

Recommendation AI in Social Media: Consequences and Mitigations
Analyzing the Sociotechnical System Surrounding Social Media Recommendation Algorithms

A Thesis Prospectus
In STS 4500
Presented to
The Faculty of the
School of Engineering and Applied Science
University of Virginia
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Computer Science

By
Raj Asthana

May 9th, 2023

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.

ADVISORS

Kathryn A. Neeley, Department of Engineering and Society

Alice Fox, Department of Engineering and Society

A Look at the Effects of Recommendation AI in Social Media

Overview:

Social media has become central to how people communicate. A report by Kepios stated that there are about 4.76 billion social media users (though this figure could be skewed due to duplicate accounts). With this increasing connectivity comes an increase in the amount of time spent on devices. The New York Times reported a 17% increase in overall screen time usage over the past 4 years, crediting this increase to the popularity of social media as well as troubles faced due to the COVID-19 pandemic. Short videos have become increasingly popular on social media. This is seen by the heavy popularity of apps such as TikTok and YouTube Shorts. A central part of how these apps work is their use of recommendation algorithms which cater content based on what the users would spend time watching and searching for. While these algorithms may seem beneficial for curating users the content they want and enjoy, there are consequences for giving people media with the intent of aiming to keep their attention on your app for as long as possible. This will be a study into important effects of recommendation algorithms and how they could be reworked.

Problematization:

Zhengwei Zhao concluded that the principles of the recommendation algorithm on Douyin (the Chinese counterpart to TikTok) effects user's addiction to the app. Additionally, as users become more addicted to these apps, they give the algorithms more data on how to recommend them content. This loop results in users generally consuming the same content. Zhao stated that the recommendation algorithm on Douyin "causes people to be more lazy and unwilling to actively explore the world." A side effect of these algorithms is the lack of variety in the content they deliver. This gives rise to "echo chambers" on these apps, where users will tend to only consume content that looks at one side of political or opinion-heavy issues. Research done by Matteo Cinelli quantified these echo-chambers by looking at the interaction networks of users that produced content regarding controversial topics. The research saw the existence of echo chambers on Facebook and Twitter, two of the most popular social media sites. Social media algorithms lead to dangerous consumption habits that increase screen time and deliver content that leads to more close-minded interactions between users.

Guiding Question:

How can recommendation algorithms be used to promote content while avoiding the encouragement of dangerous consumption habits and polarization of content?

Projected Outcomes:

This research aims to understand the nature of recommendation AI systems and their effects on users. With this knowledge, I hope to analyze how recommendation AI can be adjusted to help promote better consumption pattern. This research aims to develop ideas on how to improve these AI algorithms and mitigate the consequences that are being researched. Additionally, another goal of this research is to spread awareness and knowledge regarding the harmful effects of recommendation AI algorithms to users so they can better understand how using these social media apps has various consequences.

Technical Project Description:

When looking at recommender system AI, they generally are made to target various metrics. These will vary from app to app, but generally having people consume the media in its entirety – whether this is watching a video or clicking on some sort of advertisement link is one of them. At the end of the day, businesses are using these algorithms to try and grow their user base. This is the core of what makes these algorithms problematic. To most reliably keep people hooked on their app, delivering content that they are the most likely to consume is effective. However, this means that people can very easily end up sinking unhealthy amounts of time onto these apps, developing into addiction and corresponding issues. Part of this means curating content that is very similar to a user's opinions, which is how social media apps with AI algorithms tend to result in polarization of content. To try and make improved algorithms that can be used for media curation, they should still aim to help grow the user base of the company that uses them. This research plans to investigate the various modifications made to recommender AI and propose how they can be used or further tweaked to try and minimize polarization in content. The goal is to find a middle ground between presenting more variety in controversial or political content while also keeping user engagement. Additionally, I plan to propose methods for apps to evaluate user data and determine if their usage could be leading to addiction or polarization then decide to tweak the algorithms. My CS capstone will be technical writing on the same topic.

