Research Statement

I am an empirical economics of information systems researcher who uses methods from statistics, machine learning, deep learning, and applied microeconomics, applying both causal and predictive inference. **I focus on two broad areas of research: (1) using machine learning models to facilitate managerial decision-making; and (2) understanding the economic and social challenges of platforms and digitization.** In the past I have focused on a mix of business and economics journals, although going forward I plan to target exclusively information systems and business journals.

I. Using Machine Learning to Facilitate Managerial Decision-Making

We are still early in the transition for how managers use information to manage people and systems. In the past, managers used descriptive and diagnostic analytics to understand where their firm was positioned. Now, with the rise of accurate artificially intelligent systems, managers must build and understand prescriptive and predictive models in order to perform their job well. I began my career pioneering one type of predictive modeling – using machine learning trained against satellite images to understand risk and well-being in developing countries. Much of my work going forward focuses on the particulars of how managers make decisions using machine learning models, and what we can do to make these models more intelligent, interpretable and ultimately useful for them.

In recent work [(Hersh and Carter](#), 2022), we implement a field experiment at a major bank to test how managers use AI predictions and how explainable AI may affect their trust of these predictions. We use an AI model to build predictions informing workers whether a loan they manage might encounter a delay. We then embed these predictions into a dashboard and survey 690 managers to test which individual, team, and model characteristics affect their trust of the AI predictions. We next randomly

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assign half of the managers to receive an "explainable AI" treatment that includes additional dashboards showing how the model made its prediction. We find mixed evidence that explainable AI affects trust overall and further find that senior managers and self-reported machine learning novices are least likely to trust AI. However, these AI-reluctant groups are most likely to respond positively to explainable AI, increasing their trust of AI by five to seven times if they receive an explainable AI module. We are currently revising the paper in preparation for submission to *Information Systems Research*.

Traditional methods of measuring risk and vulnerability—using on-the-ground surveys— are often too expensive or of insufficient temporal resolution for making time-critical decisions. Machine learning and AI offer unique possibilities for creating high-frequency (in some cases real-time) predictive measures of risk and vulnerability. For much of my research in this area, I use AI computer vision models, such as convolutional neural networks, applied to satellite imagery for learning an area's economically relevant information. For example, in Engstrom, Hersh, and Newhouse (2021), we apply computer vision algorithms to high-resolution satellite imagery of Sri Lanka to develop estimates of the poverty rate for local areas. We have since expanded this work to larger countries such as Mexico in a paper (Babenko et al., 2017) that was accepted at a workshop at Neural Information Processing Systems (NIPS/NeurIPS), a leading computer science conference. In successive work, I have also explored the consequences of using closed versus openly available data for calculating official statistics. In a paper published in *Information Technology for Development* (Hersh, Engstrom, and Mann, 2020), we use openly available satellite images from the European Space Agency to build a poverty map in Belize. We argue that data pipelines should use openly available imagery if predictive accuracy is no worse than with closed systems.

Data scarcity also affects our understanding of on-the-ground violence in conflict areas. In work published in the prestigious *Proceedings of the National Academy of Sciences* (Mueller et al., 2021), we develop a computer vision algorithm using deep learning methods to identify buildings that were destroyed from bombing attacks in Syria during

the Syrian civil war. We make several methodological advances that are broadly applicable across spatio-temporal problems in computer vision networks. Data scarcity also affects the provision of credit in the consumer retail market. Partnering with the Inter-American Development Bank, I have explored how machine learning can advance the targeting of loan products for impoverished countries in Latin America (Hersh, Rivero, and Leslie, 2022).

II. Understanding the Economic and Social Challenges of Platforms and AI

Both platforms and AI are transforming how businesses should be managed. In one paper recently published in *Management Science* (Benzell et al., 2022), we examine how application programming interfaces (APIs) influence firm performance (revenue, costs, R&D expenditures, profit) as well as the risk of cyberattacks. APIs are the technological standard by which firms can create a structured, automatic way to transfer information within and between firms. However, the benefits and potential downsides of using this technology are not fully quantified from a managerial perspective. Using a unique proprietary firm-level panel dataset that includes detailed information on a firm's API flow by category and type, we find that API adoption has large and positive effects for firm profit. However, we find significant increases in the probability of cyberattacks and data breach events following API adoption. This suggests that CIOs face an important tradeoff: implementing APIs decreases the costs of information transmission across a firm and can rapidly increase productivity, but it also increases the risk of malicious individuals accessing this information.

