Rebecca Alexis Senft

Cambridge, MA • (518) 332-7332 • senftrebecca@gmail.com • Github: rsenft1 • website: rsenft1.github.io

Scientist specializing in computational image analysis with data science skills and background in neuroscience

EDUCATION

Harvard University — Cambridge, MA
PhD in Neuroscience — August 2015 – November 2020

- Funded by NIH Ruth L. Kirschstein Predoctoral Individual National Research Service Award

Swarthmore College — Swarthmore, PA
BA in Neuroscience with High Honors — August 2011 – June 2015

RESEARCH EXPERIENCE

Broad Institute of MIT and Harvard — Cambridge, MA
Postdoctoral Associate in Beth Cimini's lab — August 2021 – present

- Created custom image analysis pipelines using CellProfiler for high-throughput analysis of 500,000+ images and millions of cells in a cloud environment (AWS).
- Developed image analysis pipelines using deep learning and machine learning to segment cells in 2D and 3D
- Performed data wrangling, hierarchical clustering, and hit selection for custom analyses of a large cell painting dataset with ~13,000 different gene overexpression ORFs.
- Collaborated with wet-lab scientists, pathologists, and other experts to troubleshoot imaging, train machine learning models, and generate reproducible code notebooks for reporting and publication.
- Wrote CellProfiler pipelines and python code to track fluorescent beads over time in a CRISPR-based miniature assay to detect viruses. Coded bootstrapping simulations to validate assay stability (in prep).
- Contributed to open-source software development in Python of CellProfiler and CellProfiler Analyst by fixing bugs and contributing new functionalities, such as visualization of 3D datasets in CellProfiler Analyst.
- Designed custom documentation for DeepProfiler, a deep learning toolset for high-throughput microscopy image analysis (see Moshkov et al., 2022)
- Presented at 10 workshops teaching >300 biologists how to use CellProfiler to analyze their images. Also developed original workshops on how to use deep learning tools Cellpose and StarDist in CellProfiler.
- A leader on the image.sc forum, making 300+ posts answering user questions about image analysis.

Harvard University Medical School — Boston, MA
Graduate Student in Susan Dymecki's lab — April 2016 – August 2021

- Identified a novel circuit from median raphe VGLUT3-expressing Pet1-lineage neurons to VGLUT3+ interneurons in cortex via specialized presynaptic pericellular baskets using immunohistology and confocal microscopy in a transgenic mouse model (see Senft et al., 2021)
- Developed and validated an image analysis pipeline to quantify the neurochemical phenotype of highly collateralized axonal boutons across 13 forebrain target sites (see Senft et al., 2021)
- Coded a custom ImageJ image analysis macro to count mRNA puncta in fluorescent neurons, reducing the time necessary to complete analysis by over 80%. (see Okaty et al., 2020)
- Developed MicCheck, a web app built in R using Shiny to recommend microscopy metadata for biologists to report in publications (see Montero Llopis et al., 2021)

Swarthmore College — Swarthmore, PA
Student Researcher in Alex Baugh's lab — April 2013 – June 2015

- Created the first brain distribution map for expression of mineralocorticoid and glucocorticoid receptor mRNA in the great tit (see Senft et al., 2016)
- Further work modeling the relationship between receptor expression, physiological, and behavioral variables led to my co-authorship on another publication (See Baugh et al., 2017)

SKILLS

Programming languages: R, Python, ImageJ Macro Language, MATLAB

Software/Tools: CellProfiler, AWS, Git/GitHub, Fiji/ImageJ, QuPath, Cellpose, Shiny, Jupyter Book, Jupyter Notebook, RMarkdown, Morpheus, Imaris, Adobe Illustrator, Graphpad PRISM

Experimental skills: Image analysis, fluorescence microscopy (confocal and widefield), immunohistochemistry, RNAscope/*in situ* hybridization, stereotaxic mouse surgery, working with AAVs, mouse behavior, mouse epilepsy models, microdissection, mouse colony management, DNA extraction, PCR, writing IACUC amendments.

