Kathryn Heal

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ABOUT

My current doctoral studies focus on computational representations of the general solution set of an inherently ill-posed problem in computer vision, with a secondary emphasis on approximation of operators via artificial neural network meta-learning.

EDUCATION

Harvard University

Ph.D. in Applied Mathematics, expected May 2020. Advisor: Todd Zickler.

S.M. in Applied Mathematics, Nov 2016.

UCLA

B.S. in Applied Mathematics, June 2014. Cum laude.

AWARDS

- C.S. Draper Laboratory competitive doctoral fellowship, 2014 - present.
- Harvard University Certificate of Distinction in Teaching based on student evaluations, 2016.
- Invited as a visiting scholar to the Max Planck Institute for Mathematics in the Sciences, Spring 2019.

LANGUAGES

Experienced: Python, TensorFlow, MATLAB, Mathematica, Magma.
Intermediate: C++, Java, Git, Bash CLI, HPC cluster instruction, Blender, Illustrator/Photoshop.

SELECTED COURSEWORK

- Graduate: Randomized Algorithms, Computational Geometry, Data Science, Estimation & Control Theory, Functional Analysis, Applied Algebra, Algebraic Topology, Differential Topology, Biomedical Signal/Image Processing.
- Undergraduate: Optimization, Probability, Mathematical Modelling, Advanced Linear Algebra, Applied Numerical Methods, Real Analysis, Mathematical Imaging, Machine Learning (graduate-level), Programming in C++, Programming in Java.

TEACHING

Teaching fellow for Introduction to Probability (ES150), Spring 2016.

PUBLICATIONS

1. Heal K, Wang J, Gortler S, Zickler T. A Lighting-Invariant Point Processor for Shading. In review, 2019.
2. Ding J, Shahrampour S, Heal K, and Tarokh V. Analysis of Multi-State Autoregressive Models. *IEEE Transactions on Signal Processing*, 2018.
3. Deng Z, Ding J, Heal K, Tarokh V. *The Number of Independent Sets In Hexagonal Graphs.* 2017 IEEE International Symposium on Information Theory, 2017.
4. Enyioha C, Magnusson S, Heal K, Li N, Fischione C, Tarokh V. *On Variability of Renewable Energy and Online Power Allocation.* IEEE Transactions on Power Systems, 2017.

5. Enyioha C, Magnusson S, Heal K, Li N, Fischione C, and Tarokh V. *Robustness Analysis for an Online Decentralized Descent Power Allocation Algorithm.* Proceedings of the Workshop on Information Theory and Its Applications, 2016.
6. Magnusson S, Heal K, Enyioha C, Li N, Fischione C, Tarokh V. *Convergence of Limited Communications Gradient Methods.* American Control Conference, 2016.
7. Magnusson S, Enyioha C, Heal K, Li N, Fischione C, Tarokh V. *Distributed Resource Allocation with Limited Bandwidth Communications for Power Networks.* Conference on Information Sciences and Systems, 2016.
8. Gilles J, Heal K. *A Parameterless Scale-Space Approach To Find Meaningful Modes In Histograms – Application To Image and Spectrum Segmentation.* International Journal of Wavelets, Multiresolution and Information Processing, 2014.

INVITED TALKS

- *Representing the Space of Visual Depth Ambiguities as a Real Affine Variety.*
  - Poster. Ideals, Varieties, and Algorithms, Amherst College June 2019.
  - Talk. Max Planck Institute, Leipzig April 2019.
  - Talk. Algebraic Vision research cluster, ICERM February 2019.
  - Poster. Workshop on Real Algebraic Geometry, ICERM October 2018.
- *The Number of Independent Sets in Hexagonal Graphs.* Talk. International Symposium on Information Theory 2017.
- *Induced Probability Measures on Persistence Diagrams.* Poster. SIAM Algebraic Geometry 2017.
- *Estimating the Reach of a Manifold.* Talk. Learning, Intelligence, and Signal Processing seminar, Boston University 2016.
- *A Decentralized Online Algorithm for Fair Power Allocation.* Poster. Optimization and Parsimonious Modeling, Institute for Mathematics and its Applications 2016.

RESEARCH EXPERIENCE

- 2016 - Present, Harvard SEAS // Shape from shading; representing the space of visual depth ambiguities as a real affine variety.
- 2015 - 2016, Harvard SEAS // Group collaboration, designing and analyzing distributed algorithms for optimal energy management, i.e. strategies for smart grid. We focused on demand response strategies where the system is only allowed very limited communication.
- 2013 - 2014, UCLA Department of Mathematics // Developing novel methods to visualize neural patterns within EEG data; custom wavelet development and corresponding signal decompositions.
- Summer 2012, Research in Industrial Projects for Students (RIPS) at the Institute for Pure and Applied Mathematics (IPAM) // Developing novel reconstruction methods for Digital Elevation Modeling.
- Summer 2011, Mathematical and Theoretical Biology Institute (MTBI) at Arizona State University // Modelling the formation of photochemical smog.

REFERENCES *References available upon request.*