

# UYGAR SÜMBÜL

Grossman Center Postdoctoral Scholar at Columbia University – uyyar@stat.columbia.edu

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## EDUCATION and POSTDOCTORAL TRAINING

Postdoc.	(2014 – )	Grossman Center for the Statistics of Mind Advisor: Prof. Liam Paninski	Columbia University	NY
Postdoc.	(2009 – 2014)	Brain and Cognitive Sciences Advisor: Prof. Sebastian Seung	M.I.T.	MA
	(2012 – 2014)	Mass. Eye & Ear Infirmery Advisor: Prof. Richard Masland	Harvard Medical School	MA
Ph.D.	(2005 – 2009)	Electrical Engineering Advisor: Prof. John Pauly	Stanford University	CA
Ph.D. Minor	(2007 – 2009)	Mathematics	Stanford University	CA
M.S.	(2003 – 2005)	Electrical Engineering	Stanford University	CA
B.S.	(1999 – 2003)	Electrical Engineering Advisor: Prof. Haldun Ozaktas	Bilkent University	Turkey

## AWARDS, HONORS and SERVICE

- Grossman Center Postdoctoral Scholar, 2014 – present
- Stanford University EE Department Johnson-Lebacqz Fellowship, 2003 – 2004
- 1<sup>st</sup> in National Postgraduate Admissions Exam over approximately 125,000 candidates, 2003
- Bilkent University Scholarship, 1999 – 2003
- 14<sup>th</sup> in National University Admissions Exam over approximately 1,500,000 candidates, 1999
- Akdeniz Koleji M.C.U. Science High School Scholarship, 1996 – 1999
- Bronze medalist, Akdeniz University Nationwide Mathematics Olympiad, 1998
- Reviewer for Magnetic Resonance in Medicine, IEEE Transactions on Medical Imaging, IEEE Transactions on Signal Processing, IEEE Signal Processing Letters, Signal Processing, Neuroinformatics, Frontiers in Neuroanatomy, ICML, NIPS, COSYNE

## FULL PAPERS

- U. Sümbül, D. Roossien Jr., F. Chen, N. Barry, E. Boyden, D. Cai, J. P. Cunningham, and L. Paninski, *Automated scalable segmentation of neurons from multispectral images*, Advances in Neural Information Processing Systems, 2016
- U. Sümbül, H. Cuntz, and H. S. Seung, *Comparing neuronal arbors in entirety*, (in preparation)
- U. Sümbül\*, A. Zlateski\*, A. Vishwanathan, and H. S. Seung, *Automated computation of arbor densities: a step toward identifying neuronal cell types*, Frontiers in Neuroanatomy, 2014
- H. S. Seung and U. Sümbül, *Neuronal cell types and connectivity: lessons from the retina*, Neuron, 2014.
- N. Miyasaka, I. Arganda-Carreras, N. Wakisaka, M. Masuda, U. Sümbül, H. S. Seung, and Y. Yoshihara, *Olfactory projectome in the zebrafish forebrain revealed by genetic single-neuron labeling*, Nature Communications, 2014
- U. Sümbül\*, S. Song\*, K. McCulloch, M. Becker, B. Lin, J. R. Sanes, R. H. Masland, and H. S. Seung, *A genetic and computational approach to structural classification of neuronal types*, Nature Communications, 2014
- U. Sümbül, J. M. Santos, and J. M. Pauly, *A practical acceleration algorithm for real-time MRI*, IEEE Transactions on Medical Imaging, 2009
- U. Sümbül, J. M. Santos, and J. M. Pauly, *Improved time series reconstruction for dynamic magnetic resonance imaging*, IEEE Transactions on Medical Imaging, 2009
- H. M. Ozaktas and U. Sümbül, *Interpolating between periodicity and discreteness through the fractional Fourier transform*, IEEE Transactions on Signal Processing, 2006
- U. Sümbül and H. M. Ozaktas, *Fractional free-space, fractional lenses, and fractional imaging systems*, Journal of the Optical Society of America A, 2003

