

ABSTRACTS

NumisList

Christian Autor

Faculty Advisor: Professor Peter Yoon

There is a saying that an unorganized collection isn't a collection. That is possibly most true when it comes to coin collecting, with collections containing thousands of items and some items that have very subtle variations. Many collectors often turn to paper-based organization solutions or manual computer entry; these take a lot of upfront work, not to mention that they aren't easily accessible away from home. Some app-based solutions are out there, but they are far from a polished experience, and all suffer either from needing a lot of time overhead to add coins in the app or from inflexibility by not letting users define their own lists. Numislist is an all-encompassing platform for coin collecting that eliminates the hassle of other coin collection management approaches. Numislist is a platform-agnostic web app that allows collectors to access and manage their collection from any device. Numislist also lets collectors create custom collection lists or reuse other public lists making it easier to start using without being inflexible. Collectors will have a great degree of freedom regarding the information they want to keep about their coins. The platform also has other features like buying and selling coins, and social media features, including liking and commenting on other users' coins. My aim with Numislist is for collectors—young and old to have an enjoyable and convenient platform for managing their coin collections.

Nørd

Aadiv Sheth

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Nørd is an app built to foster intellectual connections, relationships, and collaborations between members of the Trinity community, focused on research, projects, and life. Consider trying to cast your senior thesis, or requiring an engineer's expertise on your physics project - instead of trying to figure things out yourself, just log onto Nørd, state what you're looking for and let the answer come to you. Other users will see your post, and contact you using the provided information. Nørd allows you to explore the farthest reaches of campus, and builds connections between staff, faculty, and the student body!

Virtual Business Card

Julian Mastroianni

Faculty Advisor: Professor Peter Yoon

The project that I created for my senior project is a digital business card exchange platform named "Bump Card". During the ideation phase, I asked myself "How have big tech companies become so successful today?". There is clearly not one answer to that question, but one that came to mind was their ability to dematerialize. Apple has dematerialized the camera, wallet, keys, calendars, etc. Many things that existed in the physical world are no longer necessary to own because they are all on your phone. I then asked myself "what exists in the physical world today that is able to be dematerialized?". That's when I came up with business cards. Now, there are digital business cards that do exist today, so I had to think of ways to differentiate mine from others. For a person like me, I am very interested in a lot of things, such as playing guitar and basketball, so I thought it would be a good idea to add skills like these, which are non-technical, to better show the recipient of the card who people really are. Another factor of differentiation is the ability to emit or add information depending on the recipient. I often use the example of an investment banker speaking to a journalist. The journalist may not want to share their creative fiction writing skills with the banker because it may not be relevant, so they can choose to emit that information. There are a few significant pieces which come out of this project, which I list below.

- 1) Paperless- It is environmentally friendly

- 2) Contactless- Given that we have lived in a covid ridden world for the past two years, we understand the positive implications of contactless interactions
- 3) Infinite supply- Like Elon Musk once said, the marginal cost of software approaches \$0, so this can be produced infinitely many times with zero financial repercussions
- 4) Coolness factor- It's cool to be able to have a customizable business card always sitting in your pocket, ready to go whenever.
- 5) Quicker Follow-ups- Information will already be on the phone, removing one more step.
- 6) Data Security- impossible for anyone who does not have access to your devices to access your personal information from your card

I used a few different technologies in order to create this project. In terms of front-end development, I used HTML, CSS, and JavaScript. There were plenty of resources online given that these are probably the most prevalent front-end languages there are today. For my backend, I used PHP, which mostly involved accessing Google's SMTP server to send emails from. For data storage and manipulation, I used MySQL. I used XAMPP for my web server and script interpreter. Lastly, I used an API offered by Microsoft for html2canvas.

FutureU: A Matching System for Job Seeking College Students

Emily Murphy

Faculty Advisor: Professor Nil Chakrabortii

This app is intended to serve the purpose of comparing one's interest and their field of study to that of alumni to provide suggestions for jobs and potential industries for students to research. The idea is to provide young adults and students to become more confident in finding their potential job by maximizing their interests. By allowing for students to acquire suggestions through comparing the user's input against a dataset of alumni criteria, it is the hope that students would get insight into explore varying job possibilities. The magnitude of this project is to alleviate the stress of figuring out what you want to do, while using your college degree, by providing this app as a resource to students. By comparing a student's interests with an alumni's interests, it allows for students to be able to be matched to a career path of which a similar young adult who had similar criteria was happy with. If used correctly, it also has the potential to supply under-populated jobs with more potential workers by giving more attention to an array of industries. My project is a web application with a home interface, questionnaire interface, and industry matching interface. The front-end user interface was built using nodejs, express, handlebars, bootstrap, CSS, and HTML. The backend was developed using javascript and connecting to the mongodb database. With these technologies, I was able to make an easy-to-use web app that provides suggestions using a direct match algorithm as well as a closest match algorithm. If the user input does not directly match with an alumni data point, the closest match algorithm matches the student to the alumni who has most similar interests.

