Research project offer

Location : ISAE SUPAERO, Toulouse, France **Department** : Department of Complex Systems Engineering (DISC) **Research group** : SD **Supervisor** : Dennis Wilson, Emmanuel Rachelson **Email** : dennis.wilson@isae-supaero.fr	
OFFER DESCRIPTION	
Title : Evolutionary Strategies for Policy Search using Neural Networks **Proposed duration and period** : May 1 to Nov 1, 2021	
Context	Evolutionary strategies (ES) have long been applied to continuous optimization problems but have recently found a new application in Artificial Neural Network (ANN) optimization, especially for policy search where the ANN is used in a sequential decision task. While neuroevolution with ES is competitive with deep reinforcement learning (DRL) on modern benchmarks such as Atari games, many open questions remain. In this project, the intern will explore improvements to neuroevolution for policy search.
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	Recent studies have demonstrated that even simple evolutionary strategies are competitive with contemporary DRL methods on the Atari benchmark [1]. However, there are many existing improvements to evolutionary strategies which are difficult to apply to neuroevolution due to the dimensionality of large ANNs, such as covariance matrix gradient estimates. Indirect encodings such as GENE [2] enable these costly estimates; the full possibilities of these encodings merits further study. In this project, the student will study improvements to recent neuroevolution methods using an in-house codebase and contemporary benchmark tasks. The student will join a team working on DRL, evolution, and specifically neuroevolution. [1] Chrabaszcz, P., I. Loshchilov, F. Hutter. "Back to basics: benchmarking canonical evolution strategies for playing Atari." *IJCAI* 2018. [2] Templier, Paul, Emmanuel Rachelson, and Dennis G. Wilson. "A geometric encoding for neural network evolution." *GECCO*, 2021.
Required profile and skills	Experience with deep learning, evolutionary algorithms, and the Python programming language are all highly recommended.
Other useful information	