Info

Step One

- Review the List of Sponsors and Projects
- Look for any special requirements for students
  - Specific Tech Skills
  - Citizenship

Step Two

- Complete your **preference survey** (a Qualtrics survey via the link on Week Two Canvas Module.)
  - Prefer Certain team mates
  - Avoid Certain team mates
  - Top Five Preferred projects
  - Tech Skills Strength Areas
  - Soft Skills Strength Areas

Sponsor BI Inc. # 1

Description Complex Event Processing

In the world of IoT and many industry verticals like fintech, the ability to process real-time streams of data with near zero latency can be a competitive advantage and even an absolute necessity.

Complex event processing, or CEP, consists of a set of concepts and techniques developed in the early 1990s for processing real-time events and extracting information from event streams as they arrive. The goal of complex event processing is to identify meaningful events (such as opportunities or threats) in real-time situations and respond to them as quickly as possible. This project provides the opportunity to explore and understand CEP and put it to work in real-world situations.

Sponsor BI Inc. # 2

Description IOT Protocols

The delivery of data is at the foundation of the Internet of Things (IoT). Proprietary, home-grown protocols were really the only option in the early days, but now, many industry standard protocols exist. Each one is typically suited for a particular set of scenarios, with trade-offs around complexity, flexibility, overhead and power consumption. How do they stack up?

Sponsor Caliber Public Safety #1

Description Caliber Analytics and Ad-Hoc Reporting

- In the realm of public safety, big data analysis can be used to determine crime trends, identify environmental threats, and detect public health trends, just to name a few. Additionally, there has been an increase in demand for police accountability and transparency, which can be accomplished via accurate reporting and public access to data and information.
- Communities are seeking new practices and tools, such as the use of big data and analytics, to inform decision making in public safety and justice. By providing a software solution for government agencies to define, filter and report on their data, we can keep these communities safer and better informed. This project will provide that software solution.
- The cloud based reporting application will translate our large data sets from computer-aided dispatch, records management, and other business systems into actionable intelligence, meaningful insights, and provide the ability to assess a range of disparate sources to better understand complex public safety issues.

Sponsor Caliber Public Safety # 2

Description Safetown

- We are currently looking to replace an existing software product suite we call SafeTown. The current product provides 4 main features. Below is a short description of each. This project will involve developing ONE of these four features.

Sponsor Caliber Public Safety # 2

Description Safetown

- *Household Profiles*

Household Profiles is the quick, easy and secure way to provide critical information about your home and family to the people who can help.

- *Community Alerts*

Community Alerts gives you real time visibility to alerts from police, fire, emergency services and the community.

- *Report A Problem*

Report A Problem lets you send an alert to the emergency service professionals in your town, or to the community.

- *Crime Maps*

With Crime Maps, you can view crime incidents and statistics for your neighborhood conveniently on a map. Understand what crimes are happening, where they are happening and when they are happening.

Project Book

Sponsor CEAS Advancement

Description Advancement Data Analytics

Building upon last year, create software that incorporates machine learning, data analytics, artificial intelligence, and predictive modeling to:

- Predict major gift prospects (top donors) for the Advancement team to secure philanthropic investment in our students and university.
- Develop wealth profiles *based on accurate* geographic location, employment, contact information, and wealth predictors such as charitable giving, real estate holdings, SEC filings, and all publicly available information.
- Discover correlations in major gift giving trends based on internal and external data

Project Book

Sponsor CU Boulder EBIO Department

Description Data Collection App

Participants will build upon work from last year's Capstone project (interactive map web application).

We are seeking students to develop a novel data collection application that will populate the interactive map and track data collected from throughout the state at the individual tree level and potentially orchard level.

Sponsor CU Leeds School of Business

Description

Leeds is proposing TWO distinct projects. The student team will work with the sponsor to decide which of the two projects the team will work on.

1. Digitizing a Half-Century of Financial Panel-Level Data

The goal of this project is to digitize and gather data from the Moody's manuals. These manuals, which are in the public domain prior to 1952, contain accounting, governance and other business information for listed corporations. The main goal of this project is to fully automate the data gathering process.

2. Measuring sentiment in financial text

The goal of this project is to use machine learning methods to measure sentiment in the context of financial textual corpora, and to see how it relates to stock price movements. (i) Algorithmic methods to extract sentiment. We are using a standard machine learning algorithm, the multinomial inverse regression (MNIR, Taddy, 2013) to measure sentiment in financial text.

Project Book

Sponsor CU Boulder Psychology Department

Description Racial Bias in Face Recognition

- During the 2019-2020 Senior Capstone Project, the student team created an app to train users in improving their ability to better recognize racially diverse faces.
- Adapt the existing app to allow user to select faces of different races and genders and dynamically sample different sets of faces during the training (the current app uses fixed sets for training on day 1, training on day 2, etc).
- Publish app on Google Play and the iTunes store
- If possible, use face recognition to automatically modify faces for inclusion in the app

Sponsor Digiclips

Description Admin Website Improvements

DigiClips is a media monitoring company. We record TV and Radio 24/7.

