

Curriculum Vitae Aaditya V. Rangan

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- **Academic Affiliations and Professional Experience**

- o 2012-present: Courant Institute, NYU. Associate Professor
- o 2006-2012: Courant Institute, NYU. Assistant Professor
- o 2003-2006: Courant Institute, NYU. Postdoctoral Student
- o 1999-2003: University of California, Berkeley. Graduate Student

- **Education**

- o 2003: Ph.D. in Mathematics, University of California, Berkeley.
- o 1999: B.A. in Mathematics and Physics, Dartmouth College.

- **Research Interests**

- o Large-scale scientific modeling of physical, biological and neurobiological phenomena, and the development of efficient numerical methods and related analysis.
- o Large-scale analysis of genomic data, and the development of efficient methods for this analysis.
- o Computational tools for analyzing cryo-electron microscopy (Cryo-EM) data.

- **Grants and Awards:**

- o NIH grant U19 AG023122, \$405,085, 2018-2023
- o NSF-NIH seed grant 24-74501-X0096-R9834: \$24,696, 2016-2017.
- o NSF grant F7163: \$355,580, 2012-2015.
- o NSF grant F6532: \$270,000, 2009-2012.
- o Swartz Foundation: \$54,000, 2006-2007.

- **Professional Associations**

- o 2018-present: Schork Lab, TGen, Affiliated Researcher
- o 2016-present: Flatiron Institute Center for Computational Mathematics, Consultant
- o 2015-present: NCBI dbGaP, Member
- o 2013-present: Psychiatric Genomics Consortium (PGC), Member

- **Professional Activities**

- o Advised Postdoctoral fellows Y. Sun, D. Zhou, D. Hu and J. Zhang
- o Advised Ph.D. thesis research of M. Patel (M.D. Ph.D. Student) and Zhongyi Wang.
- o Advised master's thesis research of Arjang Talattof, Brenda Jiminez, Rachid Ounit, Zuo Xi, Andrew Ronan, Sijing Shao, Quentin Chediak, Haosheng Zhao and Shreya Thirumalai.
- o Reviewer for various academic journals.
- o Grant Reviewer for DOE, NSF and NIH.

