Dr. Kevin Godin-Dubois

Contact

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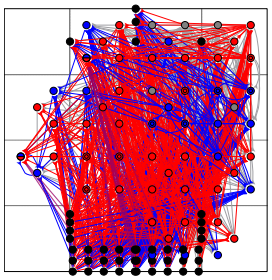
Google Scholar
ResearchGate

Position Researcher in Evolutionary Robotics (since November 2022)

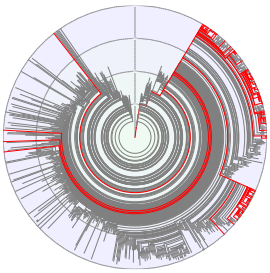
Highlights

Research *Artificial Life: Cognition, Interaction & Language*

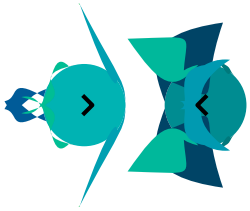
Main fields



Artificial Neural Networks



Species Dynamics



Morphogenetic Engineering

Output
1 journal article (*Artificial Life*)
5 international conference articles (*ALife, IEEE ALife, EvoAPP*)
5 international workshops short papers (*ALife, ECAL*)
Scientific software: ABrain, AMaze

Positions

Postdoctoral
2022 - Present
Computer Science / Evolutionary Robotics
"NeuroEvolution and Reinforcement Learning for Embodied Robots"
Computational Intelligence Group - Vrije Universiteit Amsterdam, The Netherlands
Supervisor: Dr. K. Miras (k.dasilvamirasdearaujo@vu.nl)
Collaborators: Dr. A. Kononova (a.kononova@liacs.leidenuniv.nl)

Postdoctoral
2020 - 2022
Computer Science / Artificial Intelligence
"Emergent cognitive architectures in virtual embodied robots"
REVA Team, IRIT - Toulouse I University, France
Supervisors: Pr. Y. Duthen (yves.duthen@irit.fr)
Pr. S. Cussat-Blanc (sylvain.cussat-blanc@irit.fr)

PhD
2016-2020
Computer Science / Artificial Life
"Environment-driven speciation: long term interactions in artificial plant communities"
REVA Team, IRIT - Toulouse I University, France
Supervisors: Pr. Y. Duthen (yves.duthen@irit.fr)
Pr. S. Cussat-Blanc (sylvain.cussat-blanc@irit.fr)

Teaching	8 years (500+ hours)
Computer Science	Learning Machines Master 2 Projects Programming languages: Python, C, R Algorithms, Data Structures, Information theory Programming projects
Generalists	Data Science tools and languages Database modeling, SQL
Skills	
Programming	Fluent: C++, Bash, Python, LaTeX Working Knowledge: C, Java, R, VB, VBA
Technical	Evolutionary Algorithms, Machine Learning, Multi-Agents Systems, High-Performance Computing
Languages	French (Mother tongue), English (Fluent - 980/990 at the TOEIC)

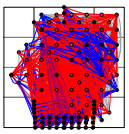
Research

Synopsis

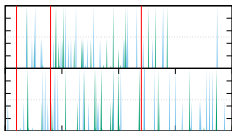
My main interests revolve around autonomous artificial life forms: from the design of efficient morphologies to the emergence of high-level control schemes and the evolutionary constraints that favor both. Recently I am mostly focused on Artificial Neural Networks (ANN) through NeuroEvolution and Reinforcement Learning, notably in the context of Interactive Evolutionary Robotics.

Artificial Neural Networks

Studying the emergence of various "cognitive" capabilities in virtual robots, controlled by a spontaneously differentiated neural network, in response to biologically plausible stimuli.



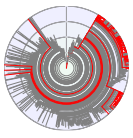
[3, 1, 2] Virtual fMRI
Extracting stimulus-specific regions of an ANN by applying a virtual equivalent to functional Magnetic Resonance Imaging (fMRI) and building high-level cognitive maps.
Software: ES-HyperNEAT (Custom implementation)



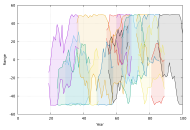
[9, 8] Communication
Exploring the mechanisms leading to emergent communication, how it becomes structured and its neural implementation.

Species Dynamics

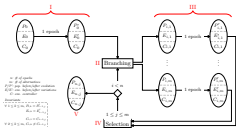
Promoting complex evolutionary trajectories and extracting species-level information from individual reproductions.