Computer Composer

Robert Allen

Faculty Advisor: Professor Nil Chakrabortii

Music is a very diverse and expansive field; one could spend a significant portion of their life devoted to the study of musical theory and still not fully perfect all its nuances. With an ever-increasing range of genres and categories, each with their own unique set of rules, rhythms, flows, conquering the realm that is music is a tall ask. However, a high level of difficulty has never been enough to stop people from trying. The field of music genre classification is one such product of computer scientists attempting to use artificial intelligence and machine learning to tackle this problem. In this study, we search for ways to increase our machine learning model's ability to differentiate between different genres given an audio file containing a piece of music.

Project Alpha; Exploring the Future of Trading

Marios Bourtzonis and Matthew Solomon

Faculty Advisor: Professor Cuiyuan (Ann) Wang

The financial markets are an interconnected and complex system that spans the whole world. Millions of market participants trade trillions of dollars worth of securities every single day with varying objectives. The new standard of being a market participant is utilizing computers to execute extensive trading algorithms. Project Alpha's objective is to create a predictive forecasting model for the future price of exchange-traded funds utilizing different types of data, such as macroeconomic inputs and asset prices. The predictive element of the model comes from utilizing a deep learning algorithm prime for sequential data sets, widely known as Long Short-Term Memory model. Testing and training the model on data from the 2000s to present will allow our model to capture a wide variety of market conditions and different volatility environments. This forecasting model can then be used as input for a quantitative trading strategy, which will help the trader decide when to increase or decrease short-term exposure of exchange-traded funds in a portfolio to achieve better returns than a buy-and-hold strategy.

Centient

Ty Deery, Finnegan McGovern, and Conor Green

Faculty Advisor: Professor Cuiyuan (Ann) Wang

Centient is a minimalist expense tracking application that helps users lower their weekly expenditures. While there are already many expense tracking and budgeting applications, most applications currently on the market tend to be convoluted, therefore we are attempting to create an application with a very simple interface that allows anyone to easily combat frivolous expenditures. Every day, the user will be given a daily budget to adhere to. The 'daily budget' that users are expected to follow is calculated through a series of algorithms. We will meet our goal of simplicity by asking for the user to input only their age, location, and income as well as the expense categories they wish to track. We will then leverage extensive data on personal spending habits in the US to create a suggested monthly, and daily budget for our users. Our robust data on age-based expenditure levels, as well as the location-based cost of living, allows us to create a sophisticated suggested budget from minimal user input. Through the creation of synthetic income data over a normal distribution, we were able to test our algorithm's effectiveness. Assuming that the user was following the app suggestions, we found that over 90% of users would save on average 5% just in the first week by following our suggested budget. Finally, the suggested budget that is generated through our initial algorithms is rebalanced via the user's actual spending habits. This is an essential component of our application, as usability will be dependent on the user's actual expenditures, not just our data. By averaging together our suggested budget with the user's historical spending data, the budget will essentially "learn" our user's habits, and adjust accordingly. This will allow the user to eventually reach a long-term equilibrium level of spending in their desired categories. We utilize Postgres, ReactNative, and SpringBoot in this application.

Jarida: From the World to the News

Rashed Alshamsi

Faculty Advisor: Professor Cuiyuan (Ann) Wang

The news is the most effective medium for spreading information and ideas about individuals and situations. News continues to play an increasingly important role as literacy and communication improve. Economists consider news to be a need of modern living. It is so powerful how a news headline can spike or crush the stock market. As a result, Jarida aggregates economic news via multiple perspectives from several nations' local media outlets. I choose the top 50 most influential countries in politics and economics. This project focuses on diversifying information and sources. The goal of Jarida is to make the news available and credible to everyone. Another goal is to get people exposed to different views about a particular subject. The news from different countries will help view a specific topic differently, influenced by culture, religion, etc. Also, Jarida is an excellent outlet for students to read the news to understand

different economics/business concepts—what a great way to learn about economics than immersing themselves in the news.

Gesture Enabled System Interaction

Rakan Alzagha

Faculty Advisor: Professor Maminur Islam

Gesture Enabled System Interaction (GESI) is a project that enables users to interact effectively with devices and systems based on intuitive hand gestures. With the exception of gaming, touch and voice have dominated the way we interact with technology over the last decade. Enabling users to utilize gestures to operate and interact with appliances, software, speakers, lights, and more will allow us to develop more interactive and robust technology. The purpose of this project is to add another dimension to user interaction with various systems and technologies. To achieve this, I developed a wearable piece of technology using the ESP-EYE microcontroller that is mounted to a pair of 3D-designed and printed glasses. The software can also be utilized as a stationary device to be placed on a desk or in a common area. The microcontroller broadcasts raw real-time video of a user's hand motions which is intercepted by a gesture-detection algorithm running remotely off of Google's MediaPipe framework. Once a gesture is recognized by the model, an API request is sent to Amazon's Alexa API (can be other APIs as well) for direct device/system interaction. A user will be able to interact with any device connected to their Alexa account or any system that has an interactive API, by issuing gestures that are unique to that specific device. Reliable, robust, and natural interactions with connected technologies is the ultimate goal of this project.

