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Marzieh Ayati, A web service for visualization of biological data

Visualization of data can shed lights to the patterns in the data. In this project, we try to develop a web service that give the users (mostly biologist or physicians) to explore their data easier. The users should be able to define different groups in the input data, and have access to different normalization methods, and different charts. We also should implement some algorithms and integrate existing biological data and information to interpret the result of the analysis. All the charts and tables should be interactive and dynamic to facilitate the data exploration.

Join this project if you like to know more about biological data, excited to read about some algorithms in the bioinformatics and passionate about statistical analysis and data visualization.

Zhixiang Chen, AI for Playing Board games, such as Gomoku and Pentago

I will direct the group of students to develop an AI program that can outperform human expert level players and can compete and win other leading AI programs. Platform: low end computing devise (in contrast to high performing, expensive computers/cluster). Approach: monomial, neural networks, reinforcement learning, Monte Carlo Search. Required skills: Python, algorithms, and data structures.

Zhixiang Chen, Web-Based Information Systems

I will direct the group of students to design and implement a Web based system. An example of such a system is “HomeNeedsService.com: An Online Marketplace for Home Needs Service.” Required skills: database, PHP, or Java, or Python programming. Complete the system and deploy it to Amazon’s AWS.

Andres Figueroa, Implementation of a Degree Auditing System

Degree Works, Navigate and Scheduler Planner are some of the UTRGV tools available for a student to keep track of his/her academic progress and to efficiently plan his/her course registration to graduate as soon as possible. However, most of the times these tools are useless due to changes in degree plans over the years, changes in course numbers and/or names, course transfers, etc., etc.

Andres Figueroa, Genetics Database Application

The increasing amount of biological data available to researchers has allowed for great improvements in genetic evaluations and diagnosis. Information ranging from physical measurements to psychological testing can provide a complete picture of an individual. Furthermore, data on familial history can allow geneticists to create a map of inheritance for genetic disorders. This project serves to organize this data in a well-defined manner that models an intuitive organizational approach. A working database will allow for advanced queries that bring various pieces of data together for quick determination, while a functional interface will simplify the query process.

Andres Figueroa, Implementation of Pedigree Drawing Algorithms

A pedigree is a graphic representation of a record of ancestry that uses standard symbols to show relationships between members in a family. Such a drawing is useful for genealogical research. The purpose of this project is to develop an application program that can produce pedigree drawings that are

easy to read. The program should also implement algorithms that reduce problematic cases related to pedigree drawings. Emphasis will be placed on making the application customizable and the drawings accurate/optimized.

Bin Fu, GPU Scheduling

GPUs play a crucial role in various aspects of computer technology, particularly in the recent advancements of artificial intelligence. This project focuses on the development of algorithms designed to optimize thread scheduling within GPUs. The primary objective is to improve memory coalescing for the caches within the streaming processors of the GPU. Accomplishing this goal necessitates proficiency in GPU simulation and CUDA programming.

Bin Fu, Connecting AI tools and developing machine learning algorithms.

The experimental part of this research is to develop software tool to connect multiple AI tools and identify new applications. The theoretical part of this research is to develop some fundamental machine learning related algorithms.

Yifeng Gao, Representation Learning for Time Series, Video, Image, or Text

Representation Learning is one of the most important functions in different deep learning related tasks. In this project, you will pick one type of data (time series, video, image or text) and learn how to train a representation learning model based on some existing dataset. In addition, you will learn how to use the model to develop various applications.

Dongchul Kim, Development of a Smart Game AI

This project is designed to foster the development of an artificial intelligence adept in navigating game environments through the application of reinforcement learning principles. The project presents a unique opportunity for you to immerse yourselves in understanding how AI can independently learn and formulate complex problem-solving strategies. Your primary objective will be to select a game, and to implement a reinforcement learning algorithm, including but not limited to DQN, PPO, or DreamerV3 (<https://github.com/danijar/dreamerv3>). Responsibilities are establishing the learning environment (game), defining the rules of the game and the AI's potential actions, evaluating the AI's performance metrics, and conducting a comprehensive visualization and analysis of the results. This project stands as an opportunity to refine your skills in programming, algorithmic design, and data analytics, while simultaneously deepening your knowledge in deep reinforcement learning techniques

Qi Lu, Path Planning for Robot Swarms

A team of mobile robots navigates to a target location. They have short vision and communication range like a group of ants. When an obstacle (walls, boxes, or U shape bug-trap) is on the way to the target location. How can we design an algorithm or obstacle avoidance strategy for the team of robots? So, they can plan a path to the target location efficiently? You will have the opportunity to learn C++ programming, robot simulation, and algorithm design. We do not have physical robot design since we are in CS.

