Department of Mathematics

May 17, 2021

UNDERGRADUATE MATH SEMINAR – Save the Date!

The next math seminar is scheduled for **Thursday, May 27**, during the common lunch hour, 1:20 – 2:15. It will be held via Zoom. More details will be announced in upcoming newsletters, via email, and they will also be posted on the Math Department's website under the Activities tab. Stay tuned!

Math Department Prizes Announced

Please join the Math department in congratulating this year's recipients of its prizes.

The Martin Terry Resch Prize

The **Martin Terry Resch Prize** is awarded to "the senior who shows the greatest promise for advanced study in pure or applied mathematics." This year, the math department gave this award to **Zijie Hu**, and **Jason Stack.**

The Eugene W. Hellmich Memorial Prize

The **Eugene W. Hellmich Memorial Prize** is awarded to "the senior who demonstrates excellence in mathematics and is planning to teach math." This year, the math department gave this award to **Hayley Coakley** and **Dante Scott.**

Calculus Help Center: Tutoring Positions Available, Fall 2021

The Math Department is now accepting applications for vacant Calculus Help Center (CHC) tutoring positions. Tutors in the fall work in the CHC one fixed night per week, Sunday through Thursday, from 7:30-10:00pm.

Qualifications: Calculus through Math 115 with grades of no less than A-. Preference will be given to students who

- have also completed Math 117 (with a grade of no less than A-),
- are declared math majors,
- are considering becoming a math teacher or pursuing graduate work in mathematics, and
- have other tutoring experience (not necessary, though).

To apply for a position, send an email to Professor Paul Friedman (friedmap@union.edu) expressing your interest, listing your mathematical background, including coursework (term, professor, and grade) and tutoring experience (if any), and discussing why you think you would be a good tutor.

Application deadline: Friday, May 28 at NOON.

Senior Writing and Pieces from Theses

*This week's contribution is from **Emma Flatland** who wrote her thesis this past winter under the direction of **Professor Roger Hoerl**.*

I did a one term thesis with Professor Hoerl in the statistics department, in the field of machine learning. My thesis focused on two particular machine learning algorithms, random forests and neural networks, which I used to build models that predicted things like wine quality, employee productivity, air quality, diamond prices, and bike rental frequency.

The user has some control over how the algorithms run. Before you run one of the algorithms, you have the option to specify settings, called hyperparameters, that determine things like how complex the model will be and when the algorithm will stop. The way these hyperparameters are adjusted can affect the quality of the model, so one goal of my thesis was to see if I could identify some general rules that could help guide the adjustment process.

(continued on next page)

Another goal of my thesis was to study the effect of noise additions on model performance. Through my literature review, I learned that adding noise to data before fitting a model can result in improved model performance, so my advisor and I were curious to see if we could replicate this finding.

I conducted my literature review during the first half of the term. During the literature review phase, I think I read about 30 papers, primarily empirical experiments that tested the effect of certain variables on model accuracy and fit. These variables included specific hyperparameters, as well as aspects of data quality, such as the amount and type of noise present. We initially planned for me to find papers that focused primarily on the effect of these variables on model overfitting, but since this is an under-researched area, we expanded our focus to include model accuracy as well.

The second half of the term I ran a series of designed experiments, varying the amount of noise in the data the models were fit to, and the complexities of the models. The experiments were similar to some that I read about, so that I could compare my results to results from other studies. I was able to identify a relationship between random forest complexity and performance, but not neural network complexity and performance. Some noise additions didn't affect model performance while others reduced model performance, but all noise additions tended to reduce model overfitting.

My one term thesis went by a lot faster than I expected. I think I only got through about half of what I had actually wanted to accomplish. So, I recommend focusing first on the tasks that you most want to complete. What also helped me was listing some of the things I wanted to accomplish as "potential goals". It took away the pressure to get through everything, but still motivated me to work at an efficient pace, because I knew I wouldn't run out of things to do.

Even though my thesis was only one term, I had worked in the same area of research the summer before through a research fellowship. I found summer research to be a great way to make my thesis stronger. While completing my thesis, I built upon some of what I accomplished during the summer, such as my understanding of how the algorithms worked and my familiarity with the data sets I was working with.

Math Club: Trivia Night, Thursday, May 20 at 5:30pm

Looking for a fun study break? Then come to the Math Club's Trivia Night this **Thursday, May 20** at **5:30pm** (sharp!). Test your mathematical wits and skills against all comers – and possibly win some fantastic prizes! Noise canceling headphones, some metal math toys, books filled with Sudoku puzzles, jigsaw puzzles with cool math pictures, math themed Rubik's cubes, and many more. But, as they say, you have to be in it to win it.

The Trivia Night will be held over Zoom: https://union.zoom.us/j/7365779779 and the contest itself is run through the website for Kahoot!

If you cannot participate, but are interested in joining the Math Club, contact the club president, Lily Dong (dongl@union.edu).

Don't forget to accept or decline your petitions
Tuesday, May 18 – Thursday, May 20