CSC468: Introduction to Cloud Computing

StatStrikeforce: A Valorant Statistics Tracker and Prediction Generator

Team StatStrikeforce Members:

Katherine McCarthy

Maxwell Mendenhall

Ryan Sayre

Tobyn Sitar

Project Summary

Our project aims to revolutionize the statistics tracking service available for the popular competitive first-person shooter Valorant. While there are sites such asTracker.gg and U.gg, we plan to create a new application that provides statistics specifically for Valorant's unique mechanics. With our project, we want to revitalize the way users track their own or others' statistics. One of the main features we want to implement is comparison, in which you can have a side-by-side comparison of your stats compared to another player. With this feature, we plan to ramp up the competition between friends, or prove to an enemy that you are the better Valorant player. We also plan to have an accurate system, where you can see accurate statistics that automatically update the second you finish your match.

Furthermore, with our project, we want to implement a user-friendly hub for all your favorite topics regarding Valorant. This homepage will show patch notes, a breakdown of the best team compositions and characters, a way to find and connect with others who are looking to play the game, and a way to upload and talk with others about gameplay highlights and opinions. We also plan to implement a machine learning algorithm to predict future performance statistics, based on the last batch of games played. Essentially, we want our model to factor in the most recent statistics into our algorithm to determine predictions for future matches. We want our project to be the best community website for Valorant players, both competitive and casual.

We will do our best to utilize resources like CloudLab effectively and continuously assess the best options to continue making forward progress with the project. Our main source for assembling our project's components will be GitHub and Kubernetes, so we can remotely commit and add to the project from our separate spaces while working on the different components of our project collectively, and we plan on meeting regularly to work on the project together. With this, however, we need to consider some limitations. One of the most important limitations is the timeframe. With all the ideal features and components that we want to implement into our tracker, time will be critical to completion of our goals. The 5-month time limit given to us is ideal for a lot of work, but with other commitments and classes, providing the adequate time limit to complete our project will be difficult. Another factor that could potentially limit us is the lack of hardware. Fortunately, some of us have complete desktop computers fully equipped for the work, but differences in hardware among our team members may cause difficulties in the future. We will address project issues as they appear and work together to resolve them and continue progressing towards our final vision. We are excited to begin working on this project and hope we can achieve our goals at the course's end.

Chapter 1

The vision of our project starts with the user, who will access our Web UI by URL. Our Web UI will have a welcome page where users input their own userID for the PC game Valorant, made by Riot Games. The user can optionally create an account that will save relevant information into an account holders database. The account feature will be used for user convenience and to avoid the need for users to input redundant information. Once the userID is entered, a backend worker program will retrieve the necessary data from Riot Developer Portal, which contains the APIs for all user data and statistics. The necessary data includes a player's wins and losses, which can be filtered based on timeframe of when the match was played, kills and deaths including the appropriate ratio, as well as statistics relating to objective completion performance. The desired statistics and data will then be filtered and organized into a machine-readable format. Here we will apply a Machine-Learning Model which will use the data and statistics to perform a prediction on the outcome and statistics of a current match based on data trends. This prediction will use statistics that favor recency over a total average to be more accurate in real time, and ideally will also collect data about teammates and opponents as well to formulate predictions that are very accurate and helpful. This can be achieved using the Riot Developer Portal, which provides historical statistics but also updates with data for active matches, which can be used to support our prediction model. We will brainstorm many different styles to convey our predictions, possibly through a percent chance to win, a prediction of a player's kills and deaths along with other relevant stats, and also maybe a grading system that tells a player how they have performed in a preset amount of time, providing letter grades on important game roles such as objective completion, support efficiency, gunfight success, and hero utility. The prediction model is something we are not completely certain of how it will function, but we are excited to work through its creation and implement features that we would find interesting and helpful as fans of the game. Once the Machine Learning Model is applied to the data and the predictions are generated, the backend worker will retrieve the statistics and predictions from the model and display it to the user through the Web UI, which we want to be organized in an intuitive way. Above all else, we want our project to provide insightful predictions that other statistic tracking services do not provide to make ours the most popular among the Valorant player base and give users an enjoyable and useful experience that players can share with their friends and expand the community to our site.