## CONFERENCE ABSTRACTS

- U. Sümbül, D. Roossien Jr., F. Chen, N. Barry, E. Boyden, D. Cai, J. P. Cunningham, and L. Paninski, *Methods for color-coded connectomics*, NIPS Connectomics Workshop, 2016
- U. Sümbül, S. Keshri, M.-H. Oh, D. Cai, J. P. Cunningham, and L. Paninski, *Semi-supervised segmentation of neurons from Brainbow images*, Data, Algorithms and Problems on Graphs, New York, 2015
- U. Sümbül, S. Song, M. Becker, K. McCulloch, R. H. Masland, and H. S. Seung, *Combining morphology and genetics towards a solution of the cell type identification problem*, Neuroscience 2012 – SfN Annual Meeting, New Orleans, 2012
- U. Sümbül, S. Song, K. McCulloch, M. Becker, R. H. Masland, and H. S. Seung, *Stratification stereotypy of genetically defined retinal ganglion cell types*, ARVO Annual Meeting, Ft. Lauderdale, 2012
- U. Sümbül, S. Song, K. McCulloch, B. Lin, R. H. Masland, and H. S. Seung, *Semi-automatic reconstruction of retinal ganglion cells using convolutional neural networks*, Neuroscience 2010 – SfN Annual Meeting, San Diego, 2010
- U. Sümbül and J. M. Pauly, *Practicality makes a comeback: Dynamic MRI without the overhead*, ISMRM 17<sup>th</sup> Scientific Meeting, Honolulu, 2009
- U. Sümbül, J. M. Santos, and J. M. Pauly, *Accelerating dynamic MRI via spatially varying causal windows*, ISMRM 17<sup>th</sup> Scientific Meeting, Honolulu, 2009
- U. Sümbül and J. M. Pauly, *Each pixel is a separate event: Application to dynamic MRI*, BCATS, Stanford, 2008
- U. Sümbül, J. M. Santos, and J. M. Pauly, *Improved time series reconstruction for dynamic MRI*, ISMRM 16<sup>th</sup> Scientific Meeting, Toronto, 2008
- U. Sümbül, J. M. Santos, and J. M. Pauly, *A very fast reconstruction algorithm for non-Cartesian multi-coil dynamic MRI*, ISMRM 16<sup>th</sup> Scientific Meeting, Toronto, 2008
- U. Sümbül, J. M. Santos, and J. M. Pauly, *Obtaining a new frame from each excitation in real-time acquisitions*, ISMRM 15<sup>th</sup> Scientific Meeting, Berlin, 2007
- U. Sümbül, J. M. Santos, and J. M. Pauly, *Fast imaging by using a diagonal covariance matrix*, ISMRM 15<sup>th</sup> Scientific Meeting, Berlin, 2007
- U. Sümbül, J. M. Santos, and J. M. Pauly, *Increasing temporal resolution via Kalman filtering*, ISMRM Real-Time MRI Workshop, Santa Monica, 2006
- U. Sümbül, J. M. Santos, and J. M. Pauly, *High frame rate cardiac imaging using Kalman filtering*, ISMRM 14<sup>th</sup> Scientific Meeting, Seattle, 2006

\* These authors contributed equally to this work.

## SELECTED TALKS

- *Color coded connectomics*, COSYNE Workshop on Computational Anatomy, Salt Lake City, 2017 (invited)
- *Color coded connectomics*, NIPS Connectomics Workshop, Barcelona, Dec. 2016
- *Semi-supervised segmentation of neurons from Brainbow images*, Data, Algorithms and Problems on Graphs, New York, 2015
- *Submicron precision in the retina: classifying the cell types of the brain*, Ernst Strüngmann Institute, Frankfurt, 2015 (invited)
- *Submicron precision in the retina: classifying the cell types of the brain*, Brain lunch, MIT, Cambridge, 2014
- *Accelerating dynamic MRI via spatially varying causal windows*, ISMRM, Honolulu, 2009
- *Improved time series reconstruction for dynamic MRI*, ISMRM, Toronto, 2008
- *Obtaining a new frame from each excitation in real-time acquisitions*, ISMRM, Berlin, 2007

## SKILLS

Programming: MATLAB, Torch, C++, Java, Intel X86 Assembly, L<sup>A</sup>T<sub>E</sub>X, PSPICE  
Operating Systems: Linux, Mac OS X, MS Windows  
Languages: Turkish (native speaker), English (fluent), German (pre-intermediate)

## BRIEF DESCRIPTIONS OF MAJOR PROJECTS

- Whole cell analysis of synapse distributions (with Prof. Liam Paninski and Prof. Franck Polleux)  
*All excitatory and inhibitory synapses on the dendritic arbors of cortical pyramidal neurons are identified using structural and molecular information. Statistical methods are devised to analyze their distributions in wild type and mutant mice.*
- Segmentation of multi-spectral images of nervous tissue (with Prof. Liam Paninski and Prof. Dawen Cai and Prof. Ed Boyden)  
*Hippocampal tissue is imaged either with conventional confocal microscopy or expansion microscopy following viral delivery of the Brainbow construct. An unsupervised algorithm is developed to automate the segmentation.*
- Dynamical system models of cortical activity (with Prof. Liam Paninski, Prof. John Cunningham, and Prof. Mark Churchland)  
*Single-unit and array recordings are obtained from the primate motor cortex during episodic reaching tasks. Dynamical system models are devised to predict the cortical activity and relate it to observed behavior.*
- Comparing neuronal arbors in entirety (with Prof. Sebastian Seung and Prof. Hermann Cuntz)  
*A metric is devised to compare and classify neuronal morphology. This metric is applied to both neuronal populations within the same region (hippocampal and retinal neurons), and time-lapse studies of single neurons.*
- Structural and molecular classification of neuronal types (with Prof. Sebastian Seung, Richard Masland, and Prof. Josh Sanes)  
*Arbors of molecularly defined and at-large neurons are imaged together with a common, molecularly defined dendritic landmark. Computational methods are developed to classify neurons in laminar structures and applied to this dataset.*
- Improved time series reconstruction for dynamic magnetic resonance imaging (PhD thesis, advisor: Prof. John M. Pauly)  
*Acquisition and sampling strategies are developed for causal and fast reconstruction of time-resolved magnetic resonance imaging. Dynamic cardiac activity of healthy volunteers is imaged. A statistical algorithm tracking dynamic behavior from incomplete magnetic resonance data is devised, and applied to this dataset.*
- Interpolating between discreteness and periodicity (Undergraduate thesis, advisor: Prof. Haldun M. Ozaktas)  
*A smooth interpolation between the fundamental concepts of discreteness and periodicity is defined using the fractional Fourier transform and operator formalism. Fractional forms of common operators are derived using this formalism.*