

Thesis Project Portfolio

Efficient Automatic Speech Recognition

(Technical Report)

A Materialist Analysis on the Role of Algorithmic Models in Mortgage Lending Discrimination and Commentary on Solutions in Informed Model Development

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

The unifying principle between my capstone research and my socio-technical research, in one word, would be accessibility. From the perspective of the capstone, this takes the form of researching how to make acoustic speech recognition (ASR) models¹ run efficiently on edge devices² such that these models may be used by a much wider audience, given the lower barrier of entry. This work will be completed by first profiling the existing state-of-the-art models on a variety of systems, working down to the level of an edge device (or analogous amount of computational power, most likely a Raspberry Pi); from here - in conjunction with my advisor,, Professor Felix Lin - I will use a combination of computing resources to work on tuning the most efficient models based on earlier profiling. Professor Lin and I undertook this research with the backing principle that conscious steps must be taken to democratize technological access, especially with the rate that companies are iterating on machine learning models. While truly meaningful social and human dimensional analysis of the technological focus of my capstone is out of scope given the timeline, a materialist analysis, specifically based in dialectical materialism, could be applied to the topic. Dialectical materialism, also, is the framework of choice for the socio-technical research which focuses on housing inequality and accessibility in the United States through the lens of algorithmically based mortgage lending. In the course of my socio-technical research I aim to successfully render a materialist analysis of housing inequality in the United States, based on the contradictions of class conflict. This analysis has the twofold purpose of one, raising awareness of how pervasive and malicious machine learning

¹ A class of machine learning models which can take auditory speech input and convert it to manipulatable data (a common example is the speech recognition portion of a program like Siri or Google Assistant)

² Edge device refers to a hardware element that controls data flow at the boundary of a network; common examples include routers, network switches, mobile phones, and broadly IoT architectures (including smart home devices).

models are and can be in day to day life, and two, from a materialist standpoint, generate meaningful policy proposals that could serve as the basis for a substantive shift in the dialogue around housing in this country. While the STS research focuses on a far more pressing issue, in concert both the capstone and STS topic, if executed can improve awareness of the potential negative impact of machine learning models in an increasing digital age; and more importantly, hopefully help to mitigate those negative effects.