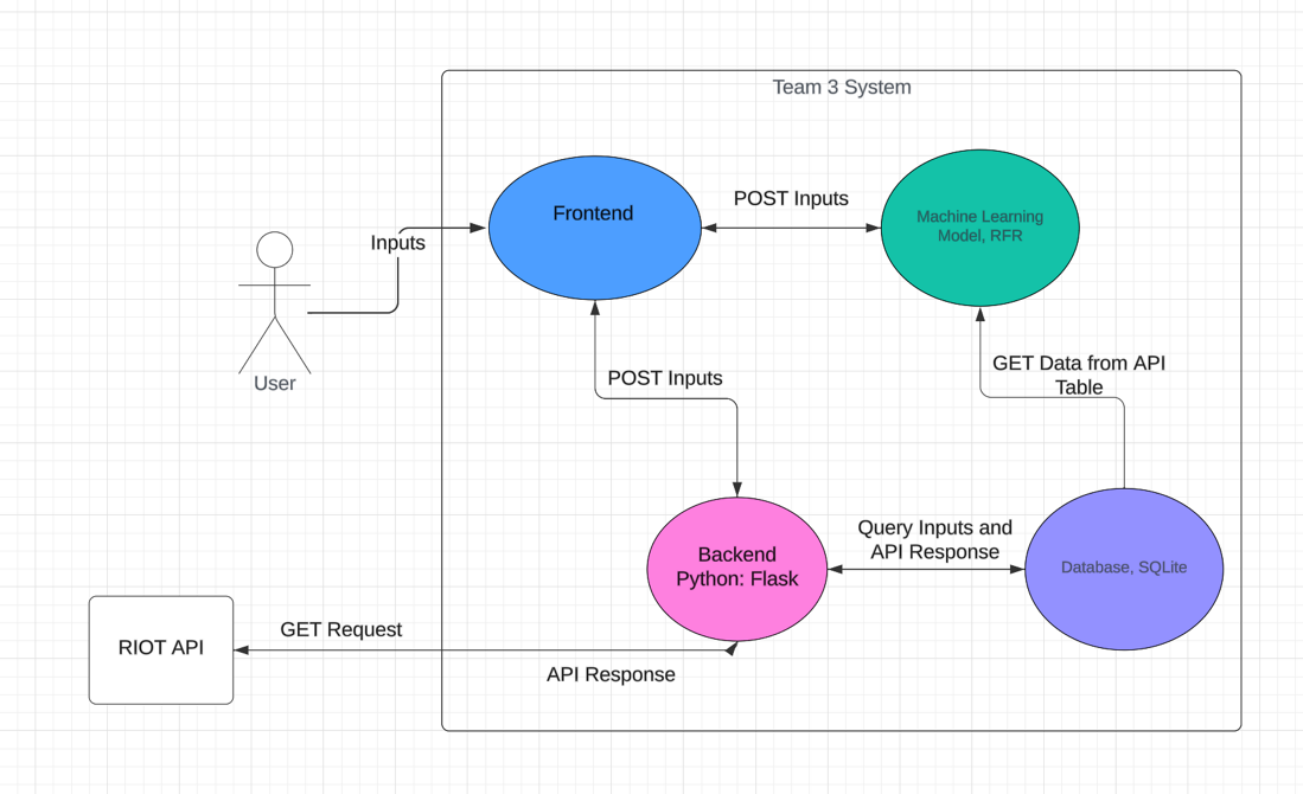


Figure 1: Design Document

Full Stack:

