

Paul Templier

PhD, Engineer

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- [Google Scholar](#)
- [Resume PDF](#)

Languages

- French (Native)
- English (Certificate of Proficiency - C2)
- Spanish (Independant - B2)

Coding

- Python (Proficient, teaching experience)
- Jax, pytorch, sklearn, pandas, MPI, Ray (Computing tools)
- Julia (Professional experience)
- C / Java (Academic experience)
- JS / HTML / CSS (Side projects)

Interests

- Evolutionary computation
- Machine Learning
- Reinforcement Learning
- Evolution Strategies
- Open-ended evolution
- Auto-ML
- Robotics

Hobbies

- Cooking
- Game development

Career Profile

Hi, I recently graduated with a PhD in Machine Learning, specializing in the use of evolutionary methods for the optimization of neural networks as intelligent agents. With a background in engineering combined with experience in consulting and teaching, I have built a wide range of skills to be comfortable at all stages of development: from research to implementation, from technical depth to high-level communication, from individual work to team collaboration.

Work Experiences

PhD in Machine Learning

2021-Present

Supervised by [Emmanuel Rachelson](#), [Dennis G. Wilson](#)
[ISAE-SUPAERO, Toulouse, France](#)

PhD topic: Leveraging Structure in Evolutionary Neural Policy Search.

Intern co-supervision: Tarek Kunze on GENE encoding extension.

Published work: see *Publications*

Visiting PhD Student

Mar-Jul 2023

Supervised by [Antoine Cully](#)
[Imperial College London, UK](#)

Visiting student at Antoine Cully's Adaptive & Intelligent Robotics Lab (AIRL) at Imperial College London: studying Evolutionary RL and mixes of ES with Quality-Diversity.

Research Intern

May-Nov 2020

Supervised by [Dennis G. Wilson](#)
[ISAE-SUPAERO, Toulouse, France](#)

Evolution of neural networks with genetic algorithms for video games. Implementing NEAT, HyperNEAT in Julia. Ranked first in the GECCO 2020 competition on evolving a DOTA 2 bot.

Cybersecurity Consultant

Feb-Aug 2020

[Wavestone, Paris, France](#)

Internship subject: current and future uses of AI for cybersecurity intrusion detection & response, with a PoC of ML for anomaly detection in a Security Operation Center. Other missions: EBIOS risk analysis, impacts on cybersecurity of emerging technologies.

Member of the Board

2017-2020

[ISAE-SUPAERO, Toulouse, France](#)

Elected mandate as Students Representative on the ISAE-SUPAERO board.

CEO's Right Hand

Jul-Dec 2019

[Pricemoov, Paris, France](#)

Leading high-stake international projects with long-term implications in an AI-focused startup. Structuring internal processes and implementing management KPIs.

Education

MSc in Engineering

2016-2020

ISAE-SUPAERO

Masters in general engineering, applied to aerospace problems. Specialized in Data Science (major) and Robotics (minor). Research projects:

- Deep Learning to solve NP-hard problems
- Deep Reinforcement Learning for human-machine cooperation.

MSc in Operations Research

2019-2020

ISAE-SUPAERO

Additional MSc coupled with the Data Science specialization with classes on:

- Optimization,
- Advanced combinatorial optimization
- Stochastic and evolutionary methods

Publications

PhD Manuscript

Leveraging Structures in Evolutionary Neural Policy Search

Defended 2024-04-22

While training an artificial agent for complex tasks like driving a car, mastering a video game, or controlling plasma in a nuclear fusion reactor, innovations can lead to intelligent behavior. In such scenarios, a promising approach is to mimic the natural world's evolutionary process, which has honed the problem-solving capabilities of animal brains. Evolutionary Neural Policy Search (ENPS) draws inspiration from this concept. It creates a diverse population of "brains" represented by neural networks, allowing the system to "evolve" by selectively combining and mutating successful individuals. This thesis delves into the core components of ENPS and their intricate interplay. By analyzing the structures of ENPS, the goal is to design novel policy search methods that enhance these components, ultimately leading to the development of more efficient and effective learning algorithms for complex tasks.

Peer reviewed:

Quality with Just Enough Diversity in Evolutionary Policy Search
GECCO 2024

Paul Templier, Luca Grillotti, Emmanuel Rachelson, Dennis G. Wilson, Antoine Cully

Quality with Just Enough Diversity (JEDi) uses behavior information from Quality-Diversity to improve the search capabilities of ES, by learning and focusing on interesting behaviors.

