Matthieu Gilson

Contact Information

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Summary

I am a post-doctorate researcher in computational neuroscience specialized in biological neural network, with applications to learning and data analysis. I have developed skills in mathematical analysis, modeling and machine learning. I have 29 peer-reviewed publications with 448 citations in Scopus (peer-reviewed publications only) and my h-index is 12.

Education and Research Positions

2014-now	Post-doctorate researcher at Computational Neuroscience Group, Universitat Pompeu Fabra (Barcelona, Spain)
2010-2013	Post-doctorate researcher at Lab for Neural Circuit Theory, RIKEN Brain Science Institute (Wako-shi, Japan)
2005-2009	Ph.D. at Electrical and Electronic Engineering, The University of Melbourne (Melbourne, Australia) Thesis on learning in biological neural networks
2001-2003	M.Sc.A. at Electrical and Electronic Engineering, École Polytechnique de Montréal (Montréal, Canada) Research project in machine learning
1998-2001	B.Sc. at École Polytechnique (Palaiseau, France) Majors in applied mathematics and computer science

Commissions of Trust

2016-2018	Marie Sklodowska-Curie Action (MSCA-IF) fellowship
2013-2015	Invited editor for the Special Topic on 'Emergent Neural Computation from the Interaction of Different Forms of Plasticity' for Frontiers in Computational Neuroscience
2005-2009	NICTA top-up scholarship (University of Melbourne)
2005-2009	PhD scholarship from the University of Melbourne
2009-now	Reviewer for PLoS Computational Biology, Biological Cybernetics, Frontiers in Computational Neuroscience, Journal of Computational Neuroscience, Journal of Mathematical Neuroscience, Neural Computation, Journal of Neuroscience Research, Brain Structure and Function
2010,2016	Reviewer for OCNS annual meeting (Organization for Computational Neuroscience), COSYNE

Organization of Scientific Meetings and Contributions to Conferences

- Co-organization of workshop 'Fingerprints of brain dynamics estimated from neuroimaging data and application to discrimination between individuals, tasks and/or conditions' during OCNS annual meeting 2017 in Antwerp (Belgium), 60 participants
- Co-organization of workshop 'Multi-area models of cortex' during OCNS annual meeting 2016 in Jeju (Korea), 60 participants
- Co-organization of workshop 'Synaptic plasticity and homeostasis' during OCNS annual meeting 2015 in Prague (Czech Republic), 50 participants
- Oral and/or poster presentation at OCNS 2007, ICONIP 2007, OCNS 2008, NeuroComp 2008, COSYNE 2009, OCNS 2009, ICCN 2011, OCNS 2011, Barccsyn 2014, OCNS 2014, OCNS 2015, Barccsyn 2016, OCNS 2016, Neural Coding 2016, Brain Modes 2016, OCNS 2017, Coupling and Causality in Complex Systems 2017, Barccsyn 2018, Neural Coding 2018

Invited Talks

- 2016: Neural Coding 2016, Köln (Germany)
- 2014: Satellite workshop 'The Complex Brain' of EECS'14, Lucca (Italy)
- 2012: Workshop on 'Inhibitory synaptic plasticity', COSYNE
- 2011: Workshop on Learning and Plasticity, in Marseille (France)
- 2011: Joint BCCN Freiburg-Berlin Workshop on Point Processes in Neuroscience

Supervision of Graduate Students and Postdoctoral Fellows

- 2015- now: 3 PhD students (2 in shared supervision) / 3 Master students (1 in shared supervision)
  Computational Neuroscience Group, Universtitat Pompeu Fabra, Spain
- 2012 - 2013: 1 Postdoc / 1 Master students
  Lab for Neural Circuit Theory, Brain Science Institute, Riken, Japan
- 2011 - 2014: 1 PhD Student
  Department of Electrical and Electronic Engineering, The University of Melbourne, Australia