Front end: Web UI
Back-end: Worker, Machine Learning Model
Database: SQLite

Chapter 2

Web UI

For this program, we want a clean, user-friendly UI. Ideally, we want to utilize a tab system in order to direct users to their preferred method of tracking, whether that be recent games, aim statistics, the ability to see recently played with or most played with users, etc. Essentially, we want the program to run the same way as other statistics trackers, but stylized to Valorant's unique playstyle, and with more features not commonly found on other sites. Essentially, we would like to have separate tabs for community updates, player statistics reports, chatting, and maybe feedback on how to improve the site as well. The website will be clean, with no outside influences (ADs), and have an aesthetic appearance to it that uses coloring and imagery that is present in the game, which will hopefully draw users to frequent the site. Furthermore, if time permits, we plan to take our application to the IOS and Android stores for users to take with them on the go.

We also want to implement a system for users to login, connect their RIOT account, and track their personal stats. Our priority is making sure the system works for everyone, not just a specified group of players that know their way around complex online gaming trackers. We plan to use a variety of Web UI frameworks to discover which ones are the most straightforward to create with regards to our desired features. We are not 100% certain how these will interact, but plan to have the program work much like other statistics trackers in its finished stage. Our frontend developer will brainstorm several templates for our site, and we will convene to discuss which model we believe fits our vision closest and proceed with development. The brainstorming phase will include a discussion of which frameworks we believe will be best to achieve our vision, whether that be HTML, CSS, or JavaScript. We also plan to use Bootstrap as a supplemental tool to help us with creating our website, which we will begin to work with and inform ourselves with its functionality. We will continue to work together to implement our desired features and offer our users a great experience using web interface.

Database

For our database, we are planning to use SQLite, as it is lightweight and already built into Python. We have done research on this, and SQLite fits all we want to build into our tracker, without difficult aspects of using MySQL. Because our team is most comfortable using Python, and SQLite has a python package built into it, we have decided that currently we will work with that to complete the database related functions of our project, which will mostly consist of storing userIDs and code-generated statistics such as K/D ratio, win rate, hero choice, score, etc. as well as our prediction calculations. SQLite also offers more data filtering commands than other database services, such as Select Distinct, Limit, Between, pattern matching, sub-querying, data transformation commands, and several unique table joining operations such as Self Join and Cross Join which will be very helpful for aggregating our necessary data and filtering that to a machine-readable format for our prediction model. This is much easier to implement for a project of our scale, which will give us more time to focus on the more challenging components of our project. SQLite also offers an online tutorial for new users to teach beginners how to effectively use the wide variety of commands that the platform offers, which we plan to take advantage of to help us complete this component of our project smoothly. The alternative to this would be using MySQL, but for a project of our scale we have currently deemed it not necessary, however we will re-evaluate our progress regularly and assess whether software changes must be made to meet the criteria of our vision.

Backend

For the backend development, we are leaning towards the use of Python, because of Python's wide spread of support for different databases and other software. It will also be compatible with SQL based databases and have good integration with SQLite which we plan to use. Due to Python's versatility with our machine learning model and its API capabilities, as well as our overall comfort with the language, we decided that it is the language we will use to create our worker in the backend. Research into Riot Developer Portal's functionality has shown that Python is the preferred language from the community to request data from their APIs, so we believe that because of these factors it is our best course of action. Riot Developer Portal offers many different APIs each with a different purpose, for example VAL-MATCH-VI specialized in match data based on an ID or recency, VAL-RANKED-VI is specifically for ranked leaderboards and associated statistics, and finally VAL-STATUS-VI is used to find the status of a player account in the present. This data can be transferred using an index of .json files, which we can use to retrieve relevant data from each API and format it into appropriate data tables. While working with API is something that is new to us, we have researched and found valuable tutorials from Riot Games users on how to effectively use their Developer Portal and its many creative features, which we will use to learn how we can apply the concepts of data requesting for the needs of our own project. We will monitor our success with this approach and assess its effectiveness regularly to ensure positive progress is made with the project.

