Department of Mathematics and Statistics Colloquium

Student Research Presentations

Metrics of Gerrymandering: Quantifying Intent

Rachel Koch

Abstract: A metric for determining the extent of political gerrymandering, called the Efficiency Gap (EG), has faced the Supreme Court of the United States (SCOTUS) this year. We will analyze EG's strengths, weaknesses, and the challenges it may face when it is scrutinized by the Court. We will also examine past SCOTUS rulings pertaining to partisan gerrymandering and the suggestions made by the Court for future plaintiffs. Finally, we present some initial findings for a new metric, the power of a vote, which focuses on the political power of the individual instead of the political power of the party. The power of a vote works to quantify intent in redistricting decisions and capitalize on Justice Kennedy's assertion that gerrymandering is a violation of the First Amendment.

Finite Element Methods and Deal.II

Ben Rhodes

Abstract: The Poisson Equation is a staple in the world of partial differential equations and a perfect building block to discover how finite element methods are used to solve partial differential equations. We will first go over a basic 1-dimensional abstract finite element method problem to get an intuitive sense of how it works, before moving on to the more complex higher dimensional cases, where we get a glimpse of the deal.ii finite element method software. We will demonstrate the power this software has to offer in regards to solving the Poisson Equation as well as many other partial differential equations, and show examples/applications in the real world.

Divisibility Tests Beyond the Integers

Cameron Stopak

Abstract: Divisibility tests in the Integers are an ancient method of testing whether one Integer divides another. We will summarize the results of others on what are called Summing and Trimming divisibility tests. These results are extended to general Euclidean Domains with special attention to the Gaussian Integers.

Evaluating Test Set Accuracy Rates for Boosting: A Machine Learning Method

Garrett Fuselier and MacLean Koslowski

Abstract: Machine learning methods work by randomly dividing data sets into two parts: training set and test set. Training set is used to build a classifier function and test set is used to verify the performance of that function. Test set accuracy is influenced by the overall sample size, proportion of random division of data into training and test sets, proportion of true differential power of the samples, etc. In this work, we investigate the bias and variance of the test accuracy rate under different experimental conditions.

An Implementation and Analysis of the Singular Value Decomposition Applied to Image Compression

Brendan Armani, Andrew Levy, and Andrew Tomassone

Abstract: This talk will cover an analysis of the Singular Value Decomposition (SVD) applied to image compression. We developed a Java applet, using the Java swing package and JAMA (Java matrix library) to produce a GUI that can load in an image and use the SVD algorithm decompose the image and produce all possible rank-deficient approximations, allowing the user to save any approximation that they desire. We used a set of (reasonably) random images obtained from the web to analyze the proportion of singular values needed for any given image to produce a seemingly indistinguishable rank-deficient approximation.

Monday, April 23 at 3:45 in Roop 103

Refreshments at 3:30