SEAN GRATE

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EDUCATION

University of Kentucky, Lexington *August 2016 - Present*
Bachelor of Science in Mathematics, minors in History, Classics, and Computer Science.

PROJECTS

Resampling Point Clouds
Used machine learning and geometric approaches to develop methods to resample point clouds. This allows for finer or coarser resolutions of the point cloud from any arbitrary view angle. Implemented with PyTorch. Joint work with Hunter Blanton and Nathan Jacobs.

Estimating Flight Lines
Used machine learning to estimate the flight path a plane capturing LiDAR data took. Implemented with PyTorch. Working under the direction of Nathan Jacobs.

Noncommutative Polytopes of the Heisenberg Group
Studied the polytopes generated by the Heisenberg group in $\mathbb{Z}^3$. Used Python for computations and generating STL files for 3D models of the polytopes. Investigated under the direction of Christopher Manon.

TA Assignments
Given a set of graduate students that must be matched to a class as a TA, is there a way to find a good matching? Can we add additional constraints like time availability or the seniority of a graduate student? Investigated under the direction of Kate Ponto.

Visualizing Algebraic Surfaces
Created 3D-printed interactive representations of common surfaces and objects encountered in a Calculus III course. Moved on to generating more complex surfaces such as the Clebsh cubic surface. Used Python, Tinkercad, Mathematica, and Blender to generate STL files. Joint work with Nathan Fieldsteel.

Generating Minecraft Worlds
Is it possible to generate "nice" looking point clouds that resemble Minecraft worlds? Using tools available in machine learning and borrowing persistent homology from computational topology, this can be done with a generative adversarial network.

TECHNICAL STRENGTHS

Software & Tools Python, PyTorch

RELEVANT WORK EXPERIENCE

Expanding Your Horizons April 21st, 2019
Workshop Mentor

· Ran a workshop with two fellow undergraduates that taught middle school girls the basics of rockets and propulsion. We built bottle rockets with vinegar and baking soda and then launched them outside.

Computer Vision REU May-August 2019
Undergraduate Researcher

· REU in computer vision under the guidance of Dr. Nathan Jacobs at the University of Kentucky. Used machine learning to estimate the flight paths of planes capturing LiDAR data across all of Kentucky.

UK Department of Computer Science August 2019-current
Undergraduate Research Assistant

· Continued researching the topics looked at in the 2019 Computer Vision REU, e.g. estimating flight routes, point cloud resampling, etc.

ACADEMIC ACHIEVEMENTS AND AWARDS

Best presentation (2019 Computer Vision REU)

Dean's List (August 2016 - Present)

Student of Good Standing (August 2016 - Present)

University of Kentucky Provost Scholarship ($1,500 per year)

EXTRA-CIRRUCULAR

Member of the University of Kentucky Math Club.

Participated in the University of Kentucky Math Lab for multiple semesters.

Member of the National Society for Collegiate Scholars.

Member of the Tau chapter of the Eta Sigma Phi Classics honorary at the University of Kentucky