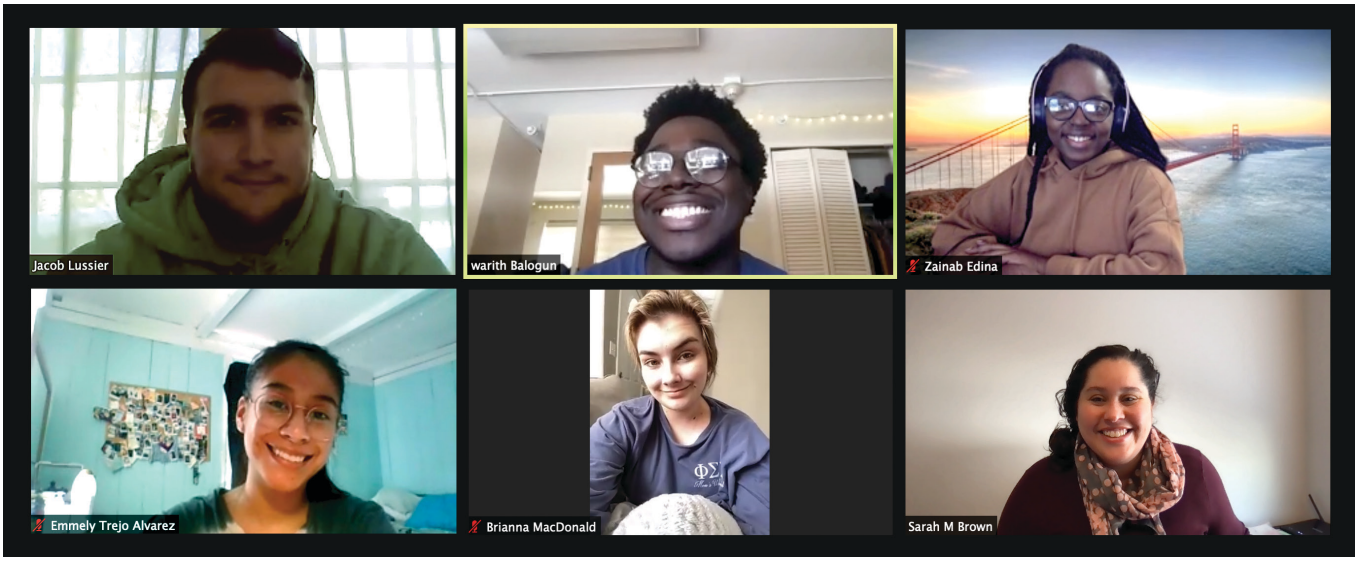
Gartner predicts distributed cloud will be the future of cloud computing.



COVID-19 research life. Pictured are Jacob Lussier, Warith Balogun, Zainab Edina, Emmely Trejo Alvares, and Dr. Sarah M. Brown

LABZ

With Fairness and Generalizability for All

Kingston, Rhode Island, USA

Emerging in August of 2020, the Machine Learning for Socio-Technical Systems Lab (ML4STS Lab) was created by Dr. Sarah Brown. The ML4STS Lab is located at the University of Rhode Island in Kingston, Rhode Island. Driven by innovation, determination, and fairness, the ML4STS Lab's establishment and growth have proven it to be a lab to watch. This lab's research focuses on fairness forensics, fairness perceptions, and the dynamics of fairness in society and technology. For this article, we define "socio-technical systems" as a framework that seeks to understand the interaction with humans and technology and/or the relationship between infrastructures and how humans behave in those environments.

The ML4STS Lab is working on a project called "Wiggum," which is a Simpson's paradox-inspired investigation of fairness forensics. This project incorporates the concepts of Simpson's paradox to create an interactive visualization system for end-users. Simpson's paradox looks at the association of values of the whole population, then focuses on the trend that reverses within the subpopulations, which are defined by categorical variables.

Wiggum can be utilized as an app or package from the GitHub repo.[1]

1 https://github.com/fairnessforensics/wiggum

The application is able to load datasets from local hard drives (i.e., CSV files) or from packages (e.g., the Iris Dataset from SkLearn). After upload, the end-user is able to complete data preprocessing activities such as select metadata arguments and allow for data augmentation. To create the visualization, the researchers use a Model-View-Controller (MVC) system architecture and incorporate a Python-based, Flask-powered backend. The frontend graphics are supported by JavaScript D3 graphics. The backend sends data using Ajax.data. D3 graphs on the front end are generated in different JS files. The results are stored variables that will be shown in the D3 graphs.

The Wiggum application can compute the distances between the overall dataset and a subgroup category, identify the trends from the dataset, calculate the classification regression line, and so much more. These function calls are incorporated into the model to create the visualization rendered for the end-user. Wiggum stands out as the ML4STS Lab's effort for broader impact in the realm

Image courtesy of Sarah Brown, Ph.D.

In Norway, the Kolos Data Center is projected to use 100% renewable energy to maximize efficiency once it is built.

of fairness and infrastructures.

Outside of Wiggum, the ML4STS Lab has developed projects about fairness perceptions, which investigates how people interpret algorithms. For this project, the researchers are creating tools to help understand individual definitions of fairness. The researchers also look to include studies about what societal and algorithmic factors influence preferences. Since fairness can be user-subjective, it is important to gain this insight to create useful and inclusive tools. The most recent work for this project explored the performance of fair classifiers when distribution shifts have occurred. This research framed the distribution shift within the context of fairness by defining label bias as the bias model and the label shift as an instrument for distribution shift. To assess the model's fairness, scenarios for distribution testing included algorithms with no access to newly labeled data, only new model inputs, and the algorithm having access to new labels, which can be potentially biased.

The lab also explores the dynamics of fairness. The project, "Dynamics of Fairness," investigates how fairness generalizes in deployment and withstands distribution shifts. To begin this project, the researchers have started investigating the intersection of machine learning and psychology to underlying fairness preferences. With the use of psychology, it is the researchers' hope that interdisciplinary research can highlight significant practices used for fairness models. These projects are still developing, but the need and importance of these types of projects are necessary for the development of social constructs and infrastructure.

— Jasmine DeHart

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BACK

Hydrogen Cars Versus Electric Vehicles, Which Is More Sustainable?

A hydrogen car has one hydrogen tank that feeds a fuel cell with compressed hydrogen gas mixed with oxygen, which excites an electrochemical reaction to produce electricity to power the electric motor. Fuel cells are the main components of hydrogen-powered cars. The only by-products of the process are water and heat. Electric vehicles (EVs) are powered by electric motors that pull current from a battery or other rechargeable electric resources. Unlike hydrogen cars, there is no chemical reaction happening thanks to the portable charged batteries in EVs.

There were 20,000 electric charging stations in the U.S. as of December 2018, while there were only 45 hydrogen-refilling stations according to the U. S. Department of Energy. Most fully EVs can travel between 100–200 miles on a single charge, while hydrogen ones can reach 300 miles. It takes 5 to 10 minutes to pump hydrogen into the tank, while EVs need several hours to get fully charged. According to a testing report, 1 kg of hydrogen stores 236 times more energy than 1 kg of lithium-ion batteries. However, the real problem of hydrogen cars is how to obtain hydrogen since it does not exist in pure form on Earth and the technology is still not efficient.

As of today, EVs are more accessible in terms of the number of charging stations and the different types of cars available. They include more efficient processes compared to hydrogen-powered cars, and if their lithium batteries are reused to meet different ends, they will remain a more sustainable solution, at least over the next few years. But when acquiring hydrogen becomes efficient, it is not easy to say which will be more sustainable long term.

— Kun Jin

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