Performance Prediction Through Machine Learning

This prediction aspect is the primary feature of our project vision. Competitive players often want to see how they will perform in a match and often look up the stats of other opponents to see how they will play. Making it easy for competitive players to use external software to predict this is the primary goal of our project. However, this prediction heavily relies on the fact that the user has a type of consistent performance throughout their games, otherwise results may be inaccurate.

Many ML models will be tested on the data before we decide on the final model. The models and not limited to are RFR (random forest regressor) and Basic Feedforward Neural Network. Stacking multiple models also to see the cost outcome will be considered.

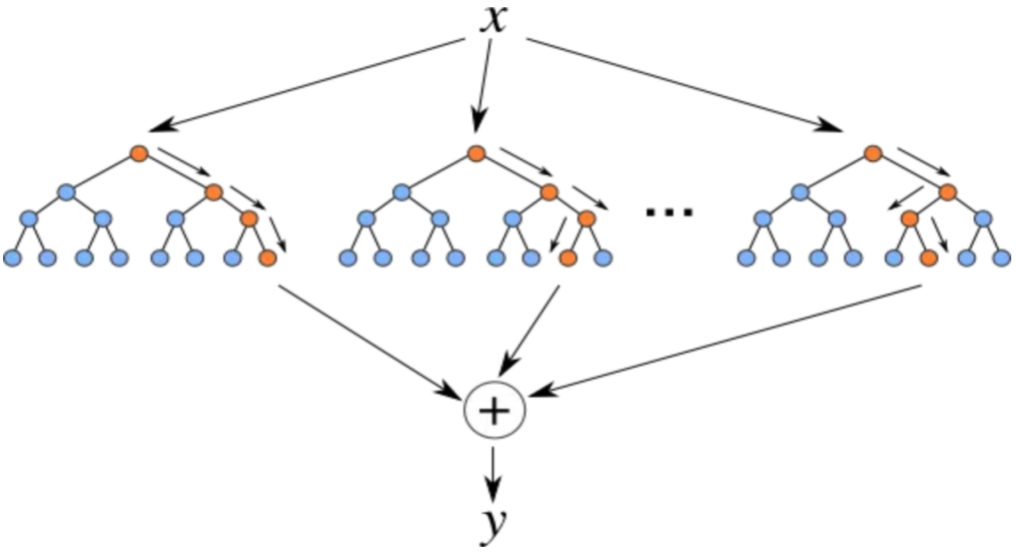
A large part of machine learning and the part that usually takes up the most time is feature engineering. We will take the data given by the APIs and engineer the data to come up with more features that we think will be relevant in helping predictions. This step-in machine learning is usually a process of trial and error so an exact number of features we will not be able to provide until the end.

The language this feature will be built on top of is python. Using python there are many libraries that aid in the development of machine learning like Scikit-learn and TensorFlow. We can build an API on top of flask (python web framework) to expose the model endpoints for the other microservices. The features will then be transferred over web protocols and the data will be passed into the model via query parameters with the web server responding with the prediction. We will evaluate the success of this method regularly and update on our progress as the project continues.

Mathematics behind RFR

RFR is a supervised machine learning model which means it learns from mapping X inputs to Y outputs. The X inputs must be labeled data so the model can learn from it. Unsupervised machine learning is when the X inputs are not labeled so the X data cannot be distinguishable from other X data within the dataset.

The idea of how RFR works is finding the best possible mean squared error (MSE) for the features provided. It uses the ensemble method of finding the MSE which operates on developing different decision trees at training time and then outputting the MSE. During the process of growing each tree it randomly selects a subset of the features at each split point, this leads to increased diversity among the trees, which in the long term helps prevent overfitting for data tremendously. It chooses the final value (or predicted value) by comparing the outcome of each tree, it then makes a prediction on the outcome data.



https://dsc-spidal.github.io/harp/docs/examples/rf/

Since RFR works on knowing the MSE, understanding how the formula works is crucial for the best output from the best features.

$$\text{MSE} = \frac{1}{n}\sum_{i=1}^{n}(y_i - \hat{y}_i)^2$$

- Where *n* is the number of data points.
- y_i is the value returned by the model.
- $\hat{y}_i$ is the actual value for data point *i*.

