Capital One Internship: What is Cloud Computing?
(Technical Paper)

The Effects of Misinformation on Society and its Future Implications
(STS Paper)

A Thesis Prospectus
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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.

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Introduction

Throughout the past decade, false rumors surrounding current events have plagued America as they spread faster with the help of social media. A study from MIT found that misinformation is 70 percent more likely to be shared on platforms, such as Twitter, than its truthful counterpart (Brown, 2020). This alarming number has directly affected the public's opinion on current events like the 2016 presidential election and COVID-19, creating a division within the country. Furthermore, the increasing popularity of social media demands the need for policies to audit information or the implementation of advanced technology like artificial intelligence to combat the growing issue. Unfortunately, the repercussions America faces from misinformation stem from a sense of irony. Misinformation has existed for decades as the country used it in many forms in the past (Soll, 2016). However, even with the familiarity of misinformation, the rise of the Information Age has made America feel like it is combating a wicked problem.

There is not a straightforward solution to solve misinformation, but there are ways to mitigate its spread on social media platforms. By combining artificial intelligence and public policy, society has seen recent success in weakening misinformation. Within the technical deliverable, a serverless solution that uses artificial intelligence will be outlined to alleviate the amount of misinformation surfacing on social media platforms. The premise of the deliverable is to utilize Amazon Web Services to support scalability and implement general principles of cloud computing. In addition, the STS research topic will analyze the effects of misinformation on society through frameworks such as Actor-Network theory and Wicked problem framing. The purpose of this prospectus is to seek a plan that involves cloud computing, artificial intelligence, and government policies to determine and remove misinformation from social media platforms.

Technical Topic

       The purpose of the technical topic is to reflect upon my internship experience at Capital One and leverage what I learned to propose a technological solution to mitigate misinformation on social media. Capital One is one of America's largest banks, founded on the belief that the banking industry should be revolutionized by information and technology ("Our Company"). In 2020, Capital One became a pioneer in the banking industry by moving its technological infrastructure to the public cloud. The bank's idea was to create a better customer experience by utilizing the cloud's ability to provide flexibility, scalability, and availability. The cloud can achieve these properties by providing on-demand computer system resources to its customers without the hassle of physical entities ("What is Cloud Computing"). For example, thumb drives were the primary resource used to store files outside someone's computer. However, cloud storage eliminated the need for thumb drives because files can now be stored in the cloud, meaning that those files live inside warehouses that can withhold Exabytes of data ("Global"). To fully grasp the capabilities of the cloud, imagine the thumb drive example for all computer-related resources like databases, networking servers, and even physical computers themselves. Due to these advantages, more companies are adopting cloud infrastructure to keep up with the changing times.

       While an intern at Capital One, I relied heavily on cloud computing to deliver an enterprise-wide product that needed to be globally accessible. The tool was called Automated Vulnerability Remediation (AVR), and its purpose was to provide a streamlined process to update Capital One's virtual environments in Amazon Web Services. With the help of AVR, Capital One was able to save approximately four hundred thousand hours of work by introducing an efficient process to execute a job within the cloud. The number of hours saved speaks for

itself, but the tool also patched a security hole within Capital One's technological architecture. The legacy process of updating a virtual machine entailed creating a ticket within the company's auditing system, waiting for the approval of an administrator, and having said administrator kick off the update. However, if there existed a vulnerability within the most recent operating system update, the majority of Capital One's virtual machines would be unprotected for approximately the amount of time the legacy process took. With the help of AVR, Capital One can eliminate its period of exposure with its technological infrastructure in the cloud.

Since AVR existed before the intern project, my team needed to create a stand-alone web application that integrated the existing tool, creating a centralized experience for the tool's customers. The motivation behind the web application was to become the face of AVR, allowing those who did not have cloud computing experience to initiate updates within their virtual machines. During my experience at Capital One, I found two computer science courses that applied to the industry experience. CS 3240 - An Introduction to Software Engineering and CS 4740 - Cloud Computing introduced topics that involved software development in an agile environment and the basics of cloud computing. By taking these classes, I understood how to deliver my work promptly and work collaboratively with the other interns. Overall, the work experience at Capital One presented me with a realistic post-graduation work environment and introduced me to computer science topics like cloud computing and artificial intelligence.

