2020

# Petersheim Academic Exposition 2020 Math & Computer Science Abstracts

Seton Hall University

**Petersheim Academic Exposition 2020**

**Math & Computer Science Abstracts**

https://teams.microsoft.com/l/meetup-join/19%3ameeting_MTRlOGYwMGItMjI4ZS00ODMxLWJhODgtNTk0NTJhN2JiYzE5%40thread.v2/0?context=%7b%22Tid%22%3a%2251f07c22-53b7-44df-b97c-a13261d71075%22%2c%22Oid%22%3a%22d265b6e0-19f9-432d-95be-2a0bdd541426%22%2c%22IsBroadcastMeeting%22%3atrue%7d

It's OK if presentations start early, and we even have about 3 minutes of give at the end.

1. 5-10 minute presentation 3:00-3:10 + questions

**Speaker:** **Christian Clarke, M.S. student in Data Science**
**Mentor:** **Manfred Minimair, Math & CS**

### Data Science Meets Compliance

**Abstract**

Data Science is one of the hottest areas of technology in recent years. “Data Scientist” has even named the sexiest job of the 21st century. Many of the applications are indeed attractive and being implemented in cutting edge and exciting ways. Recommendation engines seem to churn out the perfect product for users. Pathing algorithms allow people to explore and travel places like never before. Programs allow companies to collect more data than ever before and glean deeper insights into the innerworkings of their business. There are several areas that get overlooked when it’s time to get a shiny new toy however. Parts of the business that are just as crucial and could truly benefit from the latest that Data Science has to offer. Compliance is a department that most are not familiar with but is crucial to ensuring that the business is abiding by all necessary rules and regulations and stays out of legal issues. This project takes a look at what happens when Data Science meets Compliance.

2. 10 minute presentation 3:12-3:22 + questions

**Speaker:** **Analisa Espino, B.S. student in mathematics**
**Mentor:** **John T. Saccoman, Math & CS**

### Adjacency Eigenvalues for Underlying Split Multigraphs

**Abstract**

A split graph is a graph whose vertices can be partitioned into a clique and an independent set (whose nodes are called cones). A split graph G is proper if every cone has the same degree. Most results in spectral graph theory do not address multigraph concerns. An exception is [REF], in which the Laplacian spectrum for multigraphs having underlying split graphs of a particular structure was presented. In this work we present

a conjecture for the adjacency spectrum of these graphs. Further, if these multigraphs model a satellite communications network, we conjecture a formula for the number of triangles between ground stations and orbiting satellites.

Keywords: split graphs, spanning trees, eigenvalues, Laplacian matrix, multigraphs

3. 10 minute presentation 3:24-3:34 + questions

**Speaker:** **Josh Schappel, B.S. student in Computer Science**
**Mentors:** **Thomas Marlowe, Math & CS**
**Katherine Herbert, Computer Science, Montclair State University**

**Technology and Autism: A Survey from the Paraprofessional and Caregiver Perspective**

## Abstract

Despite 1 in 54 Americans being diagnosed with Autism Spectrum Disorder [ASD], they are one of the most underrepresented and misunderstood groups in America. The lack of information, about ASD in general, about diagnosis and treatment, and about supervising and interacting with children with ASD, can lead to misjudgments, lack of timely interventions, and in some cases even abuses. Our research into ASD comprises three efforts: an app for real-time monitoring of minors with ASD for caregivers and parents; a survey bibliography on current monitoring devices, medical discoveries, data science, dataset, and support groups; and, with a team in a year-long software engineering course, a recommender system to provide current information and guidance.

In this presentation, we look at the first two; the third will be presented separately. The survey will allow better understanding of the relationship between emerging technologies and with medical and other observations. It will provide specialists with an overview of current research, while offering a window into that world for parents and caregivers. We also look at ethical considerations in dealing with a population that is not always able to give full, informed consent.

Leveraging some of that research, we have developed a prototype system utilizing a wearable device heart monitor, to alert a caregiver when an individual with ASD is in distress. This system consists of a Fitbit, Android application and a RESTful API, communicating with one another to deliver timely and accurate information. We have found that current wearable devices available are not sufficient, and discuss what a future wearable device would need for practical use--in particular, by combining Fitbit functionality with location information.

