

Education	<b>Harvard University</b> (Cambridge, MA) 2017-
	<i>PhD Candidate in Applied Mathematics</i>
	<i>MS in Applied Mathematics</i> 2017-2019
	<b>University of Washington</b> (Seattle, WA) 2012-2017
	<i>BS in Applied and Computational Mathematical Sciences</i>
	<i>BS in Computer Science with Honors</i>
Work Experience	<b>Software Engineering Intern at MathWorks</b> Summer 2021
	<ul style="list-style-type: none"> <li>Working with the Control Design and Reinforcement Learning teams, prototyped data-driven learning of Koopman embeddings for simulation and control of nonlinear dynamical systems (<i>MATLAB Deep Learning Toolbox, LQR, Model Predictive Control</i>).</li> </ul>
	<b>Research Intern at the Honda Research Institute</b> Summer 2020
Graduate Research	<ul style="list-style-type: none"> <li>As part of HRI's Curious Minded Machines program, designed and evaluated structured latent representations of high-dimensional environments. Then, formalized and implemented curious exploration for RL agents (<i>disentangled VAEs, contrastive learning, OpenAI Gym, PyTorch, Stable Baselines</i>).</li> </ul>
	<b>Soft Math Laboratory</b> 2019-
	<ul style="list-style-type: none"> <li>Advised by Prof. Lakshminarayanan Mahadevan.</li> <li>In collaboration with Prof. Holger Klinck (Cornell Lab of Ornithology), utilizing multi-channel microphones for sound source localization and separation to assist passive acoustic biodiversity monitoring (<i>MUSIC algorithm, PCA/ICA/NMF, acoustic vector-sensor, beamforming, spectral analysis</i>).</li> <li>Employing techniques in elastic functional data analysis for characterizing the response of post-stroke participants to rehabilitative training with a soft exosuit (<i>curve and image registration, optimal transport, dynamic programming</i>).</li> <li>Extended analysis of normalized contour curvature as a quantitative model for underlying neural processing of natural images, showing discrimination between cognitive categories such as animacy, size, and type.</li> <li>Applied pre-trained audio embeddings (<i>Wavegram-Logmel-CNN</i>) to understand latent structure and clustering (<i>k-means</i>) within large datasets of birdsong recordings.</li> </ul>
	<b>Agile Robotics Laboratory</b> 2017-2019
	<ul style="list-style-type: none"> <li>Advised by Prof. Scott Kuindersma.</li> <li>Developed novel non-convex trajectory optimization algorithm (<i>ADMM, augmented Lagrangian methods</i>), benchmarked in simulation for multiple robot platforms (<i>quadrotor, Kuka Arm, RoboBee</i>) against commonly used solvers (<i>SNOPT, IPOPT</i>), and integrated with the Drake robotics toolbox (C++). <a href="#">[link]</a></li> <li>Implemented hybrid control algorithm for fixed-wing UAVs in simulation.</li> </ul>
	<b>Other Graduate Projects</b> 2017-
	<ul style="list-style-type: none"> <li>Trained a convolutional denoising autoencoder for signal enhancement of birdsong within outdoor recordings (<i>PyTorch, Librosa</i>). <a href="#">[link]</a></li> <li>Demonstrated high classification accuracy in training a multilayer perceptron to detect adversarial noise (<i>Fast Gradient Sign, DeepFool</i>). <a href="#">[link]</a></li> </ul>

**Undergraduate Research****Computer Science Senior Thesis**

2016-2017

- Co-advised by Prof. Dieter Fox and Prof. Behcet Acikmese.
- Adapted and demonstrated successive convexification algorithm for real-time trajectory planning for quadrotor drones. Constructed data collection framework including point cloud processing and segmentation (*ROS*, *PCL*) for graph-based inverse optimal control for learning manipulation tasks from demonstration on the Baxter robot. [\[link\]](#)

**NSF REU: University of California San Diego**

Summer 2016

- Devised and completed a pipeline for automatic classification of humpback whale calls for large-scale acoustic data, de-noising signals, and applying machine learning techniques (*spectrogram analysis*, *PCA*, *SVM*, *HMM*). [\[link\]](#)

**NSF REU: Hatfield Marine Science Center**

Summer 2015

- Developed a new method for behavioral segmentation of GPS tracking data (*R*, *C*). [\[link\]](#)

**NSF REU: Oregon State University**

Summer 2014

- Performed statistical analysis and modeling over fisheries datasets (*R*, *GAMMs*). [\[link\]](#)

**Publications**

\* indicates equal contribution

Under review: Tolkova I, Klinck H (2022). "Source Separation with an Acoustic Vector-Sensor for Terrestrial Bioacoustics."

Under review: Marantan A\*, Tolkova I\*, Mahadevan L. (2022). "Image Classification and Cognition Using Contour Curvature Statistics." Pre-print on *bioRxiv*.

In preparation: Swaminathan S\*, Tolkova I\*, Baker L, Revi DA, Awad L, Walsh C, Mahadevan L (2022). "A Continuous and Semi-Automated Framework for Gait Characterization and Analysis in People Post-Stroke."