COMMUNICATIONS AND OUTREACH EXPERIENCE

Images to Knowledge (I2K) Organizing Committee member and Scientific Committee member 2022
- Developed programming, selected abstracts, created instructions for speakers and participants to organize a virtual conference with over 500 attendees

Presenter and TA for 10 workshops on image analysis with CellProfiler for 300+ total participants 2021 – 2022

Creator of video tutorials for CellProfiler
- *Intro to CellProfiler Analyst* 2022
- *Using Cellpose and StarDist in CellProfiler* 2022

Author, Broad Institute Imaging Platform blog, "Measure everything…ask questions later"
- *How to normalize cell painting data* 2022
- *How to export tiles of large histology images in QuPath* 2022

Olympus Neuroscience Week Junior Scientist Presenter 2020

Advanced Imaging Methods (AIM) Workshop Presenter 2022

Graphics Artist, Science in the News (Harvard University) 2016 – 2021
- Created graphics for 20+ articles and advertising for lectures
- My work is featured in a permanent exhibit in the Museum of Science in Boston

Gallery Guide, *Harvard Museum of Natural History* 2015 – 2019

Mentor, Health Professions Recruitment and Exposure Program (HPREP) 2015 – 2016

Live Animal Center Volunteer, Academy of Natural Sciences of Drexel University 2013 – 2015

TEACHING EXPERIENCE

Harvard University
- MATLAB Bootcamp in Quantitative Methods Teaching Fellow 2020
- Thinking About Data (intermediate MATLAB statistics course) Teaching Fellow 2017, 2020
- Quantitative Microscopy and Experimental Design Nanocourse Co-instructor of Record 2019
- Discipline of Neuroscience Teaching Assistant 2018
- Health Professions Recruitment and Exposure (HPREP) Lecturer 2016, 2017

Swarthmore College
- Introductory Biology Science Associate 2014, 2015
- Genetics Teaching Assistant 2013, 2014, 2015
- Introductory Statistics Teaching Assistant 2013

SELECTED HONORS AND AWARDS

Harvard Center for Biological Imaging Simmons Award 2020

Society for Neuroscience Trainee Professional Development Award 2019

NIH Ruth L. Kirschstein Predoctoral Individual National Research Service Award F31NS108406 2018 – 2021

Harvard University Distinction in Teaching Award 2018

Harvard Brain Science Initiative Young Scientist Travel Award 2018

National Science Foundation GRFP Honorable Mention 2015, 2016

Lucretia Mott Fellowship 2015

Oak Leaf Award 2015

- Awarded to a single woman of the graduating class who is outstanding in leadership and scholarship

Leo M. Leva Memorial Prize 2015

- Awarded to a senior whose work in biology shows unusual promise

Phi Beta Kappa 2015

SELECTED ABSTRACTS

Rebecca A. Senft, Paula Montero Llopis, Lisa A. Cameron, Michelle Itano. Microscopy Metadata Checklist Generator (MicCheck): A Shiny Web App for Reproducible Microscopy Methods Reporting. Advanced Imaging Methods Workshop. *Virtual*. 2022

Rebecca A. Senft, Morgan E., Freret, Susan M. Dymecki. Multiple transcriptomically polarized subtypes of brain serotonergic neurons comprise the behaviorally-relevant median raphe nucleus and likely each modulate distinct forebrain circuits. Society for Neuroscience Annual Meeting. *Chicago, IL*. 2019.