- **Publications**

- o A.V. Rangan, W.S. Tang, P. Cossio, K. Zhang, N. Grigorieff. Estimating the tails of the spectrum of the Hessian of the log-likelihood for *ab-initio* single-particle reconstruction in electron cryomicroscopy. <https://arxiv.org/abs/2411.13263>. (2024).
- o W.S. Tang, J. Soules, A.V. Rangan, P. Cossio. CryoLike: A python package for Cryo-EM image-to-structure likelihood calculations. *Acta Cryst. D.* (under review). <https://doi.org/10.1101/2024.10.18.619077>. (2024).
- o K. Zhang, P. Cossio, A.V. Rangan, B.A. Lucas, N. Grigorieff. *New Statistical Metric for Robust Target Detection in Cryo-EM*. International Union of Crystallography (IUCr) J. accepted and in press. <https://doi.org/10.1101/2024.10.01.616095>. (2024).
- o C. McGrouther, A.V. Rangan, A. Di Florio, J.A. Elman, N.J. Schork, J. Kelsoe, the Bipolar Disorder Working Group of the Psychiatric Genomics Consortium. *Heterogeneity analysis provides evidence for a genetically homogeneous subtype of bipolar-disorder*. *PLoS Comput. Bio.* accepted and in press. <https://arxiv.org/abs/2405.00159> (2024).
- o K.S. O'Connell, M. Koromina, T. van der Veen, T. Boltz, F.S. David, J. Mei Kay Yang, K.H. Lin, X. Wang, J.R.I. Coleman, B.L. Mitchell, C. McGrouther, A.V. Rangan, P.A. Lind, E. Koch, A. Harder, N. Parker, J. Bendl, et al. *Genomics yields biological and phenotypic insights into bipolar disorder*. *Nature*. accepted and in press (2024).
- o J.A. Elman, N.J. Schork, A.V. Rangan, the Alzheimer's Disease Neuroimaging Initiative. *Exploring the genetic heterogeneity of Alzheimer's disease: Evidence for genetic subtypes*. *Journal of Alzheimer's Disease*. accepted and in press. medRxiv 2023.05.02.23289347; doi: <https://doi.org/10.1101/2023.05.02.23289347>. (2024).
- o H. Zhou, W. Lin, S.R. Labra, S.A. Lipton, J.A. Elman, N.J. Schork, A.V. Rangan. *Detecting Boolean Asymmetric Relationships with a Loop Counting Technique and its Implications for Analyzing Heterogeneity within Gene Expression Datasets*. *IEEE/ACM Transactions on Computational Biology and Bioinformatics*. accepted and in press. bioRxiv 2022.08.04.502792; doi: <https://doi.org/10.1101/2022.08.04.502792>. (2023).
- o A.V. Rangan, L. Greengard. *Robust ab initio solution of the cryo-EM reconstruction problem at low resolution with small data sets*. *J. Structural Biology*. 215(3): 107994. (2023).
- o A.V. Rangan, C. McGrouther, N. Bhadra, S. Venn-Watson, E.D. Jensen, N.S. Schork. *A time-series analysis of blood-based biomarkers within a 25-year longitudinal dolphin cohort*. *PLoS Comput. Bio.* 19(2): 10.1371/journal.pcbi.1010890. (2023).
- o A.P. Chan, Y. Choi, A.V. Rangan, G. Zhang, A. Podder, M. Berens, S. Sharma, P. Pirrotte, S. Byron, D. Duggan, N.J. Schork. *Interrogating the Human Diplome: Computational Methods, Emerging Applications, and Challenges*. *Methods Mol Biol.* 2023;2590:1-30. doi: 10.1007/978-1-0716-2819-5_1. PMID: 36335489. (2022).
- o A.V. Rangan., *Radial recombination for rigid rotational alignment of images and volumes*. *Inverse Problems*. 39(1): 10.1088/1361-6420/aca047. (2022).
- o H. Tuckman, J. Kim, A.V. Rangan, H. Lei, M. Patel. *Dynamics of sensory integration of olfactory and mechanical stimuli within the response patterns of moth antennal lobe neurons*. *J. Theoretical Biology*. 509(21): 110510. (2021).
- o M. Patel and A.V. Rangan. *Olfactory encoding within the insect antennal lobe: The emergence and role of higher order temporal correlations in the dynamics of antennal lobe spiking activity*. *J. Theoretical Biology*. Aug 7;522:110700. doi: 10.1016/j.jtbi.2021.110700. Epub 2021 Apr 2. (2021).
- o L.S. Young, L. Tao, M. Shelley, R. Shapley, A.V. Rangan and D.W. McLaughlin. *The evolution of large-scale modeling of monkey primary visual cortex, V1: Steps towards understanding cortical function*. *Commun. Math. Sci.* 17(5): 1387-1406. (2019).
- o A.V. Rangan, M. Spivak, J. Anden and A. Barnett, *Factorization of the translation kernel for fast rigid image alignment*. *Inverse Problems*. <http://iopscience.iop.org/10.1088/1361-6420/ab4e66> (2019).

