
EMPLOYMENT

Bioinformatics Scientist, Kelly Government Solutions (NIH/NIBIB), October 2020 - Present.

Description: Continuation of previous R&D, with added organizational and software development roles.

Postdoctoral Research Fellow, National Institutes of Health, August 2016 - October 2020.

Lab: Laboratory of Cellular Imaging and Macromolecular Biophysics

Description: Computer vision R&D for 3D biomedical electron microscopy.

EDUCATION

Ph.D. in Applied Mathematics, University of Maryland, College Park, May 2016.

Thesis: *Sparse signal representation in digital and biological systems*

Advisers: Dr. Wojciech Czaja, Dr. Richard Leapman [NIH/NIBIB], Dr. Mark Stopfer [NIH/NICHD]

B.A. in Mathematics, *magna cum laude*, Cornell University, August 2011.

Honors thesis: *Infinity-harmonic functions on SG*

Advisers: Dr. Robert Strichartz, Dr. Alexander Vladimirovsky

RESEARCH EXPERIENCE

Automating 3D electron microscopy image segmentation

Adviser: Richard Leapman, August 2016 - present.

Keywords: *SBF-SEM, automated segmentation, semantic segmentation, computer vision, deep neural networks.*

Compressed sensing for STEM tomography of biological structures

Advisers: Wojciech Czaja and Richard Leapman, June 2012 - May 2016.

Toolbox repository: <https://github.com/norbert-wiener-center/cset>

Keywords: *compressed sensing, electron tomography, image processing, sparse image representation.*

Computational modeling of locust olfactory processing

Advisers: Wojciech Czaja and Mark Stopfer, January 2014 - May 2016.

Keywords: *sparse sensory coding, neural population modeling, locust olfaction.*

COMPUTER SKILLS

Programming languages: Roughly in descending order of proficiency.

Python, Bash, HTML/CSS/Javascript, C++, C#, CUDA.

Software: PyTorch, TensorFlow, Keras, LaTeX, ORS Dragonfly, Unity3D, OpenGL, WebGL, three.js.

Operating systems: Linux (Ubuntu), Windows.

Keywords: *Computer vision, deep neural network design, image processing, high-performance computing, GPU computing.*

PAPERS

- (2021) **Matthew Guay**, Zeyad Emam, Adam Anderson, Maria Aronova, Brian Storrie, Irinia Pokrovskaya, Richard Leapman. *Dense cellular segmentation for EM using 2D-3D neural network ensembles*. Scientific Reports 11 (2021): 2561. <https://rdcu.be/ceYzq>.
- (2016) **Matthew Guay**. *Sparse signal representation in digital and biological systems*. Dissertation. (2016).
- (2016) **Matthew Guay**, Maria Aronova, Wojciech Czaja, Richard Leapman. *Compressed Sensing Electron Tomography for Biological Imaging*. Scientific Reports 6 (2016): 27614. <https://www.nature.com/articles/srep27614>.
- (2009) Amrish Deshmukh, Nikolaus Stahl, **Matthew Guay**. *Modeling Telephony Energy Consumption*. UMAP J. 30, No. 3, 220-221 (2009).

CONFERENCE PUBLICATIONS

- (2021) **Matthew Guay**, Richard Leapman, Brian Storrie. *Large-scale structural modeling of thrombi in COVID-19 patients*. In preparation.
- (2021) **Matthew Guay**, Richard Leapman, Brian Storrie. *Rapid large-scale whole-cell segmentation via active learning from interactive annotation*. In preparation.
- (2020) **Matthew Guay**, Zeyad Emam, Richard Leapman. *Neural Modeling of Eukaryotic Cell Ultrastructure Obtained from 3D Electron Microscopy*. Biophysical Journal 118.3 (2020): 293a.
- (2019) **Matthew Guay**, Zeyad Emam, Richard Leapman. *Two-stage neural architecture search for microscopy image segmentation*. Microscopy and Microanalysis 25.S2 (2019): 188-189.
- (2019) Qianping He, **Matthew Guay**, Guofeng Zhang, Richard Leapman. *Comparison of Techniques for Fine Alignment of Image Stacks in Serial Block-Face Electron Microscopy*. Microscopy and Microanalysis 25.S2 (2019): 148-149.
- (2018) **Matthew Guay**, Zeyad Emam, Richard Leapman. *Problems and Progress in Automating Electron Microscopy Segmentation*. Microscopy and Microanalysis 24.S1 (2018): 508-509.
- (2018) **Matthew Guay**, Zeyad Emam, Adam Anderson, Richard Leapman. *Designing deep neural networks to automate segmentation for serial block-face electron microscopy*. 2018 IEEE 15th International Symposium on Biomedical Imaging (ISBI 2018). (2018): 405-408.
- (2018) **Matthew Guay**, Zeyad Emam, Adam Anderson, Richard Leapman. *Exploring Deep Neural Network Architectures for Automated Electron Micrograph Segmentation*. Biophysical Journal 114.3 (2018): 343a.
- (2017) RD Leapman, EL McBride, A Rao, G Zhang, Q He, **MD Guay**, ID Pokrovskaya, B Storrie, M Aronova. *Comparison of 3-D Cellular Imaging Techniques using Scanned Electron Probes*. Microscopy and Microanalysis 23.S1 (2017): 1150-1151.
- (2014) **Matthew Guay**, Wojciech Czaja, Richard Leapman. *Compressed Sensing Methods for Electron Tomography of Cellular Structure*. Biophysical Journal 106.2 (2014): 598a-599a.