Thesis Project Portfolio

Predicting Future Tumor Location in Patients with Brain Metastases

(Technical Report)

Cross-Cultural Study of Cultural and Political Influence on the Success of Makerspaces

(STS Research Paper)

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Table of Contents

Sociotechnical Synthesis

The news cycles of the 21st century have been dominated by talk of the political, economic, and cultural differences between the United States and China. One of the issues at the heart of this discourse is the technical competition between the two nations. This competition is centered around the development and deployment of the next generation technology: 5G, artificial intelligence (AI), and the Internet of Things (IoT). Both governments have taken steps to intervene in and encourage grassroots innovation in the belief that its people are its great resource and the desire to do anything to find a competitive edge. My STS and technical work approach this idea from two perspectives. In my STS research I dive into the grassroots innovation subculture of makers in both China and the US in order to understand the role of culture and politics on makerspaces. My technical work reveals a different perspective in which I investigate the incredible ability of the technologies that these countries are pursuing. Specifically, the use of machine learning to predict the location of new brain metastases for preventative treatment.

The maker movement has been rapidly expanding in both China and the US over the last decade. Generally, makers are driven by curiosity and innovation, but the spaces and communities they create are incredibly diverse. This STS report looks at the impact of Eastern collectivism and Western individualism on the formation and success of makerspaces, as well as how political decisions augment the effects of culture. As a framework for this research I focus on San Francisco, USA and Shenzhen, China which are the major maker hubs of their respective countries. The analysis concludes that in both countries, the maker movements have faced economic adversity and there is no

one perfect combination of culture and policy initiatives that can foster a flourishing makerspace.

The technical section is related in that the team focuses on one area of research that has motivated the political emphasis and focus and citizen innovation: AI and ML. With the continued advances in targeted radiosurgery, physicians and scientist are able to provide repeated targeted radiation to brain metastases patients. Over the period of care, one patient often has multiple treatments targeting old tumors and new ones that have appeared since their last treatment. This series of treatments and post-operation check-ups have resulted in a unique MRI dataset that captures timepoints before, during, and after brain metastases formation. In this technical report the team describes a machine learning algorithm that utilizes this dataset to predict the location of possible new brain metastases before they are identifiable by physicians.

Together this STS and technical research provide multiple perspectives on the desire for and power of innovation and next generation technology. In light of the ongoing pandemic, COVID-19, this topic seems all the more important and relevant. Future research into outlines for successful makerspace business models and the use of ML to predict tumor response to radiosurgery would add additional layers of depth to this research.