Research project offer

Location : ISAE SUPAERO, Toulouse, France

Department : Department of Complex Systems Engineering (DISC)

Research group : SD

Supervisor : Dennis Wilson

Email : dennis.wilson@isae-supaero.fr

OFFER DESCRIPTION

Title : Structural Learning in Artificial Neural Networks for Reinforcement Learning

Proposed duration and period : May 1 to Nov 1, 2021

Context	Artificial Neural Networks (ANNs) are behind many recent advances in artificial intelligence, including computer vision, natural language processing, and automatic modelling. The structure of these networks is mostly hand-engineered through expensive processes of trial and error. Recent developments in Neural Architecture Search (NAS) have demonstrated the benefits of network structure optimization, with recent methods learning neural structure during weight training. This internship will study NAS operators for reinforcement learning.

Possibility to continue with a PhD (Yes/No) : Yes

REQUIRED APPLICANT PROFILE AND SKILLS

Study Level	☐ Undergraduate students (3rd or 4th year) ☐ **Master students (2nd year)** ☐ PhD students
Objectives and work	The objective of this project is to study structural learning in the deep reinforcement learning (DRL) domain. DRL presents many challenges compared to supervised learning, where NAS has largely been studied; these challenges include complex training schedules, shifting data distributions, and multi-network algorithms. Recent work has approached these issues, such as in RL-DARTS [1], but many problems remain open. In this internship, the student will study structural learning operators in ANNs in the DRL domain. NAS methods which include neurogenesis and neuron removal such as NeST [2] will be considered, with a focus on the conditions for these operators. The intern will join a team with PhD students currently working on NAS and DRL. [1] Miao, Yingjie, et al. "RL-DARTS: Differentiable Architecture Search for Reinforcement Learning." *arXiv preprint arXiv:2106.02229* (2021). [2] Dai, Xiaoliang, Hongxu Yin, and Niraj K. Jha. "NeST: A neural network synthesis tool based on a grow-and-prune paradigm." *IEEE Transactions on Computers* 68.10 (2019): 1487-1497.
Required profile and skills	Experience in deep learning is required. Experience in reinforcement learning is recommended, and experience in the Julia programming language is a plus.
Other useful information	