- o J.W. Zhang, Y.X. Shao, A.V. Rangan, L. Tao, A coarse-graining framework for spiking neuronal networks: from strongly-coupled conductance-based integrate-and-fire neurons to augmented systems of ODEs. *J. Comput. Neurosci.* 46(2): 211-232. (2019).
- o A.V. Rangan, C.C. McGruther, J. Kelsoe, N. Schork, E. Stahl, Q. Zhu, A. Krishnan, V. Yao, O. Troyanskaya, S. Bilaloglu, P. Raghavan, S. Bergen, A. Jureus, M. Landen and the Bipolar Disorders Working Group of the Psychiatric Genomics Consortium, *A loop-counting method for covariate-corrected low-rank biclustering of gene-expression and genome-wide association study data.* *PLoS Computational Biology.* <https://doi.org/10.1371/journal.pcbi.1006105> (2018).
- o M. Patel, A.V. Rangan, *Role of the locus coeruleus in the emergence of power law wake bouts in a model of the brainstem sleep-wake system through early infancy.* *J. Theoretical Biology.* 426(7): 82-95 (2017).
- o H. Lei, Y. Yu, S. Zhu, A.V. Rangan, *Intrinsic and network mechanisms constrain neural synchrony in the moth antennal lobe.* *Frontiers in Physiology*, doi: 10.3389/fphys.2016.00080 (2016).
- o J. Zhang, A.V. Rangan, *A reduction for spiking integrate-and-fire network dynamics ranging from homogeneity to synchrony.* *J. Comput. Neurosci.* 38(2):355-404. doi: 10.1007/s10827-014-0543-3 (2015).
- o J. Zhang, D. Zhou, D. Cai and A.V. Rangan, *A coarse-grained framework for spiking neuronal networks: between homogeneity and synchrony.* *J. Comput. Neurosci.* DOI 10.1007/s10827-013-0488-y (2013).
- o A.V. Rangan, L.S. Young. *Emergent dynamics in a model of visual cortex.*, *J. Comput. Neurosci.* 35(2): 155-167 DOI: 10.1007/s10827-013-0445-9 (2013).
- o D. Zhou, A.V. Rangan, D.W. McLaughlin and D. Cai, *Spatiotemporal dynamics of neuronal population response in the primary visual cortex.* *Proc. Nat. Acad. Sci. (USA).* 110(23): 9517-9522 (2013)
- o J. Zhang, K.A. Newhall, D. Zhou and A.V. Rangan, *Distribution of correlated spiking events in a population-based approach for Integrate-and-Fire networks.* *J. Comput. Neurosci.* 10.1007/s10827-013-0472-6 (2013).
- o A.V. Rangan, L.S. Young. *Dynamics of spiking neurons: between homogeneity and synchrony.* *J. Comput. Neurosci.* 34(3) 433-460 DOI: 10.1007/s10827-012-0429-1 (2013).
- o M. Patel, A.V. Rangan, D. Cai. *Coding of odors by temporal binding within a model network of the locust antennal lobe,* *Frontiers in Computational Neuroscience.* 7(50) DOI: 10.3389/fncom.2013.00050. (2013).
- o A.V. Rangan, *A simple filter for detecting low-rank submatrices,* *J. Comput. Phys.* 231(7): 2682-2690, (2012).
- o A.V. Rangan, *Detecting low-rank clusters of vectors via random sampling,* *J. Comput. Phys.* 231(1): 215-222, (2012).
- o D. Hu, D. Cai and A.V. Rangan, *Blood Vessel Adaptation with Fluctuations in Capillary Flow Distribution.* *PLoS One.* 7(9): e45444 (2012).
- o A.V. Rangan, *Functional Roles for Synaptic-Depression within a Model of the Fly Antennal Lobe,* *PLoS Comput. Bio.* 8(8): e1002622. (2012).
- o D. Cai, L. Tao, M.S. Shkarayev, A.V. Rangan, D.W. McLaughlin, G. Kovacic, *The role of fluctuations in coarse-grained descriptions of neuronal networks.* *Comm. Math. Sci.* 10(1): 307-354 (2012).
- o Y. Sun, A.V. Rangan, D. Zhou and D. Cai, *Coarse-grained event tree analysis for quantifying Hodgkin-Huxley neuronal network dynamics.* *J. Comput. Neurosci.* 32(1): 55-72. (2012).
- o A.V. Rangan, *Efficient methods for grouping vectors into low-rank clusters,* *J. Comput. Phys.* 230(14): 5684-5703, (2011).
- o D. Zhou, Y. Sun, A.V. Rangan, D. Cai, *Spectrum of Lyapunov exponents of non-smooth dynamical systems of integrate-and-fire type.*, *J. Comput. Neurosci.* 28(2): 229-245, (2010).

