

GIDO MARTIJN VAN DE VEN

Department of Electrical Engineering
KU Leuven, Belgium

Website: <https://gmvandeven.github.io>
E-mail: gido.vandeven@kuleuven.be

My main research interest is continual learning, which I approach from a deep learning as well as a cognitive science perspective. Contributions I have made include proposing the influential [“three scenarios” framework for continual learning](#) and developing the [brain-inspired replay algorithm](#), which alleviates catastrophic forgetting by replaying self-generated, abstract memory representations. For my [award-winning PhD](#) in neuroscience, I used optogenetics and electrophysiological recordings in mice to study the role of replay in memory consolidation in the brain.

PROFESSIONAL AFFILIATIONS

Postdoctoral Associate

KU Leuven (Belgium), Mar 2022 – now

Studying the fundamental challenges of continual/incremental/sequential learning, predominantly in the context of deep learning. Supported by two prestigious personal fellowships.

Postdoctoral Associate

Baylor College of Medicine (Houston), Oct 2017 – Feb 2022

Applying insights and experimental observations from neuroscience to state-of-the-art deep neural networks to make their performance more human-like, with special focus on continual learning.

Visiting Researcher

University of Cambridge, Oct 2018 – Feb 2022

Leading the deep learning research for a large collaborative grant from DARPA’s Lifelong Learning Machines (L2M) program, with neuroscience labs at NYU and Columbia University.

EDUCATION

| | | |
|------------|--|-----------|
| PhD | University of Oxford, Neuroscience Dissertation: “Reactivation and reinstatement of hippocampal assemblies” <i>National PhD Thesis Award</i> from the British Neuroscience Association | 2013-2017 |
| MSc | University of Oxford, Neuroscience <i>Sherrington Prize in Neuroscience</i> for best performance | 2011-2012 |
| MA | UC Berkeley, Statistics <i>Elizabeth Scott Memorial Award</i> for outstanding performance | 2009-2011 |
| BSc | Erasmus University Rotterdam, Econometrics Graduated <i>cum laude</i> , top of class | 2005-2008 |

FUNDING / GRANTS / FELLOWSHIPS

C1 project, KU Leuven – €353,383 2023-2027
Internal funding supporting a PhD student for four years and a postdoc for one year, awarded after international peer review. The project studies the stability gap in continual learning. My role is Co-PI (due to internal regulations I cannot be PI), I wrote the application almost fully myself.

MSCA Postdoctoral Fellowship – €191,760 2022-2024
Two-year personal fellowship for postdoc at the KU Leuven.

| | |
|---|-----------|
| FWO Senior Postdoctoral Fellowship – €250,000 (estimate) | 2022-2025 |
| Three-year personal fellowship for postdoc at the KU Leuven [<i>only taken up in final year</i>]. | |
| DARPA’s Lifelong Learning Machines (L2M) Program – \$2,904,658 (total) | 2018-2021 |
| “Continual Learning Across Synapses, Circuits & Brain Areas” (PI: Andreas Tolias; collaboration with NYU & Columbia), I am listed as key personnel and had an important role securing this grant. | |
| IBRO-ISN Research Fellowship – €35,000 | 2017-2018 |
| One-year personal fellowship for postdoc at the Baylor College of Medicine. | |

OTHER AWARDS

| | |
|--|------|
| MRC DTP Supplementary Funding Award (£19,697) | 2017 |
| FENS travel grant, to attend Annual Meeting of the Japan Neuroscience Society (€1,000) | 2017 |
| FENS, IBRO-PERC and The Brain Prize stipend (€1,000) | 2017 |
| Vice-Chancellors’ Fund Award, University of Oxford (£3,000) | 2016 |
| CSNII grant, for Computational Neuroscience Course in Okinawa (£2,500, estimate) | 2015 |
| Gotch Memorial Prize, for 1st year DPhil report (£1,000) | 2014 |
| MRC Research Studentship, to finance DPhil at University of Oxford (£102,674) | 2013 |
| RIKEN Brain Science Institute summer program grant (£3,500, estimate) | 2013 |
| Vreedefonds, to finance Master at University of Oxford (€6,000, partly loan) | 2011 |
| International House Berkeley Scholarship (\$4,100) | 2010 |
| Huygens Scholarship, to finance Master at UC Berkeley (€37,800) | 2009 |

