

Thesis Project Portfolio

Epistemic Accountability: Rigorously Investigating Autonomous Decisions

(Technical Report)

The Financial Revolution: Insights into the Economic Behavior of Young Adults

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

Drew Goldman

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Department of Computer Science

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Sociotechnical Synthesis

In today's society, the use of autonomous agents has become increasingly prevalent, particularly in the realms of behavioral and market economics. However, the deployment of these agents with less complete information into more complicated environments increases the risks of actions with deleterious consequences, thus requiring accountability. At the same time, the democratization of finance has led to an overemphasis on data fitting and machine learning, contributing to a widening of the wealth gap. These issues enumerate the importance of understanding the unintended side effects of technology and computing power, and the need to formalize accountability when autonomous agents make decisions with potentially adverse consequences.

To address this, in my technical report, I have employed formal methods for human-in-the-loop analysis of decisions drawn from program verification, symbolic execution, and program synthesis. In particular, the classification of a neural network trained on MNIST handwritten digit images has been investigated using the SMT-based cvc5 synthesizer. This approach may be tailored to work in tasks with different types of data, and qualitatively evaluating the usefulness of this interpretation compared to standard statistical methods is an avenue for future research.

In my STS Research Paper, in a tangential manner, I investigate the convergence of finance, technology, and behavior economics. Specifically, I scrutinize the effects of democratized finance on young adults, who are increasingly incurring large debts and partaking in risky behavior. I contend that such patterns are a direct result of industries' fixation on data fitting and machine learning. Through a comprehensive examination of peer-reviewed and literary sources, I elaborate the various factors contributing to the gradual increase of debt over

time. To understand these complex factors, I employ the theoretical framework of the Social Construction of Technology (SCOT), which enables me to explore the interdependent relationships between technological progress, cultural values, and the economy.

The connection between the two papers is the importance of democratization of finance and access to technology. Through a thorough examination of the intricate interplay between the accessibility of technology and finance, a multifaceted understanding of the sweeping economic and social implications is inevitable. By recognizing the profound impact of these systems, such as the neural network expounded upon in my Technical Report, corporations and governments will be more inclined to make informed decisions and take greater responsibility.