Deployment

The last aspect of our project is how to effectively deploy our project using a web server. We have experience creating default web servers using nginx and Apache, but this is something we will need to research and determine once our project components become more developed. To containerize the components of our project for portability, application efficiency, and security in the deployment phase, we plan to use Kubernetes. Containerization is a new concept for our team but one that we are excited to learn how to use and apply that knowledge to our project's needs. For now, we will focus on developing our components, but will take some time in the future to learn about the best strategies for web deployment to https, and also how to configure our domain name and continuously run our web server for extended periods of time. We will utilize our CloudLab docker profiles to learn more about deployment and come to an informed decision on how to proceed, along with providing updates along the way. We are pleased with the conceptualization of our project at this stage and are very excited to begin with technical development of the core components of StatStrikeforce.

Katherine McCarthy

Aspiring UI / UX engineer with a strong foundation in Computer Science

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EXPERIENCE

ICELINE, West Chester, PA — *Front Office Associate*

AUGUST 2023 - PRESENT

- Managed events with a focus on enhancing the user experience
- Developed proficiency in document editing and creating for event planning
- Leveraged a user-centered approach in customer interactions
- Utilized Microsoft office and Daysmart for efficient task management

ALDI, Malvern, PA — *Full-Time Store Associate*

MARCH 2022 - AUGUST 2023

- Gained experience in efficient store layout and customer flow
- Implemented user-friendly solutions for improving customer experiences
- Quick issue resolution to enhance user satisfaction

TJ MAXX, Quakertown, PA — *Store Associate*

NOVEMBER 2019 - MARCH 2022

- Collaborated on store layouts and merchandising to optimize customer experiences
- Adapted to changing roles within the store to meet user demands

EDUCATION

West Chester University of Pennsylvania, West Chester, PA — *BS in Computer Science*

AUGUST 2020 - ESTIMATED DECEMBER 2024

- **Major:** Computer Science with a focus on User Interface and User Experience
- **Minor:** Psychology, specializing in human-computer interaction
- Current GPA: 3.0
- Expected to receive a diploma in Computer science with a focus in UI / UX, along with a certificate in Cybersecurity.

SKILLS

Strong Problem-solving and analytical skills with a focus in user-centered design

Effective communicator and team player

Proficient with design and prototyping tools

Quick learner with a dedicated work ethic

Passion for creating exceptional user experiences

CLUBS

Women in Computer Science Club (2022-2024)

Computer Science Club (2022-2024)

Hands Helping Paws Club (2022-2024)

West Chester Gaming Club (2022-2024)

LANGUAGES

HTML, JAVA, C / C++, Python

PROJECTS

Video Game Tracker, — *CSC 468 Project*

JANUARY 2024 - ESTIMATED MAY 2024

- Utilized Python, Java, etc. For Cloud Computing purposes.
- Created an all-in-one Tracker for statistics, patch notes, and comparison of statistics with others.
- Utilized a clean, user-friendly UI to make the site / app easily accessible for new and returning users.
- Allowed for an entire brand creation, with more project ideas on the way.
- We allowed for exceptional work using basic desktop & laptop computers, with accessibility for older models.
- Implemented a User Account system to login and track stats for a connected RIOT account, with details that are personalized for the user's account.