Currently the TV back-end sends error information from the computers that do the TV recording to the MySQL database server. Administrators use stored procedures to let them know that each machine is currently running correctly and not suffering from errors that could compromise recording data. The radio back-end will be modified in another project to send errors to the database. All substantial errors should be sent to the database for later analysis by the administrative website.

Project: Take the TV and radio error data from the database and present it in chart & graphical form to the administrative website users for quicker analysis.

Sponsor Festo (1)

Description Manufacturing Marketplace

Festo is a multinational industrial control and automation company producing and selling pneumatic and electrical control and drive technology for factory or plant-floor process automation including industrial robots, sensors, vision systems, servo motors and actuators.

- The goal of this project is to implement a digital marketplace where machine owners can offer their production capacities, product-developers show their products and customers can choose what they want to have produced for them.
- The resulting software will be incorporated into ongoing development at Festo, where a Multiagent System for the machines and products is being developed.

Sponsor Festo (2)

Description Manufacturing Pay Per Use Platform

Festo is a multinational industrial control and automation company producing and selling pneumatic and electrical control and drive technology for factory or plant-floor process automation including industrial robots, sensors, vision systems, servo motors and actuators.

Recently more and more Festo customers are asking to be able to RENT these devices. This project will result in the creation of a blockchain based system that allows Festo and their customers to exchange payment data without going through a bank as intermediary.

Sponsor Full Contact

Description Identity Graph Data Analysis

Full Contact collects online user data for their clients. End-user data is stored in a Neo4j "graph" database. They use over a terabyte of raw contact fragments to build a graph of relations between billions of heterogeneous identifiers (emails, phones, names, and so on). Full Contact makes heavy use of Apache Spark running on AWS EMR (Amazon Web Services Elastic MapReduce).

Full Contact is looking for a better way to analyze and better understand their graph data. Full Contact wants a system that allows more systematic changes and scientific analysis of the impact of changes made to the graph in order to help more effectively identify root causes of issues in the graph data.

Project Book

Sponsor Gloo

Description Automated ML-Enabled Data Ingestion System

Use machine learning and heuristics to build a data intake and validation system that automatically determines what kind of data is in each column of a dataset and processes it appropriately. For example, does it contain a first name, a zip code, a currency value? Identify potential validation errors such as a string in a numeric column. Flag potential outliers for review by a human or for automatic handling. Normalize incoming data to known taxonomies. Record column information in a centralized metadata store. Build a front-end which provides the ability to specify the location of a dataset to load, processes the dataset, outputs a report about the processing, and exports cleaned data to a specified location.

Project Book

Sponsor Innovar Group

Description New Website Design and Creation

Innovar Group is an Information Technology Staffing firm whose product is people by building and fostering connections among clients and talented staff.

Innovar Group is sponsoring a project to totally reinvent their public facing website. During the project you'll team with our executives, help us to make educated decisions, and have the flexibility to build something awesome.

Project Book

Sponsor Insights

Description New Website Design and Creation

INSIGHTS Intervention envisions a world where every child is cherished as a unique individual and supported to reach his or her optimal social, emotional, and academic development. This project requests the following from the project team:

- Review the programming that was done for the two tools that are currently on our website for parents and teachers to use.
- Develop two additional tools for parents and teachers of pre-school children. This will involve cleaning data and helping us analyze it.
- Develop a tool for Spanish-speaking parents.

Sponsor Lockheed-Martin #1

Description Reinforcement Learning Battle Bots with the Everglades AI Wargame

Deep learning has shown great promise as an emerging technology. Deep reinforcement learning has excited the world through beating human experts at games such as Go, Starcraft, and Texas Hold'em poker. Lockheed Martin Missiles and Fire Control (MFC) developed Project Everglades for an Artificial Intelligence (AI) / machine learning research tool in the form of a synchronous, turn-based strategy game.

As part of this project, you'll use our AI wargame to sharpen your reinforcement learning skills. You'll develop decision engine agents and compete against your peers, and optionally, three other schools – University of Central Florida, University of Southern Florida, and Carnegie Mellon University.

Project Book

Sponsor Lockheed-Martin #2

Description Translational foundation to enable Artificial Intelligence / Machine Learning Models

This project will develop a tool that enables the translation of key inputs & outputs from behavioral models to simulated inputs and outputs. This project will establish the foundation that will enable the use of Artificial Intelligence (AI)/ Machine Learning (ML) models to transform the design, development, production, test and operations of space-based systems.

Sponsor MindBeWell

Description **Holistic Well-Being**

MindBeWell envisions to develop tools to measure personal Well-Being (WB). There are dozens of approaches and models about wellbeing, and most if not all have at least one severe shortcoming: They do not take individual priorities and preferences into account, “measuring” happiness or wellbeing with a one-size-fits-all approach. MBW strongly believes that all such approaches are therefore limited, thus not actually measuring the real individual Well-Being.

This is a real-life software development project that aims to originate an actual product. Team members can define and contribute to functionality and drive final outcome. Be an active team member and not just an implementer of someone else’s requirements.

