2020 Computer Science Senior Project Abstracts

Prabhat Bhootra, "**A Webapp for Comparable Companies Analysis**"

Comparable Companies Analysis is a method to value a company that relies on the assumption that companies from similar industries and of a relatively similar size should have a similar valuation. There are many students who could be economics majors or curious about finance who may want to use this methodology, but current methods such as Bloomberg terminals or Excel spreadsheets require a knowledge of their functionalities and have a steep learning curve. This senior project aims to allow users to carry out a customized analysis by allowing them to choose peer companies and relevant multiples that they wish to use. They can also edit data values as they deem fit. Users will be able to save analyses they have conducted for future reference. The web app will be intuitive and easy to use as users will only have to use their mouse for point and click actions.

Brady Burke, "**IBM DB2 to Presto SQL Engine Connector**"

It is estimated that by 2025 the human race will be creating 463 exabytes (463 * 10008 gigabytes) of data per day [5]. In fact, in the past two years alone, 90 percent of all data in existence was created [3]. Between the internet, social media, communication, and streaming services, humans produce an extraordinary amount of data. This volume of information provides new insights into business analytics and decision sciences that were previously unattainable.

The challenge surrounding this level of data output is interfacing with its sheer volume. To study mass amounts of data, appropriate tools are needed to efficiently analyze and make use of the information. One potential solution is Presto, a high-performance ANSI SQL engine that is capable of running in parallel over a pure memory-based architecture. It provides real-time analytical queries for data of any size, from any source. This open-source project has many connectors written for popular data sources such as MySQL, and SQL-Server.

This project is a connector for the IBM DB2 database to the Presto SQL engine. Invented over 36 years ago, the database is almost as old as SQL, yet it is still utilized to power analytical and transactional workloads by tens of thousands of companies today. DB2 is well known for its query optimizer, as IBM has begun to introduce machine learning to their software. The connector will combine the abilities of DB2 with the high-performance of the Presto engine in order to utilize results from the DB2 database in real-time. The DB2 to Presto SQL engine connector will lead to an increase in query processing performance, cost savings, and security at any scale.

Shelby Cass, "**Autonomy through Machine Learning**"

Autonomously navigating and completing tasks is a challenging goal and still a large focus of research and development. The process of designing control algorithms for autonomous agents lends itself well to machine learning, in particular reinforcement learning, a style of machine learning requiring no labeled data, instead utilizing a reward function for training. The goal of this project is to implement an autonomous mobile robot that will navigate to a GPS target while avoiding obstacles in its environment. This will be done using deep reinforcement learning in a simulated training environment.

Weishuang Gao, "**Free Financial Data Analysis Platform**"

The free financial data analysis platform aims to help investors make rational investment decisions. It combines the company fundamentals and DCF model from the fundamental perspective as well as data visualization from the technical perspective.

Ali Hasan, "**Digital Audio Signal Processor**"

Air travel with expensive equipment is a risky judgement call that is often made by professional and amateur musicians alike. Instruments and amplifiers often break in cargo due to a variety of reasons such as the quality of shipping and handling of the equipment combined with the fragile nature of the equipment itself. This concern was addressed by The Department of Transportation after the final rule and implementation of section 403 of the FAA Modernization and Reform Act, which allowed travelers to travel with their instruments as carry-ons - instead of having to check them into cargo - during commercial flights [1]. With that said, musicians are faced with the challenge of having their equipment be small enough to be transported as a carry-on. A small, fully customizable digital signal processor can lighten the load on traveling musicians as it allows them to pick and choose between different sounds, while being able to fit in a backpack.

Seb Kryspin, "**Job Hunter: A 3D Platformer Game About Getting a Job**"

Many college students worry about getting a job after graduation. A video game about "getting a job" could help students see the humor in an often competitive and stressful process. Therefore, the author created *Job Hunter*, a 3D action platformer that was built in Unity and written in C#. Players can jump and move freely around the 3D world, to explore and fight enemies. They must seek out the scattered pieces of their resume across wacky, surreal mindscapes. Many challenges await players as they strive to put their resume in front of the right eyes, get an interview, and defeat the Interviewer in verbal sparring. Job Hunter tackles the daunting task of gaining employment in a stress-free and fun way, so it will be especially enjoyed by college students that are anxious about finding a job after graduation.

