Guillaume Bellec AI and neuroscience
Johann Erzherzog platz 1, TU Wien, 1040, Vienna
+33633436243
born in 1990
guillaume@bellec.eu
https://guillaumebellec.github.io
https://scholar.google.com/citations?user=fSXUVvAAAAAJ

Career :

2025 - now **Assist. Prof.** at the Machine Learning Research Unit of **TU Wien**, Vienna

2020 - 2025 **Postdoc** researcher in the Computational Neuroscience laboratory of **EPFL**, with **Wulfram Gerstner**
- AI for neuroscience and Neuromorphic computing

2019 - now Creating and launching the **Chord AI** mobile application (more than 2,000,000 users in 2025)
- On-device deep learning for musical chord recognition in mobile phones

2015 - 2019 **PhD** in Theoretical Computer Science at **TU Graz** in Austria with **Wolfgang Maass**:
- Deep learning with recurrent networks (see Bellec et al. NeurIPS 2018, ICLR 2018)
- Theories of synaptic plasticity (see Bellec et al. Nature Comm. 2020)

2014 Master thesis in computational neuroscience with **R. Brette** and **P. Yger** at the Vision institute, Paris

2012-2013 One year internship in sound and music computing with **Anders Friberg** at KTH, Stockholm

2012 Research internship in machine learning with **Tillmann Weyde** at the City University, London

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Research supervision and teaching :

2020 - now Research project **supervision** of PhD students

2016 - 2019 **Lectures** Introduction to Machine Learning (third year of Bachelor), at TU Graz
Practical classes of advanced machine learning (master level) with Thomas Pock at TU Graz
Practical classes of reinforcement learning (master level) with Wolfgang Maass at TU Graz

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Education :

2013-2014 Master of **Mathematics, Vision and Learning** (MVA) at **ENS Paris-Saclay**, Paris

2010-2014 Master of **Optimization and Operational Research** at **ENSTA ParisTech**, Paris

2012-2013 Erasmus program at **KTH** in audio techonology, Stockholm

2008-2010 Classes préparatoires aux grandes écoles, Paris

Grants :

Intel Research Grant (Approx. 110,000 euros, for the period 2020 - 2022)
WWTF Vienna Research Group for Young investigators (Approx. 1.600,000 euros for the period 2025 - 2032)

Awards and honors :

PhD graduation graded very good **with honors** from TU Graz in 2019
Summer school on Brains, Minds and Machines at Woods hole with **MIT**, 2018. (travel grant, approx. 4000 euros)
C3N Summer school at the **Princeton Neuroscience Institute, 2018** (travel grant, approx. 4000 euros)
Inge St, Austrian travel grant for the NeurIPS 2019 conference (1240 euros)
Entrance at ENSTA Paristech via national exams corresponds to the top 5% with Maths or Physics majors

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Scientific achievements and skills :

Publishing and reviewing for NeurIPS, ICLR and ICML and journals like Science Magazine, Nature Comm.
Analysis of **neural recordings** (calcium imaging, large scale electro-physiology)
Expert knowledge of **TensorFlow and PyTorch**, also working with **JAX**
Training AI models to production **mobiles, GPU and custom hardware**

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AI and neuroscience

List of publications : **Bold title** = highlighted publications, # = joint senior author, * = equal contribution and team work

Nature Communications 2024	High-performance deep spiking neural networks with 0.3 spikes per neuron Nature Communications, 15, 6793, https://doi.org/10.1038/s41467-024-51110-5 *Stanojevic, Wozniak, Bellec, Cherubini, Pantazi, Gerstner.*
arxiv 2023	Audio Compression with Event Based Auto-encoders arXiv:2402.01571 *Lisboa, Bellec.*
NeurIPS 2023	**Trial matching: capturing variability with data-constrained spiking neural networks** Advances in Neural Information Processing Systems, 37 *Sourmpis, Petersen, Gerstner, Bellec.*
NeurIPS 2022	Mesoscopic modelling of hidden spiking neurons Advances in Neural Information Processing Systems, 35 *Wang*, Schmutz*, Bellec, Gerstner.*
NeurIPS 2021	Fitting summary statistics of neural data with a differentiable spiking network simulator Advances in Neural Information Processing Systems, 34, 18552-18563. *Bellec*, Wang*, Modirshanechi, Brea, Gerstner.*
NeurIPS 2021	**Local plasticity rules can learn deep representations using self-supervised contrastive predictions** Advances in Neural Information Processing Systems, 34, 30365-30379. *Illing, Ventura, Bellec#, Gerstner#.*
eLife 2021	Spike frequency adaptation supports network computations on temporally dispersed information ELife, 10, e65459, https://doi.org/10.7554/eLife.65459 *Salaj, Subramoney, Kraisnikovic, Bellec, Legenstein, Maass.*
Nature Communications 2020	**A solution to the learning dilemma for recurrent networks of spiking neurons** Nature Communications, 11, 3625, https://doi.org/10.1038/s41467-020-17236-y. *Bellec*, Scherr*, Subramoney, Hajek, Salaj, Legenstein and Maass.*
NeurIPS 2019 (workshop)	Eligibility traces provide a data-inspired alternative to backpropagation through time NeurIPS workshop on 'Real Neurons & Hidden Units' in 2019 *Bellec*, Scherr*, Hajek, Salaj, Subramoney, Legenstein and Maass.*
NeurIPS 2019 (workshop)	Slow processes of neurons enable a biologically plausible approximation to policy gradient NeurIPS workshop on 'Biological and artificial reinforcement learning' in 2019 *Subramoney*, Bellec*, Scherr*, Hajek, Salaj, Legenstein and Maass.*
NeurIPS 2018	**Long short-term memory and learning-to-learn in networks of spiking neurons** Advances in Neural Information Processing Systems, 31, 787-797. *Bellec*, Salaj*, Subramoney*, Legenstein and Maass.*
ICLR 2018	**Deep Rewiring: Training very sparse deep networks** International Conference on Learning Representation, 2018 *Bellec, Kappel, Maass and Legenstein.*