Sponsor NASA/JPL

Description Parallelization of NASA's SPICE Observation Geometry System for Space Science Missions

NASA's Jet Propulsion Laboratory (JPL) maintains a library called SPICE that is used by NASA and other organizations to perform geometric calculations in space. Users utilize the library to create space mission proposals, aid in the development of actual missions, and analyze obtained data. The library provides wrappers for C, Fortran, Python, Java, and Matlab. It is not an understatement to say it is one of JPL's software crown jewels.

This library, however, was developed many years ago and it has one obvious limitation: it is not thread safe due to its use of global variables.

This project's purpose is to provide a Java thread-safe version of SPICE without modifying the SPICE library in any way.

Sponsor NCAR (National Center for Atmospheric Research)

Description Ozone Garden Website Enhancement

Last year the project team developed a mobile-friendly website that works at all our gardens to improve citizen science participation, allowing us to collect more data and better understand the timing and progression of ozone injury on plants.

Adding ozone concentration information to the website will allow garden visitors to have a better sense for what ozone concentrations are in the area, and will help scientists to identify the ozone concentrations that cause visible damage. Particular tasks include:

- Access ozone concentration data streams from on-site ozone monitors or nearby EPA monitors
- Add ozone concentration data to existing ozone damage database
- Include capabilities for users to download data
- Create and connect a visualization of near real-time ozone concentration data to the existing website for each ozone garden.
- Note that some of these tasks might require revision of the current website design.

Sponsor NMBL

Description Data Aggregation Platform

NMBL Strategies seeks to empower small businesses, nonprofits and public-private enterprises through trusted co
consulting partnerships.

Students will build a platform/app that aggregates data from sponsored posts from Facebook, Linkedin, Twitter and Instagram and provides a user friendly visual that a nonprofit could access to better understand their social media development optimizations.

Sponsor Resurface

Description Instrumentation for finding problems with APIs and human interaction

We would like the Capstone team to investigate different methods of instrumentation of clients to record useful information. We currently have open source service loggers for several languages (Java, Ruby, Python, and JavaScript) that you can use as a basis.

The team will contrast and compare Open Telemetry (Java), instrumenting proxies (Envoy, Traefik), eBPF (e.g. Cilium), and a classic logger written in Go. We want to record the whole interaction between a client and server with low latency without significantly reducing the performance of the client. There are always tradeoffs and we would like you to help us find them.

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Sponsor TerumoBCT

Description Machine Learning System for Medical Device Fault Monitoring

This project allows a student team to develop a novel machine learning system that can be leveraged to improve the quality response time for Terumo BCT's fastest growing product line – the Reveos Automated Blood Processing System.

This project opportunity will offer the student team exposure to real-life medical device data generated from use across the world to explore machine-learning advantages over the human subjects applying their efforts today.

Sponsor Trimble

Description Metadata Extraction Crawler

Trimble is a leader in offering products and services that connect the physical and digital worlds. Excelling in key areas such as geographical positioning, data analytics, and modeling, Trimble offers improved productivity among many other benefits to its customers.

Create a crawler process that can traverse a cloud hosted object storage service, extract metadata from arbitrary file types, and send them to an analytics service for future analysis. The crawler should be able to understand multiple file types, and attempt to extract information ranging from text in documents, to the dimensions of image files. The data as is will be unordered, but the crawler, or a related process, should be able to propose a consistent schema based on the data. This schema will be used to create tables in the analytics service.

Sponsor UCAR

Description Climate Data Sonification Website Development

The University Corporation for Atmospheric Research (UCAR) is a nonprofit consortium of more than 115 North American colleges and universities focused on research and training in the Earth system sciences

The Sounding Climate exhibit helps general public visitors explore data on an interactive touchscreen to understand anthropogenic climate change and natural variability via animated map-based visuals, audio, and charts. Since the current application is a desktop application with strict hardware and software requirements, its impact and reach are limited to people who can physically see the exhibit at the NCAR Mesa Lab Visitor Center in Boulder, CO. We are aiming to re-develop a new application, using the same concepts as the original, but as a web accessible, mobile-friendly website, so anyone across the globe can experience it.

Project Book

Sponsor PST

Description Rail Simulation Scenario Builder

PS Technology (PST) is a commercial software subsidiary of Union Pacific Railroad.

Rail Simulation Scenario Builder will challenge students to develop a visual interface that allows non-technical users to develop their own logic systems using a set of building blocks. In addition to the technical challenges of integrating with a pre-existing system, students will also be required to learn details of how the rail industry works in order to develop an optimal solution.

Testing for this project will primarily be done by using a Train Simulator. In addition to being cool, this will give students a unique experience of learning to drive a train on the same simulator as professional railroaders.

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Project Book

Sponsor URTurn

Description Goal-setting and Progress-tracking app

UR TURN is a data project –data analytics and data visualization. The app plugs into and takes advantage of data from existing student information systems (aka parent portals to access electronic report cards). By visually transforming the data into an easy-to-understand dashboard, UR TURN puts the high school performance and behavior data in context –and into the students' and parents' hands –to help a student plan for the future.