Duke | Code <+>

2024 Potential Projects

Visualizing the Assets of Public-School Communities (+Durham). Since 2021, Data+ teams have created a web-based interactive dashboard (https://visualizingdps23.shinyapps.io/dps_dashboard/) designed to map existing assets (parks, libraries, homeless shelters, food pantries, farmers markets, childcare centers, bus stops, pharmacies) in Durham Public School communities and further contextualize the importance of each variable. The dashboard has garnered national attention from public-school leaders across the country and serves as a proof-of-concept to inform the development of an app that can be adapted to different public-school communities.

A team of students will work with the Office of information Technology, the Southeast Regional Coalition for University-Assisted Community Schools (https://southeastuacs.org/) and other stakeholders to redesign the dashboard into a user-friendly mobile and web application that can tell important asset-based stories about school communities.

Scholars@Duke Collaboration Finder Using the Power of AI. Scholars@Duke (scholars.duke.edu) is a research discovery system featuring the research, scholarship, and activities of Duke faculty, graduate students, and academic staff. The system has a significant amount of information about scholarly activity at Duke and provides many direct relationships between faculty, such as those co-publishing a paper or on the same grant -- but what about the non-direct relationships that can be gleaned from the information in Scholars?

A team of students will explore various ways of using artificial intelligence (AI) to look for additional relationships between researchers at Duke. Using Scholars@Duke as the data source, the team will experiment with various pre-trained AI models, both commercial and open source, to find similarities between researchers that could help them identify new collaborators.

Hormonal Pathways and Trait Expression in Songbirds Simulator. A team of students will work with Duke's Office of Information Technology, a faculty researcher from Davidson University, and other stakeholders to build an interactive app to allow exploration of a model of hormone influence on traits, with particular examples in songbirds.

Course Advisor System Using AI. Identifying courses within the Duke registration system that align with student learning interests and/or career ambitions is difficult for Duke students. A team of students will leverage AI-based semantic search and recommendation methods to develop a tool for students to more easily identify courses that match their interests and career aspirations. The Code+ team will collaborate with Duke's Center for Research and Engineering of AI Technology in Education (CREATE) and the University Registrar to build a prototype tool.

Duke Alumni Volunteering Hub. Duke's Alumni Engagement and Development Office (AED) regularly receives inquiries from alumni, parents, friends, and other stakeholders asking how to volunteer with the University. There are a number of longer-term volunteer opportunities available throughout the University such as board service or mentoring. However, shorter term opportunities that could provide more immediate involvement are needed, and there currently is no place within Duke's digital resources to explore short term volunteer opportunities.

A team of students will work with the Office of Information Technology, Alumni Engagement (AED) & Development team, and other stakeholders to develop a system where Duke alumni and other engaged volunteers could learn about short term volunteer opportunities, complete a volunteer application, and check the status of their application. In addition, the tool could serve as a volunteer management system.

Blue Devil Bridges. Blue Devil Bridges (BDB) is a new alumni mentorship program that connects current Duke students to volunteer alumni mentors. The program aims to foster alumni-student mentorship to aid student development, build a sense of community, and engage and connect alumni with current Duke students. The program was piloted in the Fall of 2023 primarily using Qualtrics— this initial iteration yielded about 1200 signups from students and an almost equal number of alumni volunteers.

A team of students will work with the Office of Information Technology (OIT), Duke Student Government (DSG), the Duke Alumni Engagement & Development Office (AED), the Duke Career Center and other stakeholders to define a sustainable intake workflow process and build an initial application that will allow for the creation and implementation of the matching algorithm that Blue Devil Bridges uses to match mentors and mentees.

Continued on reverse.

2024 Potential Projects Continued

Integrated Insurance Navigation for Veterans. Nearly 30% of veterans with diabetes are using both the VA and Medicare Part D to provide their diabetes medications. Veterans and their caregivers have previously reported frustration navigating the two systems and coordinating care between them. Such challenges can lead to veterans having an inappropriate medication supply, poor medication adherence, and poor glycemic control.

