Andrew Gracyk

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EDUCATION

University of California, Santa Barbara — Fall 2019 – Present
M.A., Applied Mathematics
Master's Thesis Advisor: Paul J. Atzberger
PhD-level coursework: measure theory (real analysis) A/B/C, partial differential equations A/B/C, ordinary differential equations A/B/C, numerical analysis A/B/C, machine learning, optimal transport

University of California, Los Angeles — Fall 2015 – Spring 2019
B.S., Applied Mathematics, Minor in Statistics
Alpha Lambda Delta Honor Society, Beta Theta Pi

London School of Economics — Summer 2018
Summer study abroad. Courses in managerial and financial accounting.

RESEARCH INTERESTS

Machine learning, mathematical statistics, computational statsitics, stochastic analysis.

GRADUATE RESEARCH

Master's Thesis: Convolutional neural networks in learning Fokker-Planck statistical mechanics (in progress) — Fall 2020 – Present
University of California, Santa Barbara.
Idea: Create Fokker-Planck multivariate probability density function time evolution data using numerical methods over spatial discretizations. Train convolutional neural networks on data to effectively learn time evolution of the PDE, being able to recover drift and diffusion coefficients from kernel weights.

Machine Learning Researcher in Partial Differential Equations — Fall 2019 – Present
Atzberger Research Group
Member of research group in machine learning at UCSB under Dr. Paul Atzberger, Professor of Mathematics.
Used convolutional neural networks to learn the Laplacian differential operator by training on spatial discretizations (mapping over function space). Used CNNs to learn time evolution of diffusion equation.
Used CNNs with fixed finite difference stencil weights to find the gradient of a random Gaussian generated function. Transformation created a staggered mesh.
Used numerical methods to create divergence calculator of Poisson equation from staggered mesh.
Deep neural networks learned Poisson equation diffusion function, minimizing loss between divergence from DNN output with calculator and target divergence.
Learned GMLS, a regression technique of Banach and dual spaces.

UNDERGRADUATE RESEARCH

Statistics Research Assistant in Imaging — Summer 2019
University of California, Los Angeles
Assistant in statistics research for Dr. Rick Schoenberg, Professor of Statistics, in the mapping of CT scans of cracking. Images were in dicom (medical) format.
Performed investigation into research and advanced packages (CoreCT, oro.dicom, SimpleITK) for image processing in R. Performed data analytics, etc., with these packages.

Statistics Research in Stochastic Processes in Finance — Summer 2019
University of California, Los Angeles
Performed statistics research in designing a strategy in options trading using numerical simulation with R.
Created financial statistics models with geometric Brownian motion, and designed a strategy guided by the expectation of a running maximum for stochastic process.

Used binomial option pricing to value American calls, and tested strategy effectiveness.

Mathematics Research in Numerical Analysis Fall 2018
University of California, Los Angeles
Conducted research under Dr. Chris Anderson, Professor of Mathematics, that focused on numerical methods in algorithmic and high frequency trading.
Produced smoothing spline interpolant growth and curvature algorithms in MATLAB that included constraints and predictive models.

Mathematics Research in Stochastic Differential Equations Fall 2018
University of California, Los Angeles
Analyzed and applied research in numerical methods for financial stochastic differential equations for Math 151B.
Outlined Wiener, diffusion processes, and Ito formula to analytically solve the Black-Scholes SDE.
Provided stochastic numerical methods for SDEs such as Euler-Maruyama, Milstein, stochastic Runge-Kutta, as well as Monte-Carlo sampling for quasi-random numbers, multifactor models, SVD.
Extended the ideas of the research to generate financial stock models.

PROFESSIONAL AND TEACHING EXPERIENCE

Graduate Teaching Assistant Fall 2019 – Summer 2020
University of California, Santa Barbara
Taught and lectured 100 students weekly. Held office hours and Mathlab sessions.
Created homework, practice midterms, and practice finals for students.
Held multi-hour review sessions, speaking in front of 60+ students.