Chris Lee, "**Oasis Escape**"

Oasis Escape is a mobile game which falls under the category of Masochism gaming, which are games designed to be extremely frustrating. It was created with the concept of being easy to pick up but difficult to master. The slogan for the game is "A slow ascent into Freedom and a quick descent to Madness". The game involves a character, which is a potted cactus, shooting a gun and using the backlash of the gun to move around. The entire game is one level making it very difficult because simple mistakes could send the player tumbling to the beginning of the game. Oasis Escape was written in Unity (C# library) and designed with a pixel aesthetic to bring a sense of nostalgia and familiarity to the game.

Edward Li, "**Echo**"

We are now living in a world surrounded by music. There are more than 24,000 new songs being uploaded to major streaming platforms: Spotify, SoundCloud, Apple Music, etc. As a result, musicians are more likely to be inspired. However, the problem is, these inspirations might appear anytime and anywhere. "Echo" is the solution. Echo is an iOS-based memo app for musicians to help them keep track of musical ideas so these inspirations will never slip away. It has text editor to write lyrics, built-in virtual piano for musicians to play their ideas, and recorder to record the piano or voice. Finally, musicians can revisit all the files generated from Echo and make a hit out of them when they are sitting in the studio.

Brendan Lynch, "**Digital Truck Tickets: Modernizing Port Logistics**"

Ocean container shipping moves more than five times as much international freight as all other modes (rail, road, and air) combined. But once a ship arrives at a port, trucks are needed to move the containers to their final destinations. Since ports can have tens of thousands of containers at a time, ports need a way to let drivers know where their containers are. Currently, ports print out individual paper tickets to direct truckers to their containers and provide other instructions as needed. This wastes significant quantities of paper and money, while requiring the use of hardware that is vulnerable to failure. To address environmental and fiscal concerns, a system is designed to provide ticket information to truckers digitally, working. To demonstrate proof of the concept, a model system is implemented consisting of an iOS mobile client and a Unix-based web server.

Lucy Matz, "**Vote Smart**"

Many American college students face the decision of whether to register to vote on their college campus or become an absentee voter from their home address; however, there is not yet a way to effectively evaluate which mode of voting carries the most weight in any given election. Voter engagement for Americans aged 18 to 29 years old is lacking, and as Millennial and Gen Z voters surpass the Baby Boomers as the largest electorate group in 2020, it is imperative to the functioning state of democracy that they engage in elections. This is why it is important to show voters, specifically young and possibly disenfranchised ones, that their vote matters and that they can make an impact by turning out to the polls. Vote Smart provides a solution in weighing which address to vote from to make the most impact, based on their Partisan Voter Index (i.e. the likelihood that the district will vote for one party or the other). This tool is a web application that compares two addresses and the Partisan Voter Indices of their corresponding voting districts, and returns a suggestion of where to vote to the user along with electorate demographic information for each state.

Mehluko Myanga, "**The Bantu Warrior**"

This game aims to educate its players about African culture and the strength of the African Woman through a fun and playful environment. The game will be an educational treasure hunt. Each scene of the game will introduce its players to different countries of Africa with different cultures. In a quest to hunt for artifacts, players will be taught about the history of that country through pop-up texts. Each level will be divided into three modes: the main scene with character moving around the game environment, the tile match mode where the player will have to solve a shuffled picture of an artifact, and the word search mode filled with the appropriate African words. All characters of the game will be women dressed in traditional attire and will gain character powers over the levels. Through the attire, character powers, and the pop-up texts during the game, this game will educate about the history of Africa and will portray the strength of African women.