TEACHING

| | |
|--|-----------|
| Keynote & Tutorial at CCN2024 | Aug 2024 |
| Tutorial on continual learning at the top conference on cognitive computational neuroscience | |
| INVICTA Spring School, Porto | Mar 2024 |
| Lecturer, introduction to continual learning and coding tutorial | |
| NeurIPS tutorial | Dec 2022 |
| Online tutorial on “Lifelong Learning Machines” | |
| NeuroMatch Academy (deep learning summer school) | Aug 2021 |
| Coding tutorial and online lecture on benchmarks for continual learning | |
| UC Berkeley | 2009-2011 |
| Graduate Student Instructor for: | |
| - STAT2: introductory course in Statistics | |
| - STAT151B: advanced upper-division course in Machine Learning | |
| - STAT248: graduate course in Time Series Analysis | |
| Recipient of <i>Outstanding Graduate Student Instructor Award</i> (awarded to <10% of GSIs) | |
| Erasmus University Rotterdam | 2009-2011 |
| Teaching assistant for introductory courses on Calculus and Linear Algebra | |

FORMAL SUPERVISION OF GRADUATE STUDENTS

| | |
|--|------------|
| Timm Hess – PhD student, <i>KU Leuven</i> | 2022 - now |
| Michał Zajac – visiting PhD student, <i>KU Leuven</i> | 2023 |
| Sergi Masip – visiting Master student, <i>KU Leuven</i> | 2023 |
| Roman Rothaermel – Master student, <i>University of Oxford</i> | 2017 |

Google Scholar profile: <https://scholar.google.com/citations?user=3k0l15MAAAAJ>

Zajac M, Tuytelaars T, **van de Ven GM** (2024), “Prediction error-based classification for class-incremental learning”, *International Conference on Learning Representations (ICLR)*.

Verwimp E, Aljundi R, Ben-David S, Bethge M, Cossu A, Gepperth A, Hayes TL, Hüllermeier E, Kanan C, Kudithipudi D, Lampert C, Mundt M, Pascanu R, Popescu A, Tolias AS, van de Weijer J, Liu B, Lomonaco V, Tuytelaars T, **van de Ven GM** (2024), “Continual learning: applications and the road forward”, *Transactions on Machine Learning Research (TMLR)*.

Hess T*, Verwimp E*, **van de Ven GM**, Tuytelaars T (2024), “Knowledge accumulation in continually learned representations and the issue of feature forgetting”, *Transactions on Machine Learning Research (TMLR)*.

Masip S, Rodriguez P, Tuytelaars T, **van de Ven GM** (2024), “Continual learning of diffusion models with generative distillation”, *Conference on Lifelong Learning Agents (CoLLAs)*.

Dziadzio S, Yıldız Ç, **van de Ven GM**, Trzciński T, Tuytelaars T, Bethge M (2024), “Disentangled continual learning: separating memory edits from model updates”, *Conference on Lifelong Learning Agents (CoLLAs)*.

Hess T, Tuytelaars T, **van de Ven GM** (2023) “Two complementary perspectives to continual learning: ask not only what to optimize, but also how”, *Proceedings of the 1st ContinualAI Unconference*, pre-registered report, PMLR **243**.

De Lange M, **van de Ven GM**, Tuytelaars T (2023), “Continual evaluation for lifelong learning: identifying the stability gap”, *International Conference on Learning Representations (ICLR)*, spotlight (top 25%).

van de Ven GM, Tuytelaars T, Tolias AS (2022), “Three types of incremental learning”, *Nature Machine Intelligence*, **4**(12): 1185-1197.

Kudithipudi D, Aguilar-Simon M, Babb J, Bazhenov M, Blackiston D, Bongard J, Brna A, Chakravarthi Raja S, Cheney N, ..., **van de Ven GM**, ..., Siegelmann HT (2022), “Biological underpinnings for lifelong learning machines”, *Nature Machine Intelligence*, **4**(3): 196-210.

Li S, Du Y, **van de Ven GM**, Mordatch I (2022), “Energy-based models for continual learning”, *Proceedings of the 1st Conference on Lifelong Learning Agents (CoLLAs)*, PMLR **199**: 1-22.

van de Ven GM, Zhe L, Tolias AS (2021), “Class-incremental learning with generative classifiers”, *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops*, p3611-3620.

Lomonaco V, Pellegrini L, Cossu A, Carta A, Graffieti G, Hayes TL, De Lange M, Masana M, Pomponi J, **van de Ven GM**, Mundt M, She Q, ..., Maltoni D (2021), “Avalanche: an end-to-end library for continual learning”, *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops*, p3600-3610.

Kao TC*, Jensen KT*, **van de Ven GM**, Bernacchia A, Hennequin G (2021), “Natural continual learning: success is a journey, not (just) a destination”, *NeurIPS*, 34.

van de Ven GM, Siegelmann HT, Tolias AS (2020), “Brain-inspired replay for continual learning with artificial neural networks”, *Nature Communications*, **11**: 4069.

van de Ven GM, Tolia AS (2019), “Three scenarios for continual learning”, *NeurIPS workshop*.