Chandra J\*, Muthupalaniappan S\*, Shang Z\*, Deng R\*, Lin R, Tolkova I, Butts D, Sul D, Marzouk S, Bose S, Chen A (2021). "Screening of Parkinson's Disease Using Geometric Features Extracted from Spiral Drawings". *Brain Sciences*.

Tolkova I\*, Chu B\*, Hedman M\*, Kahl S, Klinck H (2021). "Parsing Birdsong with Deep Audio Embeddings." AI for Social Good Workshop, *IJCAI 2021*.

Tolkova I (2021). "Feature Representations for Conservation Bioacoustics: Review and Discussion." AI for Social Good Workshop, *IJCAI 2021*.

Ciannelli L, Tolkova I, Lauth R, Puerta P, Helser T, Gitelman A, Thompson G (2019). "Spatial, Interannual, and Generational Sources of Trait Variability in a Marine Population." *Ecology*.

Torres LG, Orben RA, Tolkova I, Thompson DR. (2017) "Classification of Animal Movement Behavior through Residence in Space and Time." *PLOS ONE*.

**Presentations****Departmental Seminar at the Max Planck Institute for Animal Behavior**

Mar. 2022

"Spatial Bioacoustics: Improving Soundscape Analysis with a Co-located Microphone Array"

**Oral presentation at IJCAI 2021 AI for Social Good Workshop**

Aug. 2021

"Parsing Birdsong with Deep Audio Embeddings"

**Oral presentation at UCI CMCF Early Career Researcher Symposium**

Apr. 2021

"Acoustic Source Separation for Avian Biodiversity Monitoring"

<b>Presentations</b>	<b>Oral presentation at IJCAI 2021 AI for Social Good Workshop</b> Jan. 2021 “Feature Representations for Conservation Bioacoustics: Review and Discussion”
	<b>Oral presentation at Acoustics '17 Boston</b> Jun. 2017 “Automatic classification of humpback whale social calls” Culmination of NSF REU at UCSD (Summer 2016).
	<b>Poster presentation at Annual Science Conference, Copenhagen</b> Sept. 2015 “Spatial and Temporal Variation in the Size-At-Age of Pacific Cod in the Eastern Bering Sea: Implications for Sampling Strategies” Culmination of NSF REU at Oregon State University (Summer 2014).
<b>Awards</b>	<i>Quantitative Biology Fellowship</i> (Harvard NSF Simons Center) 2021-2022
	<i>Quantitative Biology Fellowship</i> (Harvard NSF Simons Center) 2020-2021
	<i>Certificate of Distinction in Teaching</i> (Harvard Derek Bok Center) 2019-2021
	<i>Outstanding Graduating Senior</i> (Applied Math Department, UW) 2017
	<i>Paradise Scholarship</i> (Robinson Center for Young Scholars, UW) 2015
	<i>Annual Dean's List</i> (UW) 2012-2017
<b>Teaching</b>	<b>Teaching Fellow for GENED 1080: Engineering the Acoustical World</b> Fall 2021 Led laboratory sessions, developed assignments, held office hours, graded homework.
	<b>Head Teaching Fellow for APMTH 22a: Solving and Optimizing</b> Fall 2020 Prepared weekly materials, held office hours, graded homework.
	<b>Teaching Fellow for ES 159/259: Introduction to Robotics</b> Spring 2020 Led laboratory sessions, developed assignments, held office hours, graded homework.
	<b>Head Teaching Fellow for APMTH 22a: Solving and Optimizing</b> Fall 2019 Prepared weekly materials, taught section, held office hours, graded homework.
	<b>Teaching Fellow for CS 182: Introduction to Artificial Intelligence</b> Fall 2018 Prepared weekly section materials, taught section, held exam review and office hours.
<b>Outreach</b>	<b>Mentor</b> for Veritas AI Bootcamp. 2022-
	<b>Lead organizer</b> for Quantitative Ecology/Ethology/Evolution seminar series. <a href="#">[link]</a> 2020-
	<b>Mentor</b> for undergraduate project at the Global Alliance for Medical Innovation. 2020-
	<b>CovEd tutor</b> for public school student. 2020-2021
	<b>Tutor</b> for APMTH 104: Complex and Fourier Analysis. 2020
	Weekly <b>tutor</b> at local public school through Cambridge School Volunteers. 2018-2019
	<b>Volunteer</b> at math competitions (GEMS, MathDay, Math Hour Olympiad). 2013-2017
<b>Hobbies</b>	President of the <b>Harvard GSAS Photography Society</b> : organized trips, photo competitions, guest speakers, and photographed events and performances for numerous organizations on campus. Enjoy hiking, biking, and spending time outdoors.
<b>Skills</b>	<b>Fluent</b> in English and Russian. <b>Proficient</b> in Python, C++, C, MATLAB, Java, R. <b>Experienced</b> with TensorFlow, PyTorch, Git, ROS, Arduino, Teensy, BeagleBone, OpenMP.