

# Michigan Math Club



## Directed Reading Program Presentations

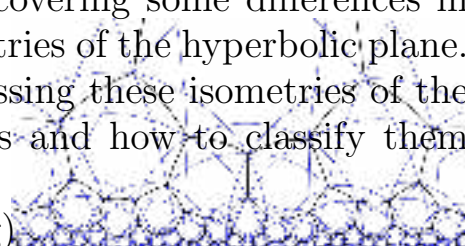
10 December 2020

### Isometries of the Hyperbolic Plane

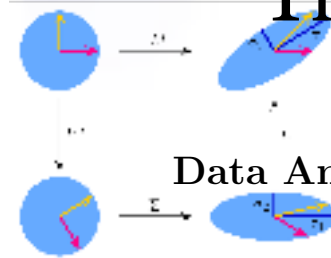
*Cassandra Prokopowicz*

One way to change the parallel postulate results in hyperbolic geometry, which has some interesting and surprising properties when it comes to isometries. For example, dilations actually preserve distance in hyperbolic space! We will start by explaining the basics of hyperbolic geometry and continue by discovering some differences in orientation-preserving isometries of the hyperbolic plane. We will then finish by discussing these isometries of the hyperbolic plane as matrices and how to classify them using invariants.

(Mentor: Christopher Zhang)



Meeting [virtually](#) for Fall 2020  
Thursdays at 4pm EST



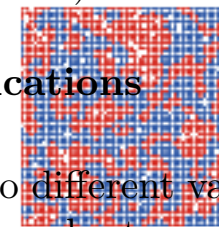
### Data Analysis with Truncated SVD on the Eigenfaces

*Chang Wang*

$$A \approx U \Sigma V^T$$

The world is flourished with a huge quantity of complicated data and information. How can we apply our linear algebra and numerical analysis skills in the field of data science? In the talk, we will discover the power of Singular Value Decomposition (SVD) in depth, and how we can use SVD and Dynamic Mode Decomposition (DMD) to make data processing and analysis possible and easier. First, I will give a brief algebraic and geometric interpretation of SVD. Furthermore, I will introduce how we would make mass data processing and analysis possible by using appropriate truncation and randomized linear algebra. Last, we will explore the application of SVD on facial recognition - Eigenfaces.

(Mentor: Saibal De)



### Mean-Field Games and their Social Applications

*Krista Hart*

What are Mean-Field Games? In this presentation, we start to understand two different varieties of  $N$ -player games and their specific cases, along with their guarantee of a Nash equilibrium, or best response strategy. Diffusion games for social dynamics of opinion are explored as potential Mean-Field Games, where we find the implications of convergence and Nash equilibrium of three potential games: those with no stubborn individuals, those including stubborn players, and those with a bounded confidence of opinion for updating. A second application comes from the potential game of resource allocation, as we use server caching as an example to further understand the dynamics of the existence of Nash equilibria for a whole system.

(Mentor: April Nellis)