[12, 10] Phylogenetics
Automatically transforming genealogic trees into phylogenetic abstraction to access the emergent species-level dynamics.
Software: APOGeT(Automated Phylogeny Over Geological Timescales)



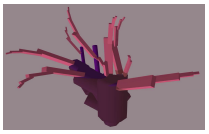
[6] Speciation
Application of a bio-inspired reproduction operator (Bail-Out Crossover) capable of spontaneously generating species barriers thereby allowing for emergent speciation.



[4, 16] Evolutionary algorithms
Introduced a novel paradigm, EDEnS (Environment-Driven Evolutionary Selection), relying on the indirect controlling of whole populations' evolutionary trajectories through an evolvable environmental controller.

Morphogenetic Engineering

Developing functional morphology in response to environmental constraints and evolutionary pressures.



[11, 4, 5, 12] Developmental morphologies
Production of mature, functional virtual plants from a single cell/structure using various genetic encodings (rules-based, L-Systems, Graphtals) in response to environmental constraints.

[1] Virtual robots
Use of genetically parameterized cubic bézier curves to control both static and mobile structures on the perimeter of virtual circular robots.
Software: Splinoids **Videos:** on Vimeo

Expertise

Evolutionary Algorithms
- Environment-Driven Evolutionary Selection (EDEnS)
- Multi-objective Optimisation
- High Performance Computing (HPC), Co-evolution, Novelty

Machine Learning
- Artificial Neural Networks (ANN, CNN, RNN)
- Composite Pattern-Producing Networks (CPPN)
- Cartesian Genetic Programming (CGP)
- Genetic Regulatory Networks (GRN)
- Hidden Markov Models (HMM)
- Stable baselines 3

Teachings

Postdoc 2023-2024
Vrije Universiteit Amsterdam
- NeuroEvolution (lecture)
- Learning Machines (projects) *45h*
- Master and Bachelor thesis supervision

Course management 2021-2022
Toulouse I University & Toulouse III University, France
- Computer Science projects *72h*

Multi-Agent Systems, Complex Systems, Simulation
- R programming *67.5h*

English lectures
- Information theory *22.5h*
- Servers and contents *18.75h*

Teaching fellow	Toulouse I University & Toulouse III University, France	
2017-2021	• Statistical software (R & Python)	*36h*
	• Algorithms	*60h*
	• Excel & VBA	*60h*
	• Modeling in databases	*21h*
Practical work supervisor	Toulouse III University, France	
2016-2021	• Software projects	*69.2h*
	• Data structures	*18.8h*
	• C Programming	*36h*
	• Python	*8h*

Outreach

Reviewer	• Symposium on Artificial Life program comitee member
2023	• Journal of Open Source Software reviewer
EduMix Aspi-Friendly	Initiated a project for the self-monitoring of well-being in students with autistic disorders alongside a heterogeneous team of neuro-(a)typical and various profiles (faculty, designers, developers ...).
2021	

Internships

Morphogenetic Engineering	Toulouse Research Institute on Computer Science (IRIT), France *"Rule-based artificial embryogenesis in a complex 3D environment"*
2016 (6 months)	Deployed rule-based genomes on the MecaCell platform to study artificial plant growth and cell specialization. **Contact:** Pr. Y. Duthen (`yves.duthen@irit.fr`)
Machine Learning	IRIT, *"Comparison of different evolutionary approaches, an application to the GECCO 2015 challenge"*
2015 (3 months)	Performed a performance comparison (accuracy, efficiency) between Artificial Neural and Genetic Regulatory Networks on the 2015 GECCO temperature prediction challenge data. **Contact:** Pr. H. Luga (`herve.luga@irit.fr`)
Machine Learning	IRIT, *"An architecture for automated bird discrimination"*
2014 (2 months)	Applied Hidden Markov Models to the BirdClef2014 challenge on the identification of specific bird species in a corpus of thousands of recordings. **Contact:** Pr. J. Farinas (`jerome.farinas@irit.fr`)

Education

PhD 2016 - 2020	Toulouse I University, France Defended the 15th of July 2020 Thesis title: *"Environment-driven speciation: long term interactions in artificial plant communities"* Investigated how complexification of artificial creatures could be further enhanced through the indirect control provided by a co-evolved, highly dynamical environment. **Rapporteurs:** Pr. P. Collet & DoR. F. Vico **Contact:** Pr. Y. Duthen (`yves.duthen@irit.fr`)
Master 2014 - 2016	Toulouse III University, France (*with honours*) Artificial Intelligence: mathematical & symbolic models, training methods
Bachelor 2011 - 2014	Toulouse III University (*with distinction*) Computer Science: networks, programming, systems, mathematics

Scholarships and Fellowships

2023-2026 $\sim$ 200K €	Postdoctoral funding from the Hybrid Intelligence consortium (Netherlands)
2016-2019 70K €	PhD Fellowship from the French Minister of Higher Education and Research (MESR)
2015 10K €	Master Scholarship from the International Mathematics and Computer Science Center (LabEx CIMI, Toulouse)
2014-2015 3K6 €	Merit Scholarship from the Regional Student Welfare Office (CROUS, Toulouse)

Research Output

Journals (peer-reviewed)

[1] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. "Explaining the Neuroevolution of Fighting Creatures Through Virtual fMRI". In: *Artificial Life* 29.1 (2023), pp. 66–93. ISSN: 1064-5462. DOI: 10.1162/artl_a_00389.