A team of students will work with Duke faculty in the Department of Population Health Sciences and Duke's School of Medicine, Durham Veterans Affairs, and the Office of Information Technology to develop a drug cost transparency tool.

Polypeptide Helicity and Ensemble Prediction Tool. Helix-coil models have a long tradition in structural biology, and predicting the behavior of nascently helical polypeptides has many potential applications. Duke faculty have built a Bayesian parameterized model capable of predicting the folding into alpha-helix by any polypeptide based on its amino acid sequence. This model can be used to predict important properties of intrinsically disordered proteins, which have a growing list of important biological functions. It can also be used to design semi-rigid linkers in multivalent recognition proteins that are being developed as "biological" therapeutics targeting diseases such as HIV, COVID and cancer.

A team of students will work with the Office of Information Technology and faculty from Biochemistry, Statical Science, Computer Science and Biomedical Engineering to develop a web application and API to make the model available to scientists around the world.

Predictive Analytics for Campus Systems. Teams within the Office of Information Technology (OIT) that support Duke's technology infrastructure have a significant amount metrics and alert data about the applications and systems they support. These teams are interested in conducting predictive failure analysis. This analysis would predict the potential failure of systems or components (software or hardware).

A team of students will work with the infrastructure teams in OIT as well as with other stakeholders at Duke to develop a dashboard to predict when and how often systems and components may fail or perform poorly, based on historical data.

Security Analytics & Visualization Interface for Research Labs. MISTRAL (https://sites.duke.edu/mistral/) is a National Science Foundation (NSF) funded project for capturing and analyzing network data for research lab environments. A team of students will work with the MISTRAL team and stakeholders, as well as members of the Duke University IT Security Office (ITSO) to develop a platform for the querying and distribution of security logs and research data. The team will develop novel techniques for analyzing network traffic data from research environments, tag this data, and present the data in an easily consumable format for researchers and security teams. In addition, the Code+ team will collaborate with a Data+ team to present security indicators and provide methods for dynamic consumption and analysis of the MISTRAL security data. The team will explore concepts such as building user interfaces and APIs, Python development, and data analysis techniques.

Campus Space & Energy Management System. The Office of Information Technology's Data Analytics team has been working with Duke Facilities Management to generate visualizations around space utilization. This project will extend this work to track/trend energy consumption and carbon footprint across campus and make this information available to building occupants. The project may include developing heat maps and visualizations of space utilization potentially using Wi-Fi data. The project will develop predictive analytics for space utilization and energy consumption and make this information available.

Security Advisory Ingestion and Notification System. The Duke University IT Security Office (ITSO) utilizes automated scanning tools and various sources of security advisories, such as vendor websites, mailing lists, and RSS feeds, to monitor the latest security updates and patches for the systems and applications in use at Duke.

A team of students will work with the ITSO to design and implement an automated system that ingests security advisories for systems and applications in use at Duke into a platform for review and prioritization of automated notifications to users and administrators. The project aims to improve the efficiency and effectiveness of the security advisory management process, enhance the security posture and compliance of Duke's systems and applications, and support the decision-making and prioritization of security resources and actions.

Reprise: Developing and Prototyping Honeypots. The Duke IT Security Office (ITSO) uses "honeypots" to develop actionable threat intelligence. A honeypot, as defined by techtarget.com, "is a network-attached system set up as a decoy to lure cyber attackers and detect, deflect and study hacking attempts to gain unauthorized access to information systems" (see https://www.techtarget.com/searchsecurity/definition/honey-pot). Picking up on a successful Code+ 2023 project by the same name, a team of students will work with Duke's ITSO to explore a set of applications as candidates for new network honeypot types. By analyzing network traffic and potential security vulnerabilities in these applications, students will use these examples to design a framework for rapid development and prototyping of new honeypots.