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Memory-Efficient Deep Learning on a SpiNNaker 2 Prototype
Frontiers 2018 — Frontiers in neuroscience, 12, 840.
Liu, Bellec* … Furber, Maass, Legenstein and Mayr.*

Neuromorphic hardware in the loop: Training a deep spiking network on the brainscales wafer-scale system
IJCNN 2017 — International joint conference on neural networks (IJCNN) (pp. 2227-2234). IEEE.
Schmitt, Bellec, … Legenstein, Maass, Mayr, Schueffny, Schemmel, Meier

Pattern representation and recognition with accelerated analog neuromorphic systems
ISCAS 2017 — International Symposium on Circuits and Systems (ISCAS) (pp. 1-4). IEEE
Petrovici, Bellec, … Maass, Schueffny, Mayr, Schemmel, Meier.

Slow Feature Analysis with spiking neurons and its application to audio stimuli
JCNS 2016 — Journal of computational neuroscience, 40, 317-329, https://doi.org/10.1007/s10827-016-0599-3.
Bellec, Galtier, Brette and Yger

A social network integrated game experiment to relate tapping to speed
SMC 2013 — In Proceedings of the Sound and Music Computing Conference (Vol. 30, pp. 19-26)
Bellec, Friberg, Elowsson, Wolff, Weyde

Creating Audio Based Experiments as Social Web Games with the CASimIR perception and explore rhythm reproduction
AES 2013 — In Audio Engineering Society Conference: 53rd International Conference: Semantic Audio. Audio Engineering Society.
Wolff, Bellec, Friberg, MacFarlane, Weyde

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Invited talks at workshops or conferences :

April 2024	Seminar at the Goup of Neural Theory, ENS Paris
September 2023	Bernstein conference in Berlin, workshop on neuromorphic computing
February 2023	Swiss computational neuroscience meeting - Crans Montana
September 2022	Berstein conference in Berlin, Workshop on Distributed computation across brain regions
February 2022	INTEL INRC virtual workshop on Continual and unsupervised learning
November 2021	ACML workshop on Energy efficient AI – virtual conference
May 2021	Pint of science Austria – popular science festival, recording at https://youtu.be/SF4rqIcXPA4
January 2020	European Institute for Theoretical Neuroscience in Paris – workshop on synaptic plasticity
September 2019	Bernstein conference in Berlin – workshop entitled 'Brain against the machine'

Invited seminar talks at universities and companies :

Mars 2023	Machine learning seminar - Sheffield university (virtual)
November 2022	Universtiy of Ottawa - Talk: AI for neuroscience
November 2022	MILA in Montreal - Talk: AI for Neuroscience
November 2021	Donders Institute for Brain, Cognition and Behaviour, Nijmegen, the Netherlands – virtual seminar
March 2021	CNRS Thales – virtual seminar
February 2021	MILA in Montreal – virtual seminar
September 2019	ENS Paris and INRIA
June 2019	Blue brain project, Geneva
April 2019	Laboratoire des sciences cognitives at ENS Paris
April 2019	Facebook AI, Paris

Contributed talks :

February 2021	INTEL INRC virtual workshop on Neuromorphic computing
December 2019	NeurIPS 2019 in Vancouver, workshop on "Future directions at the intersection of neuroscience and AI" (approx. top 10% of accepted workshop submission)
September 2019	Bernstein conference in Berlin, conference main track (approx. top 5% of accepted submission)
July 2013	Sound and Music Computing conference in Stockholm

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Contacts for reference letters :

Wulfram Gerstner	wulfram.gerstner@epfl.ch Full professor at EPFL in Lausanne
Blake Richards	blake.richards@mcgill.ca Full Professor at MILA and McGill in Montreal