Peer-reviewed Publications

1. **Gilson M**, Kouvaris NE, Deco G, Zamora-López G (2018)
   Framework based on communicability and flow to analyze complex network dynamics.
   Phys Rev E 97: 052301; doi: 10.1103/PhysRevE.97.052301
2. Pallarés V*, Insabato A*, Sanjun A, Kühn S, Mantini D, Deco G**, **Gilson M**** (2018)
   Extracting orthogonal subject- and condition-specific signatures from fMRI data using whole-brain effective connectivity.
   Neuroimage 178: 238-254; doi: 10.1016/j.neuroimage.2018.04.070
3. Glomb K, Ponce-Alvarez A, **Gilson M**, Ritter P, Deco G (2018)
   Stereotypical modulations in dynamic functional connectivity explained by changes in BOLD variance.
   Neuroimage 171: 40-54; doi: 10.1016/j.neuroimage.2017.12.074

4. Senden M*, Reuter N*, van den Heuvel M, Goebel R, Deco G, **Gilson M** (2018)
   Task-related effective connectivity reveals that the cortical rich club gates cortex-wide communication.
   Hum Brain Mapp 39: 1246-1262; doi: 10.1002/hbm.23913
5. **Gilson M** (2018)
   Analysis of fMRI data using noise-diffusion network models: a new covariance-coding perspective.
   Biol Cybern 112: 153-161; doi: 10.1007/s00422-017-0741-y
6. Rolls ET*, Cheng W*, **Gilson M***, Qiu J*, Hu Z*, Ruan H, Li Y, Huang C-C, Yang AC, Tsai S-J, Zhang X, Zhuang K, Lin C-P, Deco G, Xie P, Feng J (2018)
   Effective connectivity in depression.
   Biol Psychiatry CNNI 3: 187-197; doi: 10.1016/j.bpsc.2017.10.004
7. Glomb K, Ponce-Alvarez A, **Gilson M**, Ritter P, Deco G (2017)
   Resting state networks in empirical and simulated dynamic functional connectivity.
   Neuroimage 159: 388-402 doi: 10.1016/j.neuroimage.2017.07.065
8. **Gilson M**, Deco G, Friston K, Hagmann P, Mantini D, Betti V, Romani GL, Corbetta M (2018)
   Effective connectivity inferred from fMRI transition dynamics during movie viewing points to a balanced reconfiguration of cortical interactions.
   Neuroimage doi: 10.1016/j.neuroimage.
9. **Gilson M***, Tauste Campo A*, Chen X, Thiele A, Deco G (2017)
   Non-parametric test for connectivity detection in multivariate autoregressive networks and application to multiunit activity data.
   Network Neurosci 1: 357-380; doi: 10.1162/NETN_a_00019
10. **Gilson M**, Moreno-Bote R, Ponce-Alvarez A, Ritter P, Deco G (2016)
    Estimation of Directed Effective Connectivity from fMRI Functional Connectivity Hints at Asymmetries of Cortical Connectome.
    PLoS Comput Biol 12: e1004762; doi: 10.1371/journal.pcbi.1004762
11. Yger P, **Gilson M** (2015)
    Models of Metaplasticity: A Review of Concepts.
    Front Comput Neurosci 9: 138; doi: 10.3389/fncom.2015.00138
12. Borovkov K, Decrouez G, **Gilson M** (2014)
    On stationary distributions of stochastic neural networks.
    J Appl Probab 51: 837-857; doi: 10.1239/jap/1409932677
13. Kleberg FI, Fukai T, **Gilson M** (2014)
    Excitatory and inhibitory STDP jointly tune feedforward neural circuits to selectively propagate correlated spiking activity.
    Front Comput Neurosci 8: 53; doi: 10.3389/fncom.2014.00053
14. Kerr RR, Grayden DB, Thomas DA, **Gilson M**, Burkitt AN (2014)
    Coexistence of reward and unsupervised learning during the operant conditioning of neural firing rates.
    PLoS ONE 9: e87123; doi: 10.1371/journal.pone.0087123
15. Kerr RR, Grayden DB, Thomas DA, **Gilson M**, Burkitt AN (2014)
    Goal-directed control with cortical units that are gated by both top-down feedback and oscillatory coherence.
    Front Neural Circuits 8: 94; doi: 10.3389/fncir.2014.00094

