Animals, Riddles, & Origami: Math Modeling for Young Children

Kathy Morris, Emerita & Brightline Lahme, Sonoma State University

Mathematical modeling has been a focus in high school since the introduction of the Common Core State Standards and is a mathematical practice all students are developing. While it is easy to imagine engaging real-world problems for high schoolers given their extensive mathematical background, we will explore what mathematical modeling looks like in the early grades – even in kindergarten! Meaningful and developmentally-appropriate modeling tasks support young students to generate their own questions, act out mathematically rich scenarios, and determine the reasonableness of their approaches and solutions. We will discuss how by factoring in real-world contexts we can play a role in nurturing the math identity and agency of the children in our own lives.

A Mathematical & Historical Treatment of Timekeeping

Chris Dugaw, Humboldt State University

I will describe the history, form, and function of four timekeeping mechanisms: the pendulum, the balance spring, the tuning fork, and the quartz crystal. By the conclusion of the talk you will have a basic understanding of how these mechanisms work; the physics behind them, and the mathematics involved. While some of the more intriguing historical anecdotes may come across as only a background in trigonometry will be able to understand the majority of the mathematical content. You will get to learn a bit about me personally, my interest in timekeeping, and you will be able to see some unique watches from my personal collection. This should be a fun talk with lots of pictures, videos, and interaction.

A Mathematical Model of Parasite Transmission in Sand Crab Populations Along the California Coast

James Peirce, University of Wisconsin LaCrosse

This will be an informal discussion on the mathematical model of a parasite that has caused recent deaths of California sea otters. You may wonder why a mathematician from Wisconsin is concerned about the California sea otter. During this talk I will explain how a mathematically curious mind (like the one you are developing as a math major) can naturally lead to the discovery of new scientific questions that can aid in local conservation efforts. My presentation will focus on the biological system and its mathematical model, data collected by high school and university students, and the (unsolved) mathematical questions that are currently being investigated.

Finding Patterns in Data Using Cluster Analysis

Cristina Tortora, San Jose State University

Cluster analysis is a data analysis technique with the goal of grouping a set of objects in such a way that objects in a cluster are more similar to each other than to those in other clusters. For example, using cluster analysis, one can find groups of patients with similar symptoms. In this talk, I’ll give an introduction to cluster analysis focusing on model-based clustering, a specific subgroup of cluster analysis techniques. Model-based clustering uses density functions to model each cluster within the data; the entire data set is defined as a convex combination of the clusters. I’ll then focus on some challenges and recent advancements in model-based clustering with examples in different fields.

The Joy of Modeling, Programming, and Statistical Consulting!

Students from Math 180, 467, and 470

What does doing math research look like? For me, it involves playing with diagrams and gestures, counting objects by moving them around in different ways. Some feature selection and demonstrated the method in simulation studies.

A Comparative Study of Machine Learning Methods on T-Cell Receptor Repertoire Data

Tao He, San Francisco State University

T cells represent a crucial component of the adaptive immune system. Antigen-specific recognition is realized via T cell receptor (TCR), which is the product of somatic V(D)J gene recombination, plus some random addition/subtraction of nucleotides at recombination junctions. In this study, we aggregated the clones based on V/J gene segments, which overcomes the limitation and thus can build machine learning models across subjects. Here we presented a comparative study of different feature selection and classification on two multiclass Next-Generation Sequencing TCR repertoire data in cancer studies. We also proposed a novel ensemble of feature selection and demonstrated the method in simulation studies.

Talking About Identity, Equity and Belonging

Mary Pilgrim, San Diego State University

How many students in your classes have access to the same resources? In this interactive talk I will share two activities intended to raise awareness about identity, equity, and belonging in the mathematics classroom. These activities have been used in professional development for undergraduate tutors and graduate students at multiple institutions and are adaptable for a diversity of audiences. Participants will engage in discussion about these activities, and I will share data gathered from recent uses of each activity.

Cayley Graphs, Cayley Isomorphisms, and Kazhdan Constants

Travis Hayes, Sacramento State University

In this talk, we will explore a way to construct graphs based on the structure of finite cyclic groups and a corresponding symmetric subgroup. From here, we can discuss the Kazhdan Constant, which is a numerical value for a graph that quantifies how efficiently connected the graph is. We will round off the talk with what was found through my research while at California State University, Los Angeles.

Building with Boxes and Beads

Simone Sinners-Thors, CSU East Bay

What does math research look like? For me, it involves playing with diagrams and gestures, counting objects by moving them around in different ways. Some of the mathematical objects I study are called partitions: ways of breaking up a positive integer into positive integer parts. For example, the partitions of three are 3, 2 + 1, and 1 + 1 + 1. Partitions can be represented by diagrams, some made of boxes and some made of beads. My work in partitions is the result of a 2+ year collaboration with Drs. Hannah E. Bonser and Dr. Armin Raff. I touch across all branches of math (and sometimes an ocean). The presentation will include comments on our collaborative process as one example of how mathematicians come together and share ideas.

Machine Learning Methods for Genomic Variation

Mario Baldwin, Fresno State

Genomic anomalies, or variations, are often shared between members of the same species. Although rare, these changes may result in disease or an increase in host fitness. Most approaches for detecting structural variation rely on high quality data and are typically limited to one type of structural variant such as deletions or insertions. These genomic changes are often difficult to detect. Standard approaches for identifying such changes involve comparing fragments of DNA from the genome of interest to a reference genome. This process is usually complicated by errors produced in both the sequencing and mapping process which may result in an increase in false positive detections. In this work, we describe gradient boosting, neural network, and recommendation systems approaches in the context of genomic variants.


Carrie Diaz Eaton, Bates College

Information is a force of power, and our students consume and produce more unfiltered information than ever. They need agency as well as the tools to mem- bers of a future workforce to ethically and responsibly process this information. What is the role of mathematics instruction in helping students in their role as digital citizens? I will talk about my information literacy course using Open Educational Resources, including Calling Bull, Figure of the Day, and RStudio. This course serves as a forum to think meaningfully about probability, data analysis, and data visualization; a gentle introduction to programming; and a context to examine the interplay of information, power, and social justice. It also asks students to use these tools to explore and develop their own agency as digital citizens. I close by ex- amining the narrative of citizenship in the context of digital studies, in the context of mathematics, and in the context of Latinx displacement and immigration.

Representations for Mathematical Sense Making

Topaz Wisco, Sacramento State University

Did you discover young learners can discover and explain many interesting mathematical concepts even before they learn formal definitions and common algorithms? We will explore multiple compelling approaches to mathematical sense making and I will highlight a current research project analyzing methods of representation used by pre-service elementary school teachers.

One or Two Things You Can Do With Linear Algebra

Henry Boateng, San Francisco State University

Linear Algebra has a lot of cool applications. However, because of time constraints, a typical Linear Algebra class is not able to cover any meaningful applications. In this talk, we will try to extend and apply our knowledge from MATH 322 to some of these applications. We will look at image compression, image detection and perhaps noise filtering.