Math 3B – Integral Calculus (Mychelle Parker) Summer 2020
Math 3B – Integral Calculus (Hauchen Chen) Spring 2020
Math 3B – Integral Calculus (Mihai Putinar) Winter 2020
Math 3B – Integral Calculus (Darren Long) Fall 2019

Consolidated Communications Intern Fall 2014 – Winter 2015
Sacramento, CA
Interned at a telecommunications networking lab.
Gained networking experience in telephone and television service projects.
Helped establish a large-scale telecommunications system for phone lines, among other projects.

CONFERENCES ATTENDED

Optimal Transport, Topological Data Analysis and Applications to Shape Machine Learning Conference. Mathematical Biosciences Institute at Ohio State University. Online (Recorded videos). Summer 2020

The Second Joint SIAM/CAIMS Annual Meeting. Online (Zoom). Summer 2020

MSRI OT&ML Conference. Online (Slack). Spring 2020

Southern California Simulations in Science Conference (SCSSC). University of California, Santa Barbara. Winter 2020

SEMINAR TALKS

Machine learning in solving the Poisson equation diffusion constant Fall 2020
SIAM Graduate Seminar. University of California, Santa Barbara.

Convolutional neural networks in learning partial differential equations Summer 2020
Applied Math Summer Seminar. University of California, Santa Barbara.

Convolutional neural networks in learning partial differential equations Summer 2020
Graduate Simulation Seminar Series. University of California, Santa Barbara.

A special case of global regularity for the Navier-Stokes equation (Terence Tao) — Summer 2020
Applied Math Summer Seminar. University of California, Santa Barbara.

RESEARCH GROUP PRESENTATIONS

Machine learning in solving the Poisson equation diffusion constant — Summer 2020
Atzberger Research Group. University of California, Santa Barbara.

Convolutional neural networks in learning the Laplacian — Spring 2020
Atzberger Research Group. University of California, Santa Barbara.

GMLS-nets, a framework for scientific machine learning — Winter 2020
Atzberger Research Group. University of California, Santa Barbara.

Finite differences and introduction to convolutional neural networks for partial differential equations — Winter 2020
Atzberger Research Group. University of California, Santa Barbara.

HONORS, AWARDS

Member of ALD/PES Academic Honor Society at UCLA — 2016 – 2019

Member of Dean's Honors List at UCLA for consecutive quarters — 2015 – 2019

Recipient of multiple Beta Theta Pi Academic Scholarship Awards — 2017 – 2019

AP Scholar with Distinction — Spring 2015

RELEVANT PROJECTS

Optimal Transport Projects — Spring 2020
Wrote articles for an optimal transport Wiki page for Math 260L at UCSB.
Page on the auction algorithm, an algorithm in OT finding the optimal permutation to minimize a cost function.
Page on semidiscrete optimal transport, problems in OT with both continuous and discrete measures.

Software Development Projects in R — Summer 2019
Developed a package in R – stockpredict – using moment generating functions of lognormal distributions to predict stock value with standard deviation.
Developed continuous-time series plotter application from Shiny package in R using API data.

Quantitative Finance Project in R — Spring 2019
Quarter-long financial statistical models and portfolio theory project for Stats c183 at UCLA.
Efficient frontier. Minimum risk and optimal portfolios. Statistical models such as single index, multigroup.

VOLUNTEERING AND LEADERSHIP

Organizer, Summer Applied Math Seminar at UCSB — Summer 2020
Organized the graduate student applied mathematics seminar at UCSB for summer 2020.

Recruitment Chair — Fall 2017 – Fall 2018
Recruitment Chair and Executive for 100+ member chapter of Beta Theta Pi.
Responsible for recruiting new members. Kept track of 300+ potential new members.
Recruited a class of 35. Public speaking in groups of 8-40 people.

UCLA VIP Program — Winter 2018 – Spring 2018
Volunteer for UCLA Health Center's VIP Program, a program committed to ending sexual violence and misconduct.

PROGRAMMING

Languages, experienced: R, MATLAB/Octave, Python (Tensorflow, Keras, PyTorch, Numpy)
Langauges, basic: C++, Swift
Additional software: Git, Latex, Excel, Word, Powerpoint, Photoshop, Affinity, Maya, Revit, SolidWorks, AutoCAD, Sketchup

LANGUAGES

English (native)
Spanish (3 classes)
French (3 classes)