<https://sites.google.com/view/qilu/home>

Qi Lu, Moving Object Tracking using Drones

A moving object is moving on the ground. It can be a pedestrian, truck, or robot. A drone is searching for a moving object in a large unknown environment. Once the drone detects the moving object, it will track the object. It may predict the movement of the object using the past movement trajectory. So, the drone can predict the movement of the object, and have a more efficient tracking performance. You will have the opportunity to learn Python and C++ programming, robot simulation, and algorithm design. We do not have physical robot design since we are in CS. You will have the opportunity to use existing robots and drones directly.

<https://sites.google.com/view/qilu/home>

Carlos Pena, Fisherman's best friend App

There is a vast variety of fish species and some of them will look very similar, some will be in season to fish others will give you a fine. To address this complication, I suggest you develop an application to classify fish species after you capture them, just take a quick picture and let a Deep Learning algorithm do the rest, the application should also be useful even if you are not fishing, saving past catches, the size the weight (probably) will let the user share their fishing history on social media and other online platforms.

Carlos Pena, App development using Agile

Any mobile app with Flutter or similar, following best practices in the Agile methodology; that is creating user stories, organizing the development process with an issue tracker software like Jira, and a version control software like GitHub, while testing your code thoroughly to ensure no bugs exist in the app. Final product must be a robust, high-quality application that is ready (or close to ready) to be deployed to the App store.

Carlos Pena, Automatic attendance tracker

Develop a neural network that can detect and track students entering and leaving a classroom; create an app to deploy the network and give access to professors so they can track attendance automatically and store it in an easy to access file (i.e. CSV, EXCEL, etc.).

Robert Schweller, Dungeons & Dragons

Dungeons and Dragons is awesome. Develop a piece of software that makes playing Dungeons and Dragons even MORE great. A last semester project involves a battle simulator in which a collection of party members are entered, along with a set of monsters. The software then runs a simulation to compute the percentage chance for the party to win the encounter. Future projects may be completely new ideas or may attempt to expand on this project. Another example project might be a digital "board" in which players may move their tokens through a pre-constructed dungeon, which causes the dungeon to be progressively revealed as players progress through the dungeon corridors.

Haoteng Tang, Medical Image Segmentation with Deep Learning Techniques.

Medical image segmentation is one of the most important stages in the medical image analysis. In this project, you will learn how to handle the neuroimaging data (e.g., MRI brain images) and build up your deep learning segmentation framework on these data.

Charlie Ticer, Business Intelligence

Companies and businesses use software programs to run their operations 24 hours a day, 7 days a week, 365 days of the year with minimal downtime and disruptions to provide goods and services to customers and clients. Software programs are not just found in technology-related companies but also in other industries not mainly technology-related such as, but not limited to, education, game theory, live streaming, e-sports, business, finance, healthcare, and fitness. What they say is true, every company is a technology company. For any projects related to business intelligence, I will require groups to create an application or website that incorporates concepts pertaining to APIs, databases, machine learning, and/or cloud computing.

Charlie Ticer, Class Selection Recommender

This project will involve the use of data science to create an application that will give class recommendations for a student to take in a given semester based on a variety of preferences set by the student. These preferences may include, but are not limited to, time of day and location to take classes, having lectures and labs together or separate, experience and teaching style of professors, and historical difficulty of classes, which will be captured as quantitative data points for the application. This project may be expanded to use machine learning techniques for qualitative data points.

