Timothée Masquelier

Researcher in Computational Neuroscience

What I cannot create, I do not understand.
Richard Feynman, 1985.

Keywords

Computational neuroscience, neuromorphic engineering, spiking neural networks, vision, learning.

Experience

Academia

2013–now **Research scientist (*Chargé de Recherches*)**, *CNRS (CERCO)*, Toulouse, France.
Spike-based computing and learning in brains and machines.

2008–2012 **Postdoctoral fellow**, *Universitat Pompeu Fabra*, Barcelona, Spain.
Neurodynamics of spontaneous activity in cortical cultures.
Supervisor: Pr. Gustavo Deco, ICREA and UPF.

2004–2008 **Ph. D. Student**, *CNRS (CERCO)*, Toulouse, France.
Modeling object recognition in visual cortex with spiking neural networks.
Supervisor: Dr. Simon Thorpe, DR CNRS

2000–2001 **M. Sc. Student**, *MIT*, Cambridge, MA, USA.
Design and evaluation of a GPS-aided communication device for railroad workers.
Supervisor: Pr. Thomas B. Sheridan, MIT

Industry

2004 **Revenue Management Expert**, *Avianca*, Bogota, Colombia.
Audited and validated RM processes.

2001-2004 **R&D Engineer in Operations Research**, *Mereo*, Paris, France.
Designed and implemented a probabilistic optimization model for Revenue Management.

1999 **Research Internship**, *SNECMA*, Villaroche, France.
Computational Fluid Dynamics. Validated a wall law model. Unsteady 3D computations.

Education

2004–2008 **Ph. D. in Computational Neuroscience**, *Univ. Paul Sabatier*, Toulouse 3, France.
Graduation: 02/2008.

1999–2001 **M. Sc. in Aeronautics and Astronautics**, *MIT*, Cambridge, MA, USA.
Graduation: 06/2001.

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1996–1999 **General Engineering (*Ingénieur Centralien*)**, *Ecole Centrale Paris*, France. Graduation: 06/1999.

1994–1996 ***Classes Préparatoires aux Grandes Écoles***, *Lycée Saint Louis*, Paris, France. Option M' (theoretical maths).

Honors / Awards

2018–2019 Gundishapur PHC grant, together with M. Ganjtabesh (University of Tehran).

2009–2010 Two-year postdoctoral fellowship from the Fyssen Foundation.

2000 MIT Robert Guenassia Award.

1999 One year fellowship from the MIT Department of Aeronautics and Astronautics.

Ph. D. Students

2012–2017 Saeed Reza Kheradpisheh

2014–2018 Amirreza Yousefzadeh

2015– ... Jacob Huth

2014– ... Milad Mozafari

2017– ... Alexandre Montlibert

Diverse

HDR Habilitation à Diriger des Recherches (2017).

Teaching Various computational neuroscience modules at Ecole Centrale Paris, Supaero, Univ. Paris 6, Univ. Tehran.

Bibliometry `http://scholar.google.com/citations?user=fkzUZ-oAAAAJ`
`http://www.researcherid.com/rid/F-1159-2010`
`https://orcid.org/0000-0001-8629-9506`

Valorization Two patents submitted to the *European Patent Office* in 11/2016 and 02/2017:
`https://patents.google.com/patent/EP3324343A1/`
`https://patents.google.com/patent/EP3324344A1/`
BrainChip Inc. acquired a license in 03/2017.

Invited talks

- *GDR BioComp*, Bordeaux, France, 06/2018
- *RIKEN*, Tokyo, Japan, 04/2018
- *Vision Institute*, Paris, France, 04/2018
- *IRIT*, Toulouse, France, 04/2018
- *Univ. of Granada*, Spain, 02/2018
- *I3S*, Sophia Antipolis, France, 10/2017
- *Instituto de Microelectrónica de Sevilla*, Spain, 06/2017
- *NanoInnov*, Palaiseau, France, 06/2017
- *IPM*, Tehran, Iran 04/2017
- *M4 Conference*, Albi, France 09/2015
- *MemoCIS*, CappoCaccia, Sardegna, Italy, 05/2015
- *CERCO*, Toulouse, France, 02/2015
- *Laboratoire J.A. Dieudonné*, Nice, France, 10/2014
- *Oxford Centre for Human Brain Activity*, UK, 06/2014
- *INRIA Sophia Antipolis*, France, 11/2013
- *Ecole Centrale Paris*, France, 10/2013
- *CEA*, Saclay, France, 09/2013
- *LIP6*, Paris, France, 03/2013
- *Institut de Neurosciences de la Timone*, Marseille, France, 02/2013
- *Brain Corporation*, San Diego, CA, USA, 05/2012
- *Ruhr-University Bochum*, Germany, 03/2012
- *Universitat Autonòma de Barcelona*, Spain, 05/2011
- *Instituto Gulbenkian de Ciência*, Lisbon, Portugal, 05/2010
- *Instituto de Microelectrónica de Sevilla* , Spain, 04/2010
- *INRIA Sophia Antipolis*, France, 02/2010