Personal Website, — *Personal Project*

JANUARY 2024 - ESTIMATED JULY 2024

- Utilized Canva, HTML, and CSS in order to organize and make an aesthetic website, with easy tabs.
- Utilized for personal use, with hot-links to different frequented websites, and tabs for different aspects of my life
- Planned as a personal planner, much like Notion, but customized to my own liking.
- Implements updated Spotify built-in tracker in order to utilize my music statistics

Discord Servers, — *Personal Use*

JANUARY 2020 - PRESENT

- Added different bots and customization tools in order to personalize servers to different topics or friend groups
- Customized roles, colors, settings, and different folders to organize and distribute correct server settings
- Allowed for custom bots built by friends for ultimate customization tools (including music bots, Pokemon bots, chat bots, etc.)
- Tracked user frequency, and user engagement through bot trackers

MAXWELL MENDENHALL

Malvern, PA 19355 | 484-999-4102 | mendenhallmaxwell@gmail.com |
WWW: https://www.linkedin.com/in/maxwell-mendenhall-317ba61b6/ | **WWW:** https://www.maxwellmendenhall.tech

Education

Bachelor of Science: **Computer And Information Sciences** Expected in Dec 2024
West Chester University of Pennsylvania West Chester, PA

Professional Summary

Computer Science student at West Chester University with a minor in White Collar Crime and a Computer Security Certificate. Skilled in object oriented technologies including Python, Java, C#, with hands-on experience in data science and ML models. Seeking an internship to gain practical industry experience.

Skills

- Python
- Java
- Next.js
- MySQL
- Node.js
- Machine Learning
- Wireshark
- Data Science
- MongoDB
- API's

Work History

Professional Proprietary Algorithmic Trader Jun 2023 - Current
Topstep LLC Remote

- Developed a profitable trading algorithm in python and C#.
- Manage and secured 50k worth of funding from a proprietary trading firm for market deployment, integrating with a broker's API and slack API for real-time position updates.
- Continuously achieving strong performance; established a website and machine learning model to display real-time results and progress.

Frontend Web Developer Jan 2023 - Apr 2023
The Wrap Shack West Chester, PA

- Developed an engaging website for Wrap Shack to establish an online presence and reach a wider audience, featuring their services and portfolio.
- Implemented a user-friendly contact page, enhancing client-business communication.
- Successfully attracted new clients, significantly expanding Wrap Shack's customer base and market visibility.

Projects

Machine Learning Trading Optimization | Python, scikit-learn, and Machine Learning

- Developed a logistic regression machine learning model from scratch, gaining a deep understanding of its core functions and underlying mathematics.
- Integrated trading algorithmic data into the model to uncover correlations between wins and losses.
- Enhanced the algorithm by incorporating additional features, aiming for more precise and conclusive results.

Extracurricular Activities

- Computer Science Club Member, 2021 - Actively participated in discussion on various computer science topics.
- Competitive Programming Club Member, 2022 - Participated in Capture The Flag (CTF) competitions placing overall 89 out of 3000 students.
- West Chester Rugby 2021-2023 - Engaged in team building activities in an fast paced environment.
- 51st West Chester Fire Department, Volunteer Firefighter 2022 - Served as a first responder to emergency calls, developing and applying strong communication skills in a high pressure environment.

Ryan Sayre

Downingtown, PA 19335 | (484) 723-9748 | rsayre14@gmail.com
www.linkedin.com/in/ryan-sayre-283633185

Fourth year student at West Chester University working towards a B.S. in Computer Science. Seeking a challenging internship that will allow me to utilize and expand my skill set; detail-oriented with excellent communication and collaborative skills.

EDUCATION

West Chester University of Pennsylvania Jan 2022 - Dec 2024 (Expected)
Bachelor of Science (B.S.) – Computer Science
4.0 GPA Dean's List student with strong desire to learn new skills. Relevant coursework in Programming Language Theory/Paradigms, Data Structures, Computer Systems, Database Management, Data Science/Visualization, and implementation of Cloud Computing solutions.