Charlie Ticer, Esports Program Manager

This project will involve the use of web or mobile development to create a website or application that will be used by gamers to create and manage esports events spanning a variety of video games. Features include creating and managing teams and tournaments, account authentication and authorization of external gaming platforms (Twitch, Discord, etc.), tracking scores and results, and capability of displaying scoreboard overlays (similar to how ESPN does this). This project may be expanded to use digital image processing and computer vision techniques to capture gameplay of a video game in real-time to automatically update scores and results as well as machine learning techniques to automatically match players or teams similar in skill level and predict likelihood of players or teams winning or losing.

Charlie Ticer, Twitch Raider Recommender

This project will involve the use of data science to create an application that will give the best live stream recommendation for a Twitch broadcaster to send their viewers to at the end of the stream (called a raid) based on a variety of preferences set by the Twitch broadcaster. These preferences may include, but are not limited to, follower and viewer count threshold, similar stream categories and schedules, frequency of live streams, and community involvement, which will be captured as quantitative data points for the application. This project may be expanded to use machine learning techniques for qualitative data points and creating a chat bot for Twitch broadcasters.

Charlie Ticer, Video Game Soundtrack Recognizer

This project will involve the use of machine learning to create an application that will analyze audio samples of a video file containing gameplay of a video game and determine which video game soundtrack is being played given a list of video game soundtrack audio files (similar to how Shazam does this). The list of video game soundtrack audio files will live on the cloud. An API for tying video game soundtracks to information about the video game will be used.

Emmett Tomai, Game Jam

Over the course of the semester, we will make three different rapid prototype games in sub-teams of two or three people. We will stress quickly making playable demos and iteratively improving them.

For the Game Development class, we have used a variety of different technologies, most recently the Unity 3D engine. Unity is an accessible, modern engine with massive market share, but the reason we use it is because of the extensive community documentation. The Game Development class focuses on fundamentals but also gives students opportunities to make games so that they can independently explore a much broader field of content. Unity enables this because it's very easy to find tutorials, guides, and references for anything in Unity.

For this project, we will be using the open-source GODOT engine (<https://godotengine.org/>). GODOT follows largely the same architecture, conventions, and design ideas as the market leaders (Unity and Unreal) and does pretty much the same things at an intro level. We will be doing this with a particular eye towards evaluating the community documentation.

For this project, students should either have taken CSCI 3370 Game Development, have comparable experience with developing games, or have developed more-than-class-projects in multiple programming environments. You need to be comfortable jumping into a new environment and putting together a demo in a few weeks.

Depending on the number of people interested, we may have to set a meeting time outside the normal class schedule (8am, 5pm, or 3:30pm on TR). Being able to make the meeting time in-person will be a hard requirement of the project.

Emmett Tomai, Web Development

Modern web development is very framework oriented. Projects should seek to learn a new framework rather than recreating wheels. I will require detailed design work with mockups and formal use cases in order to have a clear deliverable.

Emmett Tomai, VR/AR

For VR you need a proposal that actually leverages the strengths of VR, which is harder than it sounds. Also, the whole team has to have compatible VR hardware (most headsets run on SteamVR+Unity).

Phone/tablet AR still isn't in a great place right now. Specialized hardware is growing and might be interesting, but the whole team has to have access to the hardware for that to work.

Tim Wylie, Game Strategies and Complexities

For many strategic games, little is known about strategies, complexity, or even good approaches to these two areas. The class of games I'm most interested in are called combinatorial games. This refers to any game based solely on strategy (no randomness) and perfect information (no hidden cards, etc.). Some example games are chess, checkers, go, connect 4, tic tac toe, and so forth. I welcome taking teams of students that are willing to pick an approved game, and work at progress in three key areas which address open problems and interesting ways to make progress on what is known. A useful reference is my course webpage, from my special topics course, covering many of these game attributes. Please survey the material before committing to a game project.

<http://academic.timwylie.com/17CSCI4341/CSCI4341.html>

Tim Wylie, Classic Video Game Jam

One aspect of modern programming is few limitations on hardware resources. We want to look at limited systems and make games while maintaining the same limitations that were required when games were originally programmed on these systems. However, we have the benefit of a rich set of tools and communities that have developed around these systems which we will utilize. This will allow us to use some familiar high-level languages along with some native machine code and basic.