Thesis Portfolio

Inferring Patterns of Neural Response with STL Learning

(Technical Report)

The Role of Informational Ubiquity in Belief Formation

(STS Research Paper)

An Undergraduate Thesis

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Table of Contents

Sociotechnical Synthesis

The nexus between psychology and technology provides many unique opportunities for exploration in the coming years. From better articulating the neural patterns at work in the brain to better understanding how people use connective technologies, various methods of psychological analysis both in a quantitative and qualitative manner can help us understand ourselves and how we interact with the technologies around us. For my technical project, I explored the quantitative side of this by using modern machine learning techniques to derive mappings of neural activity in the brain. Conversely, for my STS portion, I went into a more qualitative analysis of the patterns with which we use modern networking technology to inform our worldview.

On the technical side, the emergence of machine learning has provided us with an important new tool in modeling the world around us. Whereas in the past our mathematical models of the world were dependent upon manual synthesis and testing of various parameters, machine learning has the potential to both generate models and fit the parameters thereof with observed data from our world. This power allows us to better understand many complex phenomena, and what better application than working towards pinning down the workings of the human brain, one of the most complicated systems in nature?

For my technical project, I worked with Dr. Lu Feng and Josephine Lamp on applying the emerging algorithms of signal temporal logic learning to mapping patterns of neural activity with environmental stimuli. This sort of application has shown utility for cyber-physical modeling of certain physiological systems, but had not been applied to the field of neuroscience yet. Using publicly available neurological recordings, I used the principles of signal temporal logic learning to generate descriptive correlations of neural activity to visual stimuli.

While this is a more quantitative interaction of technology and psychology, my STS thesis went more into the overarching patterns of human psychology in our use of the internet. Specifically, I investigated how we inform our worldview through the internet. Rapid changes in this technology, particularly the ease of access to information, have influenced how any connected individual obtains and processes data. While this does provide us with an unprecedented opportunity for the average person to educate themselves and have a more well-rounded worldview, in recent years we have seen an explosion in the dissemination of misinformation and extremist rhetoric online. I looked into the psychological mechanisms at play which may have potentially driven this shift for my STS thesis.

Though these topics are for the most part unrelated in their methodology and scope, they do have one aspect in common: trying to understand how we operate as people in our environments. These theses together demonstrate the sheer breadth of the interaction between psychology and technology. We can use evolving technologies to better understand the neurological structure of the individual human brain, and at the same time the technology we use on a daily basis is fundamentally shifting the manner with which we operate in our environment. While quantitative assessment of our brain's operation may elucidate how we process our world, qualitative descriptors are just as valuable for gleaning our behavioral patterns in a larger society.

An inherent dichotomy between these two theses is that of static and dynamic psychology. Using AI techniques can allow us to better represent neurological structures in the brain which have remained fundamentally unchanged throughout human history, but it's inherently more difficult to lay out our interactions at large in a similar way. Technology influences our behavior as a society in a much more complicated manner that likely can't be modeled as quantifiably given its changing nature. This doesn't mean that we shouldn't attempt to

have descriptive accounts of this interaction; rather that it's important to acknowledge that societal structures are dynamic interactions which are constantly changing in new and unexpected ways.

The synthesis of technology and psychology is an ever-expanding field. If I learned anything from my STS project, it's that the technology we use has a massive effect on our interaction with the world surrounding us. One of these interactions which has manifested has been to better understand our operation at an individual level. It's important to note that technology can both help us make sense of our world, as well as add a layer of complexity to our societal structures. There is a fascinating interplay where technology allows us to answer questions but simultaneously gives us more problems to solve. Within the intersection of technology and psychology, this means we will always have new interactions to study so long as technology continues to develop.