Alejandra Pardos, "**Investment Club Integrated Platform**"

The Investment Club at Trinity College is a student-run organization that manages over five hundred thousand dollars of the school's endowment and invests this money in the stock market. Given the large membership of the club and the need to make quick investment decisions due to the rapid movements of the market, there can be an occasional lack of communication among the students in the organization. In addition, it is hard to balance the task of making investment

profits while fulfilling the mission of the club, which is to educate and start conversations on market conditions and possible investments.

Through a personalized integrated platform with various features for the organization, the members are able to track equity trends and experiment using the Modern Portfolio Theory. This theory calculates position recommendations with the goal of creating an efficient portfolio, yielding the highest investment return for a given level of risk. The platform also makes all the resources available to the members during and after club meetings creating an even more cohesive, transparent and productive experience.

Thanh Son Phung, "**VA-NN: A Proposed Machine Learning Model with Limited Labelled Constraints**"

The paper will introduce a new representational classifier model called VA-CNN. This model is conceptually composed of the Variational Autoencoder model [1], denoted VA, and the Convolutional Neural Network model [2], denoted CNN, hence the model's name VA-CNN. The VA model has the encoder-decoder structure. It tries to copy its input data to its output, and minimize the errors between the input and the output. The CNN model is a popular variant of a neural network and is designed to classify images.

James Sheehy, "**Campus Watch**"

CampusWatch is an iOS application whose purpose is to complement the "Blue Light System" on college and university campuses. This student safety app has three main components. The first component is a location readout, updating in real time with an accuracy of 10 meters from the user. The second component is a large, easy to see emergency call button. The user can call any of three preset numbers: a friend, campus safety services, or the local police. The final component is a flashlight functionality. In this way, a student crossing campus late at night has the ability to see better around them to identify any dangerous situations, know their exact location, and then call the appropriate outlet to deal with said situation. With CampusWatch, users unable to run to a nearby Blue Light call box can access all these necessary features with a touch of a button.

Kalsang Sherpa, "**Personalized Application for Hotel Mulberry**"

My family business, Mulberry is a private hotel which effortlessly combines contemporary international standard with time-honored, personalized service that reflect Nepal's traditional family values and high-quality hospitality. In most hotels, a common way for guests to use hotel facilities is either through going to the reception or making a phone call. However, this application provides the hotel guests with seemless experience by providing convenient, flexible and easy access to the amenities of the hotel. It provides specific features for each of the services the hotel provides such as access to restaurant menu and making food and booking appointments for the spa. This application encourages guests to make best use of the hotel's facilities providing quality hospitality.

Zorawar Singh, "**PS4CT: Provable Security for Certificate Transparency**"

Certificate Transparency (CT) is a widely used open-framework that supports a more secure web by allowing domain owners and authorities to monitor and audit TLS certificates circulating around the internet. It is an IETF open-standard that makes the web more accountable and transparent but does not solve all issues associated with Public-Key Infrastructure. As of October 2019, this project records 6.69 billion entries and has reduced the detection time of suspicious certificates from days to hours. Nevertheless, ambiguities, loopholes, and inefficiencies in the CT RFC provide an attack surface that can nullify the benefits it provides. This project has three

objectives. The first is to configure and analyze the open-source implementation to understand how ambiguities in the RFC are practically dealt with. Next, based on a refined specification developed by security researchers at the Trinity College, University of Connecticut and Bar Ilan University, the open-source CT project will be extended to be robust and provably secure. Finally, this improved system will be deployed to the cloud in a distributed manner and benchmarked for testing and optimizations.

Fumihiro Tamada, "**Random Number with Expander Graph**"

Random number generators (RNG) are used everywhere such as monte-carlo simulation and computer science algorithm. However, the correctness of the random number generator is yet to be proven. Creating random phenomena out of deterministic computer is not easy. My research is about producing better RNG from a deterministic object called expander graph.