Immersive Learning

Anna Chin

Faculty Advisor: Professor Maminur Islam

This project's main objective is to create an immersive learning environment using high-level userface interaction. The purpose is to curate a space where human data can be transformed into rich, personalized experiences through a series of powerful, one-of-a-kind interactions. It aims to incorporate both aspects of visual arts and technology- merging them in a unique way that will transform a space into an immersive learning environment. To achieve this goal, a neural style transfer network is used to train images to generate into a single- stylistic image. This immersive learning environment will be created by using the softwares such as Tensorflow & Keras, Jupyter Notebook.

Library Data Sorter

William Tanamli

Faculty Advisor: Professor Maminur Islam

Librarians at Trinity have access to an extensive database of the school's collection. With such a high volume of available resources, one of the most useful tools a librarian could use would be specific searches and sorts. I used Python and a Python based Data Management tool called Pandas to create a webpage that uses selected library data files to perform specific searches. My goal was to create a tool that will allow for searches to be easily performed, such as the ability to search for only items present in both the school's physical and digital collections simultaneously. I included the ability to filter a search by a large number of possible fields, allowing for ease of searching and instant feedback in such a large dataset. I also want to provide a useful visual analysis of library data, because I think that it would be of interest to the librarians and others to see the concentration of data like book subjects.

Compare2

Yeran Xu

Faculty Advisor: Professor Takunari Miyazaki

With the increasing number of online-shopping websites and platforms available, the time spent to buy the ideal product becomes longer. Although there are price comparison websites, and other videos and blogs making recommendations, it is hard to find an app or website that could present most of the important features of the products to be compared in a table. Compare2 is an iOS app that focuses on making comparison of phones and laptops. The users can select up to 3 products they wish to compare either from the database or enter manually and the app is going to output the features comparison table with illustrative graphs. This is to help customers see the difference among the products more straightforwardly and make decisions more wisely.

Off Mark-It: An Off Market Real Estate Tracker

Emily Capprini

Faculty Advisor: Professor Ewa Syta

Off Mark-It is an iOS mobile application designed to track off market real estate. The purpose of this is to be a unique tool potential homebuyers can use to find and track properties that are not currently on the market they are interested in buying, whether they are actively searching or taking their time with the process. A special quality of this application is that it allows users to target specific homes or neighborhoods that they find desirable to buy a house in. It serves as an easily accessible tool to save houses to their profile when on the go. The main features include an autocomplete search for addresses, where the result shows up on a map, a view of the saved listing with the property details available, including if it is currently listed, and a map of the properties the user has saved. Having all of the property's details displayed will allow the user to determine if the house is within their budget and to the specifications they would like to have. The saved houses will be displayed sorted by whether they are listed or not, so when the user logs in they can easily check for changes.

Fibermap: Mapping the fiber infrastructure on the Trinity College campus

Federico Cedolini

Faculty Advisor: Professor Ewa Syta

"How to maintain the organization secure while minimizing the impact of productivity?" is the never-ending question that organizations around the world face regularly. Keeping an organization secure is not an easy task given all the different areas that compose cybersecurity. Asset security and accountability of critical infrastructure is one of those challenging areas. Organizations need to be able to efficiently keep track of all active and inactive infrastructure and devices that are key for enabling the normal operations. Fiber optic infrastructure is a collection of assets whose failure or compromise could highly prevent an organization to operate creating a negative impact on business activities. Fibermap is a tool that aims to facilitate the asset management of the fiber optic infrastructure by acting as inventory while keeping track of all different ports that are currently being used to connect devices and locations or are free to be used in new connections. Additionally, Fibermap makes the setup of new connections easier by allowing network administrators to quickly and efficiently identify the shortest path between locations using open ports. After generating the shortest path, Fibermap offers different data visualization by providing the option of creating a map view of the shortest path or an exportable list.

Tattool: The Security Analyst Tool

Tyler Brennan, Brian Garten and Iryna Onyshko

Faculty Advisor: Professor Ewa Syta

With the escalating growth of cybersecurity attacks and the projected cybercrime cost of \$10.5 trillion annually by 2025, vulnerability monitoring and management has gained particular importance. In cybersecurity, analyzing clients' systems can be tedious and consist of searching through thousands of rows

of Excel or csv files generated by cybersecurity software. For our project, we created a tool that can analyze and identify vulnerabilities in the system to improve the efficiency of cybersecurity analysts. Our project, named Tattool, streamlines the process of analyzing the data that is conducted most frequently and generates reports highlighting changes in systems' vulnerabilities over time for each customer. Our team received guidance from Hybrid Pathways, a cybersecurity company that has agreed to describe the needs seen in cybersecurity consulting. Our final product supports fixed scenarios in the three most used cybersecurity tools (Tenable.io, Carbon Black, and Cylance). Tattool's overarching architecture has a Spring Web MVC backend and a Vue frontend. The backend will retrieve data from the external cybersecurity tools' APIs, and AWS Secrets Manager is used to securely hold the cybersecurity tools' API keys. Everything is hosted on AWS to ease deployment and keep the application secure.