Virginia Polytechnic Institute and State University Aug 2019 - Dec 2020
Mechanical Engineering
3.2 GPA student with significant experience with collaborative problem solving and design. Relevant coursework in Engineering, Advanced Mathematics, and Professional Writing.

STEM Academy, Downingtown, PA Aug 2015 - Jun 2019
International Baccalaureate Diploma
Cum laude International Baccalaureate graduate and National Honor Society member. Coursework focused on Physics, Engineering, and Advanced Mathematics.

EXPERIENCE

Information Services & Technology, West Chester University Aug 2023 - Present
Multimedia Technician Intern
Responsibilities include multimedia equipment installation and testing, user education for students and faculty, documentation of university assets, technology troubleshooting, and completion of AVIXA CTS training with focus on Audio, Video, and Networking Technology.

Rainbow Bru Thru, Valley Township, PA Mar 2021 - Aug 2022
Assistant Manager
Responsibilities included opening and closing duties, documentation of daily earnings, customer service and professional relations, product organization, and training of new employees.

CURRENT PROJECTS

Valorant Statistics Tracker and Prediction Generator Feb 2024 – Present
Collaborative project to design and implement a statistics tracker and predictor for Valorant which utilizes Cloud-based infrastructure through CloudLab virtual machines. The core components are containerized using Kubernetes, which include Web UI development, Database Management, APIs, Systems Administration, and application of Machine Learning Models. Relevant skills include Linux, SQL, GitHub, and Python Programming.

TECHNICAL SKILLS

Java Programming, Python Programming, IntelliJ IDEA, Linux, SQL, GitHub, C Programming, Microsoft Office, AV Technology, Networking Technology

References Available Upon Request

Tobyn Sitar

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West Chester, PA
Sitartobyn@gmail.com

EDUCATION

West Chester University **West Chester, PA**
Bachelor of Science in Computer Science *Graduation May 2024*

- **Relevant Coursework:**
  - Computer Science I (CSC 141): An introduction to programming using Java.
  - Intro to Cloud Computing (CSC 468): Completed a course on cloud computing, covering foundational concepts, virtualization, containerization, and orchestration technologies.
    - Project: Valorant Game Statistics Tracker and Prediction Generator
  - Computer Science II (CSC 142): Implementation of classes and objects, sorting and searching arrays, intro to GUIs using Java.
  - Computer Security & Ethics (CSC 301): An introduction to Computer Security and the ethical underpinnings of security
  - Digital Image Processing (CSC 317): Introduction to data visualization, image analysis, and mathematical foundations using Python programming and the Matplotlib and OpenCV libraries.
  - Computer Science III (CSC 240): Advanced topics in object-oriented Java programming, including project design, planning, and testing, and introduction to basic data structures.

EXPERIENCE

IT Support Intern, The Wright Center, Scranton PA (2023)

- Configured laptops for medical residents, ensuring optimal setup for educational and clinical needs.
- Supported server and computer maintenance, enhancing network reliability and system performance.
- Provided technical assistance, improving user experience and operational efficiency.

IT Support, Sitar Auctions, Waverly PA (2022-2023)

- Provided technical support, performed maintenance tasks, improved computer performance, enabled efficient communication across the organization, configured email accounts, optimized computer systems, and improved communication processes for a family-owned business.

Team Lead, Kitchen Supervisor, Montage Mountain, Scranton PA (2018-2022)

- Effectively communicated tasks and responsibilities to kitchen staff
- Organized and facilitated events, ensuring smooth operations.
- Encouraged and facilitated employee engagement and feedback, resulting in improved morale and productivity.

ADDITIONAL SKILLS

- Technical skills: Java, C, Python, Microsoft Office Suite, SPSS
- Soft Skills: Adept at providing exceptional IT helpdesk support, showcasing excellent communication and interpersonal abilities. Demonstrates adaptability by quickly learning new software and programming languages. Experienced in working with large datasets, ensuring optimal performance and efficiency in code execution.