Jillian Winer, "**The Trust Game 2.0**"

A number of ground-breaking and innovative findings have been made in the field of experimental and behavioral economics during just the last few decades, particularly in the interest of trust and bargaining. The *Trust Game* is a classic game theory experiment in which players send money back and forth over the course of multiple rounds with the goal of earning the highest payoff. It is used by experimenters to examine the presence of trust and bargaining in economic transactions. However, current platforms for the game lack adjustability and creativity which limits the extent to which research can be conducted. *The Trust Game 2.0* is a complex and flexible renovation which provides the means of discovering new theories surrounding trust in economics.

Utilizing the *The Trust Game 2.0* research platform built with oTree*,* economists have the power to produce more than 1 billion unique experiments through the manipulation of thirty different variables. Settings range from changing numerical amounts, allowing randomized opponents and roles, displaying round or partner information, enabling chat rooms specific to player type, and presenting results, to even grouping based on a gender or class year algorithm. At the end of any experiment, researchers immediately receive customized and sorted data reports along with the names of winners and eliminated players. By providing economists with the tools to manipulate game theory situations and generate trust dilemmas, the answers to a plethora of trust hypotheses can finally be discovered.

Edson Zandamela, "**Offshore Ecommerce Mobile Application for Online Shopping in the U.S.**"

Thanks to the internet and globalization, Mozambicans are now able to stay up to date with the latest products available across the world. From clothing and cosmetics to electronic devices, Mozambicans know what the latest trends are and are always eager to have them. However, one of the biggest challenges that they face is the lack of a platform that allows them to purchase and have these products delivered to them at affordable costs. Offshore is a mobile application that allows Mozambicans to do their shopping in the US at low costs, as well as make money while traveling by delivering orders to locals at their destination.

Currently, Mozambicans that want to purchase products from the US face expensive shipping charges to have these items delivered to them. People often rely on their friends, relatives, or Facebook groups to pay someone to purchase and deliver US products to them.

Most Mozambicans would love to be able to purchase US products from home without having to travel and/or asking a relative to do so. Furthermore, the few platforms that can deliver products to Mozambique have limited options of US stores to shop from and have very expensive shipping costs. Offshore allows users to buy US products at US prices, in any US store while avoiding expensive international shipping taxes.

Mason Allen, "**StarCraft II Meetup**"

In the real time strategy game StarCraft II, players control one of three alien races- Zerg, Protoss, or Terran. Each race has its own unique abilities and playstyle, and so players must devote considerable time to mastering each matchup. In its current state, StarCraft II does not allow player to specify the race of their opponent. This is good for creating a balanced and fair match making system, but it is bad for practice efficiency. In particular, players would benefit from the ability to match with an opponent of a specific race, as this would allow them to create more focused and efficient practice sessions that are sensitive to their personal weaknesses. SC2 Meetup does just that- users navigate to a website where they fill out a form, and they are contacted by email when a viable practice pair is found. Players receive their practice partner's BattleTag only- no email address- which allows them to manage contact with their partner via the StarCraft II friend system. Once in contact, it is straightforward for them to set up a custom game and begin practicing. SC2 Meetup is powered by Django and styled with Bootstrap.

Yichun Wang, "**A Dialogue Agent Powered by Deep Learning**"

A statistic made by Bain & Company shows that if companies use chatbots instead of people to work on the customer services, it will help businesses save more than $8 billion per year. Therefore, in order to decrease the service cost and increase the productivity, an intelligent dialogue agent is necessary in workplace.

Recent developments in deep learning have stimulated automating the process to create a computer-programmed dialogue chatbot. For the traditional chatbot, input messages and responses are matched by a pre-determined rule, meaning the chatbot cannot answer any other questions that are not in the set of pre-determined rules. In this project, the author will try a new chatbot model called *Generative Pretrained Transformer* (GPT2), and it will be trained by machine learning, where deep generative models are employed to learn the language and have human-like conversations with people.

Saumik Tewari, "**Gadfly, a Voting Platform College Students Actually Use"**

Abstract not currently available