International conferences (peer-reviewed)

[2] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. "Specialization or Generalization: Investigating NeuroEvolutionary Choices via Virtual fMRI". In: *ALIFE 2024: Proceedings of the 2024 Artificial Life Conference*. MIT Press, July 2024. DOI: 10.1162/isal_a_00817.

[3] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. "Spontaneous Modular NeuroEvolution Arising from a Life/Dinner Paradox". In: *The 2021 Conference on Artificial Life*. Cambridge, MA: MIT Press, 2021, p. 95. DOI: 10.1162/isal_a_00431. Presentation: https://vimeo.com/godinduboisalife/alife2021main.

[4] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. "Beneficial Catastrophes: Leveraging Abiotic Constraints through Environment-Driven Evolutionary Selection". In: *2020 IEEE Symposium Series on Computational Intelligence (SSCI)*. 2020, pp. 94–101. DOI: 10.1109/SSCI47803.2020.9308411.

[5] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. "Self-Sustainability Challenges of Plants Colonization Strategies in Virtual 3D Environments". In: *Applications of Evolutionary Computation*. Ed. by P. Kaufmann and P. A. Castillo. Cham: Springer International Publishing, 2019, pp. 377–392. ISBN: 978-3-030-16692-2. DOI: 10.1007/978-3-030-16692-2_25.

[6] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. "Speciation under Changing Environments". In: *ALIFE 19*. Vol. 31. Cambridge, MA: MIT Press, 2019, pp. 349–356. ISBN: 978-0-262-35844-6. DOI: 10.1162/isal_a_00186. Presentation: https://vimeo.com/godinduboisalife/alife2019.

Workshops

[7] K. Godin-Dubois et al. "Interactive Embodied Evolution for Socially Adept Artificial General Creatures". In: *Evolution of Things Workshop at the ALife 2024 Conference*. arXiv, July 2024. DOI: 10.48550/arXiv.2407.21357.

[8] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. "Emergent Communication for Coordination in Teams of Embodied Agents". In: *4th International Workshop on Agent-Based Modelling of Human Behaviour (ALife2022)*. 2022.

[9] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. "On the Benefits of Emergent Communication for Threat Appraisal". In: *3rd International Workshop on Agent-Based Modelling of Human Behaviour*. Online, 2021. Presentation: https://vimeo.com/godinduboisalife/abmhub2021.

[10] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. "APOGeT: Automated Phylogeny Over Geological Timescales". In: *MethAL Workshop at ALife 2019*. 2019. DOI: 10.48550/arXiv.2407.21412.

[11] K. Dubois, S. Cussat-Blanc, and Y. Duthen. "Towards an Artificial Polytrophic Ecosystem". In: *Morphogenetic Engineering Workshop, at the European Conference on Artificial Life (ECAL) 2017 September 4*. 2017.

Posters

[12] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. "Studying Long Term Interactions between Plants and Their Environment". In: *Alife 2018*. Tokyo, 2018. DOI: 10.13140/RG.2.2.27553.97125.

Oral presentations

[13] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. *Splinoids: First Steps out of EDEnS*. Talk. Montreal (Virtual), 2020.

Softwares and datasets

[14] K. Godin-Dubois, K. Miras, and A. V. Kononova. *AMaze: Fully Discrete Training with Three Regimes (Direct, Scaffolding, Interactive) and Two Algorithms (A2C, PPO)*. Dataset. Apr. 2024. DOI: 10.5281/zenodo.10622914.

[15] K. Godin-Dubois, K. Miras, and A. V. Kononova. *AMaze: A Lightweight Benchmark Generator for Sighted Agents*. Zenodo. Software. Apr. 2024. DOI: 10.5281/ZENODO.10907939.

Thesis

[16] K. Godin-Dubois. "Environment-Driven Speciation: Long-Term Interactions in Artificial Plant Communities". PhD thesis. Doctoral school of Mathematics, Computer Science and Telecommunications (Toulouse, France), 2020. URL: http://www.theses.fr/2020TOU10026/document.