

REU Seminar Series

Wednesday 2:30pm, Nesbitt Room

July 5

Brian Burks

(Mentor: Brendan Pawlowski)

Title: Reduced Words for (p,q) -clans

Abstract: Weak Bruhat order is a partial ordering of permutations. Various analogues exist, including one for involutions with signed fixed points: (p,q) -clans. From this poset, we may consider a (p,q) -clan analogue of reduced words of permutations. In this talk, I'll characterize reduced words of matchless clans, and also a notion of equivalence classes of reduced words for all clans. Time permitting, I'll also discuss other aspects of clans I've explored, including finding the (p,q) -clan with the most reduced words for fixed p and q , and a probability distribution for picking a random (p,q) -clan.

Jiachang Liu

(Mentor: Ilker Kocyigit)

Title: L1 Magic and Imaging Science

Abstract: For the past seven weeks, I've studied underdetermined system, $y = Ax$, with application to MRI and radio signal discovery. A question to ask for a linear system with more variables than equations is under which condition there will be a unique solution. Luckily there are some nice mathematical theorems arising from this problem. My project focuses on using l1 method and convex optimization to numerically find this unique solution. To guarantee the uniqueness, I have to presume the solution is sparse (most variables equal to 0) and vectors in matrix A is incoherent ($\langle a_1, a_2 \rangle$ is almost 0). The challenge of the project lies in how to judiciously select vectors and reconstruct A . I will use my time to go over the motivation for this inverse problem, then brief theoretical development, and last our current numerical results and obstacles.

Erika Pirnes

(Mentor: Karen Smith)

Title: Resolution of Singularities

Abstract: Let V be the zero set of a polynomial f in n variables over an algebraically closed field; this is a special case of an algebraic variety. In cases $n=2$ and $n=3$ V would be a curve or a surface, respectively. A point on V is called singular if all the partial derivatives of f vanish at that point. A resolution of singularities is a smooth variety (i.e. which does not have singular points) together with a map from this variety to V which satisfies certain conditions. The purpose of this talk is to gain a basic understanding of the resolutions of singularities through examples.

Jeremy D'Silva

(Mentor: Marisa Eisenberg)

Title: Modelling Perineural Invasion: Understanding the Active Role of Nerves in The Nerve-tumor Interaction

Abstract: We developed preliminary hybrid models for perineural invasion (PNI) of head and neck cancer (HNC) in an in vivo experimental system. It is important to understand the process of invasion in HNC in order to improve treatment outcomes, because invasion ultimately contributes to increased risk of mortality. Our hybrid model for PNI consists of an agent-based model for neurite outgrowth coupled to a reaction-diffusion equation for the peptide galanin, which has been shown to promote neurite outgrowth and facilitate PNI. This system is particularly interesting because both nerve and cancer secrete galanin with various responses from the other tissue. We found that our simple hybrid model recaptures several important features of the neurite outgrowth observed in vivo, and offers a promising avenue for further study of PNI.

