5 - How to apply

Interested candidates should send an email to the supervisors amer.baghdadi@imt-atlantique.fr / damith.ranasinghe@adelaide.edu.au / jean-philippe.diguet@cnrs.fr with the following:

- Detailed curriculum vitæ, including personal realizations
- Recommendation letters or contacts from former teachers/advisors
- Cover letter stating your motivation and fit for this project
- Full university transcripts

6 – References

[GUP17] S. Gupta, J. Davidson, S. Levine, R. Sukthankar and J. Malik, “Cognitive Mapping and Planning for Visual Navigation”, 2017 IEEE Conf. on Computer Vision and Pattern Recognition (CVPR), Honolulu, USA, 2017.

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[MOU19] A. Mousavian, A. Toshev, M. Fišer, J. Košecká, A. Wahid and J. Davidson, “Visual Representations for Semantic Target Driven Navigation”, Int. Conf. on Robotics and Automation (ICRA), Montreal, Canada, 2019.

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[WAN19] X. Wang, Y. Han, V.C.M. Leung, D. Niyato, X. Yan, X. Chen, “Convergence of Edge Computing and Deep Learning: A Comprehensive Survey”, arXiv:1907.08349

[WOR19] M. Wortsman, K. Ehsani, M. Rastegari, A. Farhadi and R. Mottaghi , “Learning to Learn How to Learn: Self-Adaptive Visual Navigation using Meta-Learning”, CVPR19, arXiv:1812.00971