Another strain of research examines the effectiveness and efficacy of online media anti-piracy policies. In one paper published in *MIS Quarterly* (Danaher et al., 2020), we analyze how supply-side piracy interventions may affect legal and illegal channels of consumer online media streaming. We analyze three court-ordered website blocking events of increased effectiveness that affect consumers in the UK. We first study internet service providers' blocking of 53 major piracy sites in 2014 and then study two

smaller waves of blocking—the blocking of 19 piracy sites in 2013 and the blocking of Pirate Bay in 2012. We find that blocking 53 sites in 2014 caused treated users to decrease piracy and to increase their use of legal subscription sites by 7% to 12%.

In another paper with Brett Danaher (Danaher and Hersh, 2020) we revisit how policy makers should think about anti-piracy enforcement. Using panel data on streaming video users before and after a major link piracy site was shut down, we examine the types of users who continue to pirate even after a large enforcement crackdown and those who move to more legitimate streaming services. We find that while total piracy goes down, demographics do not play a large role in who continues to pirate. Income, however, is highly predictive of legal consumption use, suggesting that the pricing behavior of alternative streaming services matters more than criminal intent.

In one paper published in the *Journal of Economic Behavior and Organization* (Hersh, Lang, and Lang, 2022), we examine the relationship between the growth of smartphones and traffic accidents in California between 2001 and 2011. We link cellular coverage along a highway in 2016 to the location of antenna towers and then apply machine learning techniques to predict coverage between 2001 and 2011. We find that car accident rates increase when 3G cell phone coverage is introduced, even when controlling for traffic volume.

References

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III. Unpublished Work in Progress

1) **Brett Danaher & Jonathan Hersh. (2020).** [**Whom Should Antipiarcy Enforcement Actions Target? Evidence from the MegafilmesHD Shutdown in Brazil**](#)

   Prof. Danaher and I are currently revising this draft for submission to *Journal of Management Information Systems (*An FT50 ABDC A* journal).

2) **Selina Carter & Jonathan Hersh. (2022).** [**Explainable AI Helps Bridge the AI Skills Gap: Evidence from a Large Bank**](#)

   I have recently presented this paper at Erasmus University, Rotterdam, at USC's Artificial Intelligence and Management Conference (AIM 2023), and at Wharton/Columbia's Management, Analytics, and Data conference. At AIM 2023 it won an award for best graduate student paper. We are currently revising it for submission to *Information Systems Research* or *Strategic Management Journal*.

3) **Seth Benzell, Jonathan Hersh, and Marshall Van Alstyne.** [**Technology as Strategy**](#)

   We have submitted a six-page proposal to *Sloan Management Review* to write the article for inclusion in their journal. (This is the standard process for inclusion in SMR/HBR.)

4) **Seth Benzell, Jonathan Hersh, and Marshall Van Alstyne. Do Startups Invert? API Networks and Startup Exits**

   We are currently cleaning data and estimating models to extend our 2022 *Management Science* paper which focused on how publicly traded companies used APIs. Turning our focus to startups, we are exploring how startups use APIs strategically, and how the network of API connects affects their chance of IPO, the value of exits, and startup valuation.

5) **Luis Alberro, Joshua Anderson, Jonathan Hersh, Tina George, and Kushal Kumar Reddy. (2022).** [**Delivering Public Services in Data-Scarce Environments: Using Open Data to Solve the Facility-Location Problem at Scale**](#)

   After presenting this work at AEA 2023, we declined to submit the paper for inclusion in AEA P&P, in favor of revising the work for an Operations Research or Information Systems

specific journal. This work derived from a collaboration with the government of Togo, who were concerned with how they were going to deliver national ID cards to all 8 million inhabitants of their country. We developed an algorithm to help deliver these national ID cards, which they deployed in the field in Summer of 2022.

We are currently working with the government of Nigeria to use a similar algorithm as part of their national ID strategy to deliver National IDs to 200M persons in Nigeria. In designing the algorithm, we were able to uncover a plausible natural experiment that would allow us to causally identify the impact of receiving a national ID on political, social and economic outcomes. We are currently writing a grant to begin connecting data to test the impact of national IDs on these outcomes.

At the present we are drafting an article for submission to *Production and Operations Management, Operations Research,* or *Management Science*.