Lopes-dos-Santos V, van de Ven GM, Morley A, Trouche S, Campo-Urizza N, Dupret D (2018), “Parsing hippocampal theta oscillations by nested spectral components during spatial exploration and memory-guided behavior”, *Neuron*, **100**(4): 940-952.

van de Ven GM, Trouche S, McNamara CG, Allen K, Dupret D (2016), “Hippocampal offline reactivation consolidates recently formed cell assembly patterns during sharp wave-ripples”, *Neuron*, **92**(5): 968-974.

Trouche S, Perestenko PV, van de Ven GM, Bratley CT, McNamara CG, Campo-Urizza N, Black SL, Reijmers LG, Dupret D (2016), “Recoding a cocaine-place memory engram to a neutral engram in the hippocampus”, *Nature Neuroscience*, **19**(4): 564-567.

Möttönen R, van de Ven GM, Watkins KE (2014), “Attention Fine-Tunes Auditory-Motor Processing of Speech Sounds”, *The Journal of Neuroscience*, **34**(11): 4064-4069.

PREPRINTS

van de Ven GM*, Soures N*, Kudithipudi D (2024), “Continual learning and catastrophic forgetting”, *arXiv preprint*, arXiv:2403.05175.

Hemati H, Pellegrini L, Duan X, Zhao Z, Xia F, Masana M, Tscheschner B, Veas E, Zheng Y, Zhao S, Li SY, Huang SJ, Lomonaco V, van de Ven GM (2024), “Continual learning in the presence of repetition”, *arXiv preprint*, arXiv:2405.04101.

Vogelstein JT*, Dey J*, Helm HS, LeVine W, Mehta RD, Tomita TM, Xu H, Geisa A, Wang Q, van de Ven GM, Gao C, Yang W, Tower B, Larson J, White CM, Priebe CE (2020), “Ensembling representations for synergistic lifelong learning with quasilinear complexity”, *arXiv preprint*, arXiv:2004.12908.

van de Ven GM, Tolia AS (2018), “Generative replay with feedback connections as a general strategy for continual learning”, *arXiv preprint*, arXiv:1809.10635.

OPEN SCIENCE / REPRODUCIBILITY

Continual learning library: github.com/GMvandeVen/continual-learning (>1500 stars)

Contributor to Avalanche project: avalanche.continualai.org (>1700 stars)

INVITED TALKS

CVC Seminar, “Two complementary perspectives to continual learning”, 23 May 2024

Dagstuhl Seminar “Generalization by People and Machines”, 5-8 May 2024

Guest lecture (UMass Amherst), “Continual learning with deep neural networks”, 7 Mar 2023

Sony & inCSL Seminar, “Three types of incremental learning: a framework”, 1 Mar 2023

Guest lecture (University of Pisa), “Using generative models for continual learning”, 20 Dec 2021

ContinualAI Seminar, “Class-Incremental Learning with Generative Classifiers”, 21 May 2021

Reading Group of Simons Institute (UC Berkeley), “Brain-inspired replay”, 11 Nov 2020

ContinualAI Meetup, “Robustness and Generalization in Continual Learning”, 30 Oct 2020

Cambridge Memory Meeting, “The role of replay in stabilizing memories”, 4 April 2019

Memory Reactivation Workshop (Cardiff), 8 May 2017

Peer-reviewed for:

- Nature, Nat Mach Intell, Nat Hum Behav, Nat Commun, PLoS Comp Biol, Neural Networks, IEEE TPAMI, IEEE TNNLS, Artificial Intelligence, TMLR
- ICLR (top reviewer 2022 and 2023), NeurIPS, CVPR, ICML, CoLLAs

Organizer of scientific meetings:

- CVPR Workshop “Continual Learning in Computer Vision”, 18 June 2024, Seattle
- Continual AI Un-Conference, Talks Chair, 19 October 2023, virtual
- CVPR Workshop “Continual Learning in Computer Vision”, 18 June 2023, Vancouver
- Dagstuhl Seminar “Deep Continual Learning”, 19-24 March 2023, Germany
- CVPR Workshop “Continual Learning in Computer Vision”, 20 June 2022, New Orleans

REFERENCES

Prof. Tinne Tuytelaars

Postdoctoral mentor (Mar 2022 – now)

Address: ESAT-PSI – bus 02441, KU Leuven, Kasteelpark Arenberg 10, 3001 Leuven, Belgium

E-mail: tinne.tuytelaars@esat.kuleuven.be

Prof. Andreas S. Tolias

Postdoctoral mentor (Oct 2017 – Feb 2022)

Address: Dept Neuroscience, Baylor College of Medicine, 1 Baylor Pl, Houston 77030 TX, USA

E-mail: astolias@bcm.edu

Prof. David Dupret

PhD supervisor (Oct 2013 – Sep 2017)

Address: MRC Brain Network Dynamics Unit, Univ of Oxford, Mansfield Rd, OX1 3TH, UK

E-mail: david.dupret@bndu.ox.ac.uk