- o Y. Sun, D. Zhou, A.V. Rangan, and D. Cai, *Pseudo-Lyapunov exponents and predictability of Hodgkin-Huxley neuronal network dynamics*, J. Comput. Neurosci. 28(2): 2247-266, (2010).
- o M.S. Shkarayev, G. Kovacic, A.V. Rangan, and D. Cai. *Architectural and functional connectivity in scale-free integrate-and-fire networks*, Europhys. Lett. 88, 50001, (2010).
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- o K.A. Newhall, G. Kovacic, P.R. Kramer, D. Zhou, A.V. Rangan, and D. Cai, *Dynamics of current-based Poisson driven, integrate-and-fire neuronal networks*, Commun. Math. Sci. 8(2): 541-600, (2010).
- o A.V. Rangan, *Diagrammatic expansion of pulse-coupled network dynamics in terms of subnetworks*, Phys. Rev. E. 80(3): 036101, (2009).
- o A.V. Rangan, *Diagrammatic expansion of pulse-coupled network dynamics*, Phys. Rev. Lett. 102, 158101, (2009).
- o G. Kovacic, A.V. Rangan, L. Tao, and D. Cai, *Fokker-Planck description of conductance-based integrate-and-fire neuronal networks*, Phys. Rev. E, 80:021904, (2009).
- o M. Patel, A.V. Rangan, and D. Cai, *A Large-scale Model of Locust Antennal Lobe*, J. Comput. Neurosci. 27(3): 553-567, (2009).
- o Y. Sun, D. Zhou, A.V. Rangan, and D. Cai, *Library-based Numerical Reduction of the Hodgkin-Huxley Neuron for Network Simulation*, J. Comput. Neurosci. DOI 10.1007/s10827-009-0151-9, (2009).
- o A.V. Rangan, L. Tao, G. Kovacic, and D. Cai, *Large-Scale Computational Modeling of the Primary Visual Cortex*, In K. Josic, M.A. Matias, R. Romo, and J. Rubin, editors, *Coherent Behavior in Neuronal Networks*, volume 3 of *Springer Series in Computational Neuroscience*, Springer-Verlag, 263-296, (2009).
- o A.V. Rangan, L. Tao, G. Kovacic, and D. Cai, *Multi-scale Modeling of the Primary Visual Cortex*, IEEE Engineering in Medicine and Biology Magazine, 28(3):19-24, (2009).
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- o A.V. Rangan, D. Cai and D. McLaughlin, *Quantifying neuronal network dynamics through coarse-grained event trees*, Proc. Nat. Acad. Sci. (USA), 105, 10990 (2008).
- o A.V. Rangan, D. Cai and G. Kovacic, *Kinetic theory for neuronal networks with fast and slow excitatory conductances driven by the same spike train*, Phys. Rev. E 77 041915 (2008)
- o A.V. Rangan and D. Cai, *Fast numerical methods for simulating large-scale integrate-and-fire neuronal networks*, J. Comput. Neurosci. 22, 81-100 (2007).
- o A.V. Rangan, *Automatic coordinate transformation for two-point boundary value problems*, Commun. Math Sci. 5 (2007).
- o A.V. Rangan, D. Cai and L. Tao, *Numerical methods for solving moment equations in kinetic theory of neuronal network dynamics*, J. Comput. Phys. 221, 781-798 (2007).
- o A.V. Rangan and D. Cai, *Maximum-entropy closures for kinetic theories of neuronal network dynamics*, Phys. Rev. Lett. 96, 178101 (2006).
- o D. Cai, L. Tao, A.V. Rangan and D. McLaughlin, *Kinetic theory for neuronal network dynamics*, Comm. Math. Sci. 4, 97 (2006).
- o A.V. Rangan, D. Cai and D. McLaughlin, *Modeling the spatiotemporal cortical activity associated with the line-motion illusion in primary visual cortex*, Proc. Natl. Acad. Sci. (USA), 102, 18793 (2005).
- o D. Cai, A.V. Rangan and D. McLaughlin, *Architectural and synaptic mechanisms underlying coherent spontaneous activity in V1*, Proc. Natl. Acad. Sci. (USA), 102, 5868 (2005).
- o A.V. Rangan, *Adaptive solvers for partial differential and differential-algebraic equations*, Ph.D. Thesis (2003).