Preliminary Literature Review & Findings:

Anitha Anandhan provided an overview of how recommendation systems in social media excel at processing vast amounts of online information, with their utility becoming even more valuable as content volume increases. The paper delves into the techniques employed to process data based on user consumption patterns, highlighting the usefulness of these algorithms, which will be considered throughout the research. Matteo Cinelli examined the effects of content curated by these algorithms, identifying the formation of echo chambers consequently. These echo chambers reinforce existing opinions within a group and drive the entire group towards more extreme viewpoints. The research sought to identify polarization in topics among like-minded individuals sharing similar perspectives. Furthermore, Samantha Bradshaw and Philip N. Howard investigated how political parties exploit social media for spreading misinformation campaigns. By combining these concepts, we observe how the convergence of political polarization, rampant misinformation, and excessive social media usage can lead to hazardous consumption patterns among users. Users end up consuming highly opinionated or misinformation-laden content, discussing it within echo chambers, creating a self-reinforcing loop that exacerbates polarization. Moreover, excessive social media use has been linked to psychological distress, as Betul Keles, Niall McCrae, and Annmarie Grealish's research illustrates the connection between social media usage and psychological issues such as depression and anxiety, particularly among younger audiences. While there are evident benefits to recommendation systems, it is crucial to adjust them to mitigate the observed drawbacks.

STS Project Proposal:

STS encompasses the social aspects of technology. To me, a significant aspect of STS is the interaction between individuals and technology, as well as the impact of technology on society. These interactions involve multiple stakeholders and often have unforeseen consequences. I consider this project to be an STS project because it addresses some of these

consequences. The technology being studied is a recommendation system AI, which serves as a practical tool for effectively curating content tailored to individual users. However, these algorithms have the unintended effect of increasing screen time significantly and creating a cycle of delivering increasingly polarizing content. These issues contribute to harmful consumption patterns that negatively impact users' mental health.

This research aligns with STS, mental health, and psychology, as it focuses on the effects of using recommendation AI. Specifically, we are examining the consequences of polarization and addiction. These issues have psychological implications and are commonly observed in relation to social media usage. Polarization and echo chambers contribute to individuals becoming more closed-minded and primarily engaging with like-minded individuals. Given these factors, I will be connecting papers that discuss potential technological modifications for recommender AI with research that investigates the effects of social media consumption on individuals. By doing so, I aim to draw conclusions that emphasize how AI algorithms can be enhanced to preserve their functionality while mitigating these adverse consequences.

This research will employ actor network theory as a social framework to examine the topic. By considering the various stakeholders involved in recommendation AI, the use of actor network theory will effectively establish and analyze the relationships between these stakeholders. One significant advantage of utilizing actor network theory is that it enables a focus on the businesses' imperative to engage as many users as possible. This framework will effectively maintain consistent terms of relationships between actors. For example, when proposing changes to recommendation systems, it is crucial to consider how the relationship between businesses, algorithms, and users might evolve and how it needs to be upheld. Furthermore, our application of actor network theory will not overly complicate the analysis, as it will primarily concentrate on the relationships between users, businesses, and AI. This approach prevents unnecessary complexity that can arise when examining a vast network of actors. Ultimately, this actor network theory approach aligns with the objective of improving interactions between individuals and technology, aligning with the broader scope of STS.

This research primarily aims to analyze the actor network theory and its implications. The focus will be on understanding the current network and explaining the factors influencing the relationships between stakeholders. Specifically, I will examine how businesses' prioritization of maintaining a userbase can lead to the AI promoting harmful consumption patterns, which ultimately negatively impacts users. Once the network dynamics and contributing factors have been established, I will propose enhancements to address these issues. Subsequently, I will modify the network to incorporate these improvements and assess how these changes will impact users and their interactions with technology. The overarching goal of this research is to enhance the interactions between individuals and technology, aiming for more positive outcomes.

Barriers & Boons

One of the major limitations pertains to the complexities involved in training AI systems. This process is computationally demanding and necessitates extensive datasets. Unfortunately, I am unable to easily modify algorithms and train them on datasets to conduct comparative analyses. Furthermore, the availability of user data for evaluating issues like social media polarization is quite limited. Consequently, I will primarily rely on existing published research to address these concerns. Another challenge lies in quantifying and precisely determining the impact of algorithmic influence when numerous other factors are at play. For instance, in the context of polarization, various factors beyond the algorithm itself, such as the contentious

nature of the topic or an increasingly polarized political climate, may contribute to the phenomenon. To tackle these challenges, efforts will be focused on improving data labeling and analyzing patterns in content recommendations.