

Undergraduate Thesis Prospectus

Improving Computer Science Curricula to Better Prepare Students to Develop Secure Applications

(technical research project in Computer Science)

Order versus Justice: The Struggle over Predictive Policing in the U.S.

(sociotechnical research project)

by

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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## **General research problem**

*How are social groups in the US seeking to improve public security and safety?*

In regards to security and integrity of the public, it is crucial to look into this seriously as malicious techniques continue to improve with the lives, reputation, and property of innocent people at risk. In digital systems, security, privacy, justice, and malice are in dynamic and unstable tension. Efforts to bolster security or to thwart malice may degrade privacy or justice. Efforts to enforce justice or protect privacy can compromise security, shelter malice, or be misrepresented as malice. Efforts to subvert justice or to invade privacy may be misrepresented as efforts to thwart malice.

## **Improving Computer Science Curricula to Better Prepare Students to Develop Secure Applications**

*How may CS students be better prepared to develop secure applications?*

This project is under the department of Computer Science and there is currently no technical advisor (expected in Spring 2022). This is a technical project and there are no other collaborators. For this project, I will investigate ways to better prepare CS students to develop secure applications. Cyber security concerns in the United States have become an increasingly big issue with even United States President Joe Biden making October cyber security awareness month to bring attention to the matter (White House, 2021). With these problems, it is becoming more evident that computer science students should be more prepared in being able to develop applications with secure design. I propose the idea of a synthesized course combined with CS3420 (Advanced Software Development Techniques) and CS4630 (Defense Against the Dark Arts).

Through this synthesis, the goal is to create a course that teaches students how to develop applications with an emphasis on implementing security techniques and design practices that prevent applications from being hackable. This in turn will accomplish helping students be comfortable with security practices that can be beneficial in the United States' fight to improve cyber security. Based on what is possible to do right now, in CS3240, a course that focuses on having students develop web apps, could require students to implement security aspects into their applications. However, given the nature of the course, it is unlikely that meaningful security techniques can be taught to students without taking away core concepts specific to CS3240 from its curriculum. A separate synthesized course solely dedicated to teaching security techniques within applications would be more beneficial for students.

The methodology to make such a course possible will require examining the curriculum of CS3240 and CS4630. It will require examining how techniques and concepts taught in CS4630 can be applied into the application development process demonstrated in CS3240. Similar to CS3240, students would also have to develop an application as a project, but they would have to focus on the security aspect. If successful, a course based on these principles can be offered which then will allow students to be able to learn how to make meaningful applications with security techniques. This will ultimately aid in creating work ready students that can help tackle America's cyber security issues.

### **Order versus Justice: The Struggle over Predictive Policing in the U.S.**

*In the U.S., how are advocacies, law enforcement agencies, police unions, and tech companies competing to determine the proper extent and applications of predictive policing?*

Over the last 15 years, predictive policing, which uses algorithms to anticipate crimes before they happen, has proliferated in the U.S. Predictive policing algorithms have been accused of perpetuating and exacerbating racism in law enforcement. Algorithmic bias is seldom intentional. Barton (2019) attributes bias to incomplete or misrepresented datasets and historical human bias in the datasets that train algorithms. Insufficient population variety in datasets can distort algorithmic decision making (Turner Lee, 2018). Algorithms that are of practical value in society must be trained on data gathered from society, and if the society has encoded institutionalized inequities, racial or otherwise, these inequities will be encoded in the algorithms as well. For example, in the United States, districts of disinvestment, deprivation, and discrimination are likely to have had a higher crime rate and to have been subjected to intensive and discriminatory policing, such that arrests per crime will be greater than elsewhere. Algorithms trained on arrest data from such districts are likely to overestimate the actual crime risk in them. O'Donnell (2019) documents numerous cases in the U.S. in which law-abiding people of color have been subject to aggressive policing; because of such policing, predictive policing algorithms are twice as likely to flag black subjects as risks than white subjects.

For example, a predictive policing AI system assigned James Rivelli, a white convicted shoplifter who had served five years in Massachusetts state prison, a risk score of 3/10. Robert Cannon, a black man who had committed the same crime, received a score of 6/10 from the same system (Angwin et al., 2016). In online searches with African-American names, results with the word "arrest" appeared at greater frequency in advertisements and pop-ups associated with the search (Silva et al., 2018). According to Megan Smith, former Chief Technology Officer of the United States, algorithmic biases cause excessive surveillance in communities of color. This in turn imparts social stigma, which diminishes employment and educational opportunities (AJL,

n.d.). According to Bratingham (2018), some police officers selectively fail to report crimes by geographic area, thereby distorting algorithms that are trained on crime data. The Human Rights Data Analysis Group found that due to inaccuracies in crime data, police are more likely to be sent to African-American communities (Shapiro, 2017).

Law enforcement agencies generally welcome predictive policing as a cost-effective crime prevention tool and see it useful to achieving their goal of reducing crime (Pearsall, 2010). Former Los Angeles Police Department Chief Bill Bratton says that “so much of what creates tension with the community is crime; by reducing crime, we reduce tension” (Uchida, 2009). Some members of heavily policed populations, especially people of color, allege bias and have organized to challenge predictive policing on this basis (Angwin et al., 2016). “Any time you take out the human perspective or interaction, I don’t believe there’s any positives. You’re making algorithms off a false narrative that’s been created for people — the gang documentation thing is the state defining people according to what they believe,” says Aaron Harvey, a resident of San Diego who fended off charges of alleged gang conspiracy (Winston et al., 2018). Some organized advocacies seek reform in predictive policing (Stop LAPD Spying Coalition, n.d.). The Algorithmic Justice League has called for algorithmic transparency (AJL, n.d.). PredPol (n.d.), however, contends that predictive policing is necessary, cost-effective, and fair. With so much conflict of interest amongst several social groups, it becomes necessary that a solution that is deemed fair and reasonable must be found.

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