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Referee for

- Advances in Artif. Neur. Sys.
- Biol. Cybern.
- CNRS Momentum
- Comp. Vision and Image Understanding
- Cosyne
- Front. Comp. Neurosc.
- Front. Neuroinform.
- Front. Neurorobotics
- Front. Neurosc.
- Front. Perception Sci.
- IEEE Access
- IEEE Trans. Cog. and Dev. Syst.
- IEEE Trans. Emerging Topics in Comput. Intell.
- IEEE Trans. Neural Netw.
- IEEE Trans. Neural Netw. Learn. Syst.
- IEEE Trans. Patt. Anal. and Mach. Intell.
- Int. J. Neural Syst.
- ISCAS
- J. Comput. Neurosci.
- J. Neural Eng.
- J. Neurosci.
- J. Physiol.-Paris
- J. R. Soc. Interface
- Neural Comp.
- Neural Netw.
- Neurocomputing
- Neuroscience
- Nonlinearity
- Pattern Recognition
- Phil. Trans. R. Soc. B
- PLoS Comp. Biol.
- PLoS ONE
- Research Foundation - Flanders (FWO)
- Sc. Reports

Publications

Peer-reviewed International Journals

1. Chauhan, T., Masquelier, T., Montlibert, A., and Cottereau, B. R. (in press). Emergence of binocular disparity selectivity through hebbian learning. *Journal of Neuroscience*
2. Masquelier, T. and Kheradpisheh, S. R. (in press). Optimal localist and distributed coding of spatiotemporal spike patterns through STDP and coincidence detection. *Frontiers in Computational Neuroscience*
3. Mozafari, M., Kheradpisheh, S., Masquelier, T., Nowzari-Dalini, A., and Ganjtabesh, M. (in press). First-Spike-Based Visual Categorization Using Reward-Modulated STDP. *IEEE Transactions on Neural Networks and Learning Systems*
4. Tavanaei, A., Masquelier, T., and Maida, A. (2018). Representation learning using event-based STDP. *Neural Networks*, 105:294–303
5. Huth, J., Masquelier, T., and Arleo, A. (2018). Convis: A Toolbox to Fit and Simulate Filter-Based Models of Early Visual Processing. *Frontiers in Neuroinformatics*, 12(March):1–16
6. Kheradpisheh, S. R., Ganjtabesh, M., Thorpe, S. J., and Masquelier, T. (2018). STDP-based spiking deep convolutional neural networks for object recognition. *Neural Networks*, 99:56–67
7. Ashtiani, M. N., Kheradpisheh, S. R., Masquelier, T., and Ganjtabesh, M. (2017). Object Categorization in Finer Levels Relies More on Higher Spatial Frequencies and Takes Longer. *Frontiers in Psychology*, 8(July)
8. Masquelier, T. (2017b). STDP allows close-to-optimal spatiotemporal spike pattern detection by single coincidence detector neurons. *Neuroscience*
9. Deneux, T., Masquelier, T., Bermudez, M. A., Masson, G. S., Deco, G., and Vanzetta, I. (2017). Visual stimulation quenches global alpha range activity in awake primate V4: a case study. *Neurophotonics*, 4(3):031222
10. Kheradpisheh, S. R., Ghodrati, M., Ganjtabesh, M., and Masquelier, T. (2016c). Humans and Deep Networks Largely Agree on Which Kinds of Variation Make Object Recognition Harder. *Frontiers in Computational Neuroscience*, 10(August):1–15
11. Kheradpisheh, S. R., Ghodrati, M., Ganjtabesh, M., and Masquelier, T. (2016b). Deep Networks Can Resemble Human Feed-forward Vision in Invariant Object Recognition. *Scientific reports*, 6(August):32672
12. Portelli, G., Barrett, J. M., Hilgen, G., Masquelier, T., Maccione, A., Di Marco, S., Berdondini, L., Kornprobst, P., and Sernagor, E. (2016). Rank order coding: a retinal information decoding strategy revealed by large-scale multielectrode array retinal recordings. *Eneuro*, 3(June):1–18
13. Kheradpisheh, S. R., Ganjtabesh, M., and Masquelier, T. (2016a). Bio-inspired unsupervised learning of visual features leads to robust invariant object recognition. *Neurocomputing*, 205:382–392
14. Masquelier, T., Portelli, G., and Kornprobst, P. (2016). Microsaccades enable efficient synchrony-based coding in the retina: a simulation study. *Scientific Reports*, 6:24086
15. Masquelier, T. (2014). Oscillations can reconcile slowly changing stimuli with short neuronal integration and STDP timescales. *Network: Computation in Neural Systems*, 25(1-2):85–96
16. Masquelier, T. and Deco, G. (2013b). Network Bursting Dynamics in Excitatory Cortical Neuron Cultures Results from the Combination of Different Adaptive Mechanism. *PLoS ONE*, 8(10):e75824