PUBLICATIONS

* These authors contributed equally

11. **Rebecca A. Senft***, Barbara Diaz-Rohrer*, Pina Colarusso, Lucy Swift, Nasim Jamali, Helena Jambor, Thomas Pengo, Craig Brideau, Paula Montero Llopis, Virginie Uhlmann, Jason Kirk, Kevin Andrew Gonzales, Peter Bankhead, Edward L. Evans III, Kevin W. Eliceiri, Beth A. Cimini (2022). A biologist's guide to the field of quantitative bioimaging. Zenodo. https://doi.org/10.5281/zenodo.7439284 (preprint)
10. Nikita Moshkov, Michael Bornholdt, Santiago Benoit, Claire McQuin, Matthew Smith, Allen Goodman, **Rebecca Senft**, Yu Han, Mehrtash Babadi, Peter Horvath, Beth A. Cimini, Anne E. Carpenter, Shantanu Singh, Juan C Caicedo. Learning representations for image-based profiling of perturbations. (2022). *bioRxiv* (preprint)
9. Benjamin de Bivort, Sean Buchanan, Kyobi Skutt-Kakaria, Erika Gajda, Julien Ayroles, Chelsea O'Leary, Pablo Reimers, Jamilla Akhund-Zade, **Rebecca Senft**, Ryan Maloney, Sandra Ho, Zach Werkhoven, Matthew A-Y Smith. Precise Quantification of Behavioral Individuality From 80 Million Decisions Across 183,000 Flies. (2022). *Front Behav Neurosci.*
8. **Rebecca A. Senft** and Susan M. Dymecki. Neuronal pericellular baskets: neurotransmitter convergence and regulation of network excitability. (2021). *Trends in Neurosciences.*
7. Paula Montero Llopis, **Rebecca A. Senft**, Tim J. Ross-Elliott, Ryan Stephansky, Daniel P. Keeley, Preman Koshar, Guillermo Marqués, Ya-Sheng Gao, Benjamin R. Carlson, Thomas Pengo, Mark A. Sanders, Lisa A. Cameron, Michelle S. Itano. Best practices and tools for reporting reproducible fluorescence microscopy methods. (2021). *Nature Methods.*
6. **Rebecca A. Senft**, Morgan E. Freret, Nikita Sturrock, Susan M. Dymecki. Neurochemically and hodologically distinct ascending VGLUT3 versus serotonin subsystems comprise the r2-Pet1 median raphe (2021). *Journal of Neuroscience.*
5. Krissy A. Lyon, Benjamin D. Rood, Lorna Wu, **Rebecca A. Senft**, Lisa V. Goodrich and Susan M. Dymecki. Sex-Specific Role for Dopamine Receptor D2 in Dorsal Raphe Serotonergic Neuron Modulation of Defensive Acoustic Startle and Dominance Behavior (2020). *eNeuro*.
4. Benjamin W. Okaty*, Nikita Sturrock*, Yasmin Escobedo Lozoya, YoonJeung Chang, **Rebecca A. Senft**, Krissy A. Lyon, Olga V. Alekseyenko and Susan M. Dymecki. A single-cell transcriptomic and anatomic atlas of mouse dorsal raphePet1 neurons. (2020) *Elife.*
3. Alexander T. Baugh, **Rebecca A. Senft**, Marian Firke, Abigail Lauder, Julia Schroeder, Simone L. Meddle, Kees van Oers, and Michaela Hau. Neuroendocrine, endocrine and behavioural syndromes: an integrative and multilevel approach in a European songbird (*Parus major*). (2017) *Hormones and Behavior*.
2. Mukta Chakraborty, Emma E. Fridel, Liang-Fu Chen, Marguerita E. Klein, **Rebecca A. Senft**, Abhra Sarkar, Erich D. Jarvis. Overexpression of human NMDAR2B receptor subunit in LMAN causes stuttering and song sequence changes in adult zebra finches. (2017) *Scientific Reports*.
1. **Rebecca A. Senft**, Simone L. Meddle, Alexander T. Baugh. Distribution and Abundance of Glucocorticoid and Mineralocorticoid Receptors throughout the Brain of the Great Tit (Parus major). (2016) *PLOS One*.