VLADIMIR ITSKOV · CV

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Research interests

Applied algebraic topology. Convex geometry.
Theoretical and computational neuroscience.
Mathematics arising from neural networks and neural coding.

Employment

Department of Mathematics, Pennsylvania State University — University Park, PA
Associate Professor — 08/2014–

Department of Mathematics, University of Nebraska-Lincoln — Lincoln, NE
Assistant Professor — 08/2009–07/2014

Center for Theoretical Neuroscience, Columbia University — New York, NY
Swartz Postdoctoral Fellow — 09/2006–08/2009

Center for Molecular and Behavioral Neuroscience, Rutgers University — Newark, NJ
Research Assistant Professor — 06/2004–08/2006

Department of Mathematics, Duke University — Durham, NC
Visiting Assistant Professor — 01/2003–05/2004

Max-Planck-Institut für Mathematik — Bonn, Germany
Postdoctoral fellow — 09/2002–12/2002

Education

University of Minnesota — Minneapolis, MN
Ph.D. in Mathematics (Differential Geometry & Mathematical Physics) — 08/2002

Moscow Institute of Electronics and Mathematics — Moscow, Russia
B.A. in Mathematics — 1995

Research funding

Joint NSF DMS/NIGMS grant, R01GM117592 (single PI),
"Topological methods for detection of low-dimensional and low-rank structure in biological networks" — August 2015 – April 2019 ($600,000)

NSF IOS-1555925 (co-PI with 5 other PIs)
"Collaborative Research: Analysis of the Mammalian Olfactory Code" — November 2015 – October 2018 (PSU budget: $395,701)

DARPA Young Faculty Award W911NF-15-1-0084 (single PI), — March 2015–Feb 2017 ($504,386)

Janelia Farm Visitor Program - Howard Hughes Medical Institute
(co-PI , with E. Pastalkova & C. Curto) *"Development of a mathematical tool for rigorous analysis of neural activity sequences"* — 2013-16 *(*$114,932*)*

NSF DMS 1122519 (single PI), *"Topology of neural coding in recurrent networks: theory and data analysis."* — 2011–15 ($316,862)

NSF DMS 0818227 (single PI), *"Relating stimulus space geometry and topology to neural network activity and connectivity."* — 2008–12 ($124,937)

Swartz postdoctoral Fellowship in Theoretical Neuroscience — 2006–09

Preprints

21. J. Cruz, C. Giusti, V. Itskov, B. Kronholm. *On open and closed convex codes.* 2016. Available at arXiv:1609.03502 [math.CO]

20. K. Morrison, A. Degeratu, V. Itskov, C. Curto. *Diversity of emergent dynamics in competitive threshold-linear networks: a preliminary report*. 2016. Available at arXiv:1605.04463

Peer-reviewed publications

19. C. Giusti, E. Pastalkova, C. Curto†, **V. Itskov**† (†*equal last authors*). *Clique topology reveals intrinsic geometric structure in neural correlations.* Proceedings of the National Academy of Sciences, 112 (44):13455-13460, 2015.

18. C. Giusti, **V. Itskov**. *A no-go theorem for one-layer feedforward networks.* Neural Computation, 26(11):2527-2540, 2014.

17. C. Curto, A. Degeratu, **V. Itskov**. *Encoding binary neural codes in networks of threshold-linear neurons.* Neural Computation, 25(11):2858-2903, 2013.

16. C. Curto, **V. Itskov**, A. Veliz-Cuba, N. Youngs. *The neural ring: an algebraic tool for analyzing the intrinsic structure of neural codes.* Bulletin of Mathematical Biology, 75:1571-1611, 2013.

15. C. Curto, **V. Itskov**, K. Morrison, Z. Roth, J.L. Walker. *Combinatorial neural codes from a mathematical coding theory perspective.* Neural Computation, 25(7):1891-1925, 2013.

14. C. Curto, A.Degeratu, **V. Itskov**. *Flexible memory networks.* Bulletin of Mathematical Biology, 74:590-614, 2012.

13. C. Lacefield, **V. Itskov**, T. Reardon, R. Hen, J. Gordon. *Effects of Adult-Generated Granule Cells on Coordinated Network Activity in the Dentate Gyrus.* Hippocampus, 22(1):106-116, 2012.

12. **V. Itskov**, D. Hansel, M. Tsodyks. *Short-term facilitation may stabilize parametric working memory trace.* Frontiers in Computational Neuroscience, 5:1-19, 2011.

11. **V. Itskov***, C. Curto*, E. Pastalkova, G. Buzsaki. *Cell assembly sequences arising from spike threshold adaptation keep track of time in the hippocampus.* Journal of Neuroscience, 31(8):2828-2834, 2011. (**equal contribution*)

10. **V. Itskov**, P.J. Olver, F.Valiquette. *Lie Completion of Pseudo-Groups.* Transformation Groups, 16(1):161-173, 2011.

9. K.D. Harris, P. Bartho, P. Chadderton, C. Curto, J. de la Rocha, L. Hollender, **V. Itskov**, A. Luczak, S. Marguet, A. Renart, S. Sakata. How do neurons work together? Lessons from auditory cortex. Hearing Research, Vol. 271(1-2), 2011, pp. 37-53

8. C. Curto, S. Sakata, S. Marguet, **V. Itskov**, K.D. Harris. *A simple model of cortical dynamics explains variability and state-dependence of sensory responses in urethane-anesthetized auditory cortex.* Journal of Neuroscience, Vol. 29(34):10600-10612, 2009.

7. C. Curto*, **V. Itskov*** (**equal contribution*). *Cell groups reveal structure of stimulus space.* PLoS Computational Biology, Vol. 4(10), 2008.

6. **V. Itskov**, L. F. Abbott. *Pattern Capacity of a Perceptron for Sparse Discrimination*. Physical Review Letters, 101(1), 2008.

5. **V. Itskov**, E. Pastalkova, K. Mizuseki, G. Buzsaki, K. D. Harris. *Theta-mediated dynamics of spatial information in hippocampus.* Journal of Neuroscience, 28(23), 2008.

4. E. Pastalkova, **V. Itskov**, A. Amarasingham, G. Buzsaki. *Internally Generated Cell Assembly Sequences in the Rat Hippocampus.* Science, 321(5894):1322 - 1327, 2008.

3. **V. Itskov**, C. Curto, K.D. Harris. *Valuations for spike train prediction*. Neural Computation, 20 (3): 644-667, 2008.

2. **V. Itskov.** *Orbit reduction of contact ideals.* Contemporary Mathematics. 285:171-181, 2001.

1. **V. Itskov**, M.Karasev, and Yu.Vorobjev. *Infinitesimal Poisson cohomology.* In "Coherent transform, quantization, and Poisson geometry". AMS Trans. Ser. 2, 187, 327-360, 1998.