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17. Masquelier, T. (2013). Neural variability, or lack thereof. *Frontiers in Computational Neuroscience*, 7:1–7
18. Serrano-Gotarredona, T., Masquelier, T., Prodromakis, T., Indiveri, G., and Linares-Barranco, B. (2013). STDP and STDP variations with memristors for spiking neuromorphic learning systems. *Frontiers in neuroscience*, 7(February):2
19. Masquelier, T. (2012). Relative spike time coding and STDP-based orientation selectivity in the early visual system in natural continuous and saccadic vision: a computational model. *Journal of computational neuroscience*, 32(3):425–41
20. Gilson, M., Masquelier, T., and Hugues, E. (2011). STDP allows fast rate-modulated coding with Poisson-like spike trains. *PLoS Computational Biology*, 7(10):e1002231
21. Masquelier, T., Albantakis, L., and Deco, G. (2011). The timing of vision - how neural processing links to different temporal dynamics. *Frontiers in psychology*, 2:151
22. Zamarreño-Ramos, C., Camuñas-Mesa, L., Perez-Carrasco, J., Masquelier, T., Serrano-Gotarredona, T., and Linares-Barranco, B. (2011). On spike-timing-dependent-plasticity, memristive devices, and building a self-learning visual cortex. *Frontiers in Neuroscience*, (MAR)
23. Deco, G., Buehlmann, A., Masquelier, T., and Hugues, E. (2011). The role of rhythmic neural synchronization in rest and task conditions. *Front Hum Neurosci*, 5:4
24. Masquelier, T., Hugues, E., Deco, G., and Thorpe, S. J. (2009b). Oscillations, phase-of-firing coding, and spike timing-dependent plasticity: an efficient learning scheme. *The Journal of neuroscience*, 29(43):13484–93
25. Masquelier, T., Guyonneau, R., and Thorpe, S. J. (2009a). Competitive STDP-Based Spike Pattern Learning. *Neural Comput*, 21(5):1259–1276
26. Masquelier, T., Guyonneau, R., and Thorpe, S. J. (2008). Spike timing dependent plasticity finds the start of repeating patterns in continuous spike trains. *PLoS ONE*, 3(1):e1377
27. Masquelier, T. and Thorpe, S. J. (2007). Unsupervised learning of visual features through spike timing dependent plasticity. *PLoS Comput Biol*, 3(2):e31

Peer-reviewed Conference Proceedings

1. Yousefzadeh, A., Masquelier, T., Serrano-Gotarredona, T., and Linares-Barranco, B. (2017). Hardware Implementation of Convolutional STDP for On-line Visual Feature Learning. *Proc. of IEEE ISCAS*
2. Tavanaei, A., Masquelier, T., and Maida, A. S. (2016). Acquisition of visual features through probabilistic spike-timing-dependent plasticity. In *2016 International Joint Conference on Neural Networks (IJCNN)*, pages 307–314. IEEE
3. Masquelier, T. and Thorpe, S. J. (2010). Learning to recognize objects using waves of spikes and Spike Timing-Dependent Plasticity. In *The 2010 International Joint Conference on Neural Networks (IJCNN)*, pages 1–8. IEEE
4. Masquelier, T. and Thorpe, S. (2006). Face feature learning with Spike Timing Dependent Plasticity. *Proc. of the 1st French conference on computational neuroscience (NeuroComp)*

Reports / Book Chapters

1. Masquelier, T. (2017a). Spike-based computing and learning in brains, machines, and visual systems in particular (HDR Report). *Université Paul Sabatier Toulouse 3, France*, pages 1–102
2. Serrano-Gotarredona, T., Masquelier, T., and Linares-Barranco, B. (2014). Spike-timing-dependent plasticity with memristors. *Chapter in Memristor Networks (Eds. A. Adamatzky and L. O. Chua). Springer-UK.*
3. Masquelier, T. and Deco, G. (2013a). Learning and coding in neural networks. *Chapter in Principles of neural coding. Ed. R Quian Quiroga and S Panzeri. CRC Press*
4. Masquelier, T. (2008). Learning mechanisms to account for the speed, selectivity and invariance of responses in the visual cortex. *PhD thesis, Université Paul Sabatier Toulouse 3, France*
5. Masquelier, T., Serre, T., Thorpe, S., and Poggio, T. (2007). Learning complex cell invariance from natural videos: a plausibility proof. *CBCL Paper #269/MIT-CSAIL-TR #2007-060, Massachusetts Institute of Technology, MA, USA*

Toulouse, France, September 13, 2018

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