Genetic Drift Regularization: on preventing Actor Injection from breaking Evolution Strategies
IEEE CEC 2024

Paul Templier, Emmanuel Rachelson, Antoine Cully, Dennis G. Wilson

By studying the injection of an RL actor into an ES population, we show they drift apart genetically, which can lead to the ES breaking. We introduce GDR, a simple regularization in the actor training loss, to fix it.

Searching Search Spaces: Meta-evolving a Geometric Encoding for Neural Networks
IEEE CEC 2024 ([Paper](#))

Tarek Kunze, Paul Templier, Dennis G. Wilson

The Geometric Encoding for Neural Network Evolution (GENE) relies on pseudo-distance functions to encode neural networks as smaller genomes. Using Genetic Programming as a meta-evolution loop, we learned a new encoding based on GENE. The discovered encoding makes sparse networks emerge naturally.

LUCIE: An Evaluation and Selection Method for Stochastic Problems
GECCO 2022 ([Paper](#)) ([Code](#))

Erwan Lecarpentier, Paul Templier, Emmanuel Rachelson, Dennis G. Wilson

To tackle the impact of uncertain evaluations in genetic algorithms, we introduce LUCIE, a resampling scheme based on a bandit approach. LUCIE is able to better select elite individuals, making the GA more robust to noise.

A Geometric Encoding for Neural Network Evolution
GECCO 2021 ([Paper](#)) ([Code](#)) ([Video](#))

Paul Templier, Emmanuel Rachelson, Dennis G. Wilson

Directly optimizing the weights of a neural network with evolution can get expensive, especially with methods like XNES or CMAES. We introduce GENE, a new method to encode neural networks as genomes which keeps the performance of direct encoding while reducing the size of the genome by an order of magnitude.

Evolving a Dota 2 bot: Illuminating search in CGP and NEAT

Competition at GECCO 2020 ([Paper](#)) ([Code](#))

Paul Templier, Lucas Hervier, Dennis G. Wilson

Blog articles:

- [Detecting security incidents with Machine Learning \(FR\)](#)

Hugo Moret, Paul Templier

RiskInsight blog (Wavestone)

- [Security of instant messaging applications \(FR\)](#)

Wajih Jmaiel, Paul Templier

RiskInsight blog (Wavestone)

Teaching

Evolutionary Computation

2021-2022-2024

Class managed by [Dennis G. Wilson](#)

ISAE-SUPAERO (40h total)

Elective module on evolutionary computation for students in their 1st year of MEng program. Teaching:

- Evolution Strategies
- Evolution of neural networks
- Genetic representation and operator design
- Quality-diversity approaches, evolution of behavior, coevolution
- Final project supervision: policy search for soft robots with ES

Python - Algorithm and Computing

2021-2022-2023

Class managed by [Jérôme LACAN](#)

ISAE-SUPAERO (100h total)

Teaching python to students in the FISA program and MSc in Aerospace Engineering:

- Basics of Python and algorithms
- 3D representation of planet movements
- Introduction to embedded systems with Micro:Bit

Bash & Python

2022-2023

Class managed by [Dennis G. Wilson](#)

ISAE-SUPAERO (20h)

Introduction to Bash, Git and Python for students in the last year of the MEng. program.

Projects

Here are some of the recent projects I worked on, either during my PhD or my Masters degree, or as personal side projects.

[BERL](#) - Benchmarking Evolutionary Reinforcement Learning: a python framework to test and evaluate Evolution Strategies for RL tasks, with MPI parallelism

[GENE](#) - A Geometric Encoding for Neural Network Evolution

[NeuroEvolution.jl](#) - A Julia implementation of NEAT-based neuroevolution algorithms (NEAT, CPPN, HyperNEAT)

[Multidimensional GP for multiclass classification](#) - Jupyter notebook implementing, presenting and explaining a research paper for Data Science specialization.

[Genepy](#) - Artificial life simulation in a 2D environment, with a custom implementation of NEAT for the brains.

[Groinkbot](#) - Multi-platform chatbot framework, based on a modular architecture and with a high-level interface.

[Compute](#) - Python tool to easily configure and run experiments on remote hosts with pre-defined configurations through SSH

[Solvers](#) - Bruteforce solvers for puzzle games like Minesweeper or Scrabble.

Talks

Ma Thèse en 180 secondes - Regional Finals (FR)

25 March 2022

Théâtre Sorano (460 people) - [Video](#)

Regional finals of the MT180 competition, where PhD students have 3 minutes to explain their research topic to a broad public.

A Geometric Encoding for Neural Network Evolution

21 July 2021

GECCO 2022 (online) - [Video](#)

Presenting our GENE paper at GECCO 2021. The video was pre-recorded.