16. Kerr RR, Burkitt AN, Thomas DA, **Gilson M**, Grayden DB (2013)
Delay Selection by Spike-Timing-Dependent Plasticity in Recurrent Networks of Spiking Neurons Receiving Oscillatory Inputs.
PLoS Comput Biol 9: e1002897; doi: 10.1371/journal.pcbi.1002897

17. Vogels TP, Froemke RC, Doyon N, **Gilson M**, Haas JS, Liu R, Maffei A, Miller P, Wierenga CJ, Woodin MA, Zenke F, Sprekeler H (2013)
Inhibitory synaptic plasticity: spike timing-dependence and putative network function.
Front Neural Circuits 7: 119; doi: 10.3389/fncir.2013.00119

18. **Gilson M**, Fukai T, Burkitt AN (2012)
Spectral Analysis of Input Spike Trains by Spike-Timing-Dependent Plasticity.
PLoS Comput Biol 8: e1002584; doi: 10.1371/journal.pcbi.1002584

19. **Gilson M***, Bürck M*, Burkitt AN, van Hemmen JL (2012)
Frequency Selectivity Emerging from Spike-Timing-Dependent Plasticity.
Neural Comput 24: 2251–2279; doi: 10.1162/NECO_a_00331

20. **Gilson M***, Masquelier T*, Hugues E (2011)
STDP allows fast rate-modulated coding with Poisson-like spike trains
PLoS Comput Biol 7: e1002231; doi: 10.1371/journal.pcbi.1002231

21. **Gilson M**, Fukai T (2011)
Stability versus Neuronal Specialization for STDP: Long-Tail Weight Distributions Solve the Dilemma.
PLoS ONE 6: e25339; doi: 10.1371/journal.pone.0025339

22. **Gilson M**, Burkitt AN, van Hemmen JL (2010)
STDP in recurrent neuronal networks.
Front Comput Neurosci 4: 23; doi: 10.3389/fncom.2010.00023

23. **Gilson M**, Burkitt AN, Grayden DB, Thomas DA, van Hemmen JL (2010)
Representation of input structure in synaptic weights by spike-timing-dependent plasticity.
Phys Rev E 82: 021912; doi: 10.1103/PhysRevE.82.021912

24. **Gilson M**, Burkitt AN, Grayden DB, Thomas DA, van Hemmen JL (2010)
Emergence of network structure due to spike-timing-dependent plasticity in recurrent neuronal networks V: self-organization schemes and weight dependence.
Biol Cybern 103: 365–386; doi: 10.1007/s00422-010-0405-7

25. **Gilson M**, Burkitt AN, Grayden DB, Thomas DA, van Hemmen JL (2009)
Emergence of network structure due to spike-timing-dependent plasticity in recurrent neuronal net- works IV: Structuring synaptic pathways among recurrent connections.
Biol Cybern 101: 427–444; doi: 10.1007/s00422-009-0346-1

26. **Gilson M**, Burkitt AN, Grayden DB, Thomas DA, van Hemmen JL (2009)
Emergence of network structure due to spike-timing-dependent plasticity in recurrent neuronal networks III: Partially connected neurons driven by spontaneous activity.
Biol Cybern 101: 411–426; doi: 10.1007/s00422-009-0343-4

27. **Gilson M**, Burkitt AN, Grayden DB, Thomas DA, van Hemmen JL (2009)
Emergence of network structure due to spike-timing-dependent plasticity in recurrent neuronal networks II: Input selectivity - symmetry breaking.
Biol Cybern 101: 103–114; doi: 10.1007/s00422-009-0320-y

28. **Gilson M**, Burkitt AN, Grayden DB, Thomas DA, van Hemmen JL (2009)
Emergence of network structure due to spike-timing-dependent plasticity in recurrent neuronal networks I: Input selectivity - strengthening correlated input pathways.
Biol Cybern 101: 81–102; doi: 10.1007/s00422-009-0319-4

29. Burkitt AN, **Gilson M**, van Hemmen JL (2007)
Spike-timing-dependent plasticity for neurons with recurrent connections.
Biol Cybern 96: 533–546; doi: 10.1007/s00422-007-0148-2

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