"Data & Statistics on Autism Spectrum Disorder." CDC, 25 Mar. 2020, www.cdc.gov/ncbddd/autism/data.html

4. 10 minute presentation 3:37-3:47 + questions

**Speakers:** **Prof T. Marlowe, Prof. G. Chang**

**Recommender Systems: An overview of a year-long class project**

We give an overview of recommender systems, outline why it was a solid and challenging project for a year-long software engineering course, and how the students have benefitted. Then we look at the five very different team projects, and overview the three that will not be presented separately.

5. 15 minute presentation and code demo 3:50-4:05 + questions

**Speakers:** **Sachin Mahashabde, John Bar Eli, Joshua Schappel, Jeremy Suero, Melkishar Delly, B.S. students in Computer Science**
**Mentors:** **Garett Chang, Thomas Marlowe**

**Autism Searches: A recommender system for ASD related information**

Design of a recommender system was the course project for a year-long software engineering sequence, with each team choosing a different topic. For a combination of academic and personal reasons, we chose to look at ASD.

As far as we can determine, there is no site that provides all of the following: (1) information on ongoing research, diagnoses, and treatments, (2) advice and guidelines for parents, caregivers and individuals with ASD, and (3) information on stories and events related to ASD. Our application provides and classifies information on all these, and is configurable to individual needs and preferences.

The application is built on a layered architecture, and uses two tools. It interfaces with external API's to browse the web to get the latest articles, both scholarly publications and news. We expect to add articles from organizational sources such as Autism Speaks. It also uses machine learning and other data science tools to filter that information to meet user interests and needs. Users can select articles or topics of interest in their current report, which will guide future selections. Future work would include enriching the user interface.

The software architecture comprises three major parts: a website built in Javascript using the React framework, a backend server built in Java using Spring MVC, and a MySQL database. We have redesigned and refactored the application multiple times, making heavy use of continuous testing, aspects, design patterns, mock objects, and threading, following Robert C. Martin's *Clean Code* and refactoring principles.

6. 15 minute presentation and code demo 4:10-4:25 + questions

**Speakers:** **Ajay Shah, Harshal Patel, Eric Gargiulo, B.S. Students in Computer Science**
**Mentors:** **Garett Chang, Thomas Marlowe**

The Cyber Security Search Engine project is the development and implementation of a recommender system, which is the byproduct of Seton Hall's Computer Science Software Engineering I and II courses. Our group decided to delve into the topic of cybersecurity. As technology continues growing rapidly, so do persistent threats to cyber security. The need for a competent and up-to-date system that allows any cybersecurity professional to reference data on of how breaches occur is pertinent. The project follows breaches: unauthorized accesses to data, and how individuals tasked with protecting cyber security within their companies can utilize this information to protect themselves from similar breaches.

Cyber Security data is bountiful, there is static information on breaches and are API's that catalogue them, but as we found no competent search engine that allows the user to: (1) Search the large volume breaches through a simple search bar, (2) Return a listing of breaches that give individual information on the breach (location, type of breach, industry, etc.); and (3) Use a comprehensive algorithm that returns breaches that are related to the original breaches searched for.

The Cybersecurity Search Engine is built on a layered architecture built of three major parts: (1) use of Go-Lang for backend functionality, which includes the entire implementation for the recommendation algorithm; (2) the ECHO Web Framework for supporting website generation for the search website, coded in HTML and JavaScript, and (3) SQLite3 as a medium to the database of breaches, referencing all the hard data we have on breaches plus user information. Our project utilizes a self-developed score-based matrix recommendation system that utilizes tree-map to give quick and accurate recommendations on similar breaches to the one being viewed by the user.

We are currently expanding our database data to include up-to-date information from a myriad of API's that collect cyber security breach data. Further progress is being made on development of a cleaner user interface, allowing users to make changes to their account, and increasing the user's ability to view new data with the best possible recommendations as they use our website.