Given my previous experience at Capital One, the technical solution will utilize the advantages of cloud computing and artificial intelligence to combat misinformation. Similar to a google chrome extension, the application will scan users' feeds within their web browser and notify them if a given post contained fake news. The first part of the solution will use artificial intelligence to detect misinformation by crowd-sourcing data sets from verified users on social

media such as the New York Times and the Washington Post. Additionally, these compiled data sets will be stored in infinitely scalable storage within the cloud called a bucket, providing the application with an adaptable architecture for the future. Second, the application will be hosted on a virtual private cloud to ease the deployment of the application and maintenance for the future. While this solution uses a combination of both cloud computing and artificial intelligence, the architecture within the cloud allows the application to be adaptable if a new technology comes out in the future. Thus, the technical deliverable will discuss a previous internship experience and outline a solution that results from computer science topics that came from it.

STS Topic

In 2022, forty-eight percent of Americas use social media as their primary source for news ("How Many"). However, social media algorithms are programmed to prioritize information that the user wants to see, disregarding the content's truthfulness (Brown, 2022). These algorithms lead to social media feeds being swarmed with misinformation, making it deceiving for users to decide if they trust what they see. Misinformation is the spread of false information, regardless of whether the intent was present ("News"). Additionally, misinformation has become a trending word in light of current events such as the 2016 presidential election and COVID-19. In 2016, the FBI concluded that misinformation was created and disseminated to influence the election between Donald Trump and Hillary Clinton ("The Danger"). The source of the misinformation stemmed from Facebook, a social media networking site that enables users to connect online. It was here that one hundred twenty-six million Americas were shown Russian-backed, politically twisted stories that were intentionally

released to influence the 2016 election ("The Danger"). As a result, Congress passed a bill in 2017 to mandate social media companies to keep copies of advertisements within their platform and how much said advertiser paid. The intention here was to audit advertisers for Congress to analyze where social media companies were receiving revenue. However, social media companies like Facebook and Twitter rebutted the bill, claiming that Russia manipulated their platform during the election and argued the misinformation scandal had nothing to do with their advertisement infrastructure ("A Guide"). Although legislation failed to stop misinformation within advertisements on social media platforms, the 2017 bill proved that companies were aware of the content.

In 2020, Facebook's platform was used again to spread misinformation regarding vaccination during the COVID-19 pandemic. However, when policymakers questioned Facebook's feed algorithm, the company used the first amendment to support its technological structure. Facebook's claim on free speech soon latched on to other companies, like Twitter, to combat allegations against them from policymakers ("FB Papers"). As social media companies keep finding a way to combat legislation, a consensus around misinformation has formed within Washington DC to combat the issue as it becomes more dangerous for the future.

To answer my research question, I will use Actor-Network theory and Wicked Problem Framing. The analysis will begin with providing background around misinformation, specifically regarding the 2016 presidential election and COVID-19. French sociologist and philosopher Bruno Latour's Actor Network Theory will then show the relationships between social media platforms, policymakers, users, and misinformation (Cressman). As the paper uses Actor-Network theory, the analysis will reveal hidden relationships between entities during those current events and exploit unintended consequences that arose from them. However, Latour's

theory fails to provide an extensive analysis of social structures and struggles with conceptualizing problems between humans and non-human entities (Alcadipani and Hassard). To combat these faults within the theory, the effects of misinformation on social media platforms during the 2016 election and COVID-19 will reveal a societal hierarchy between users and social media companies. Afterward, Seager's Wicked Problem framing technique will analyze the future implications of misinformation by presenting solutions to mitigate current issues (Seager et al.). By using Wicked Problem framing, Seager's technique will define current problems surrounding misinformation and present a variety of solutions to prevent them. However, the wicked problem-framing technique lacks a justifiable way of defining problems. This stands as a fault within Segear's framing technique because it states wicked problems as incomplete and constantly changing ("What are wicked problems?"). To resolve the technique's flaw, the analysis will provide distinct problem definitions that stem from current events and solutions policymakers aim to make in the future to solve misinformation.

Methodologies

Research Question: How has misinformation from social media affected society, and what are its future implications?

This paper will use historical case studies to evaluate the effects of misinformation and the actions that resulted from them. The analysis will be placed in chronological order, indicating that the 2016 presidential election will come before COVID-19. In the context of the 2016 election, the paper will use Hunt Allcott and Matthew Gentzkow's journal as its primary source (Allcott and Gentzkow, 2017). Then, the paper will use a qualitative case study from Brazil to examine misinformation on social networks during the pandemic (Biancovilli et al.). The

intention of placing the analysis in chronological order is to emphasize the build-up of misinformation over the past decade. With the combination of documentary sources and scholarly articles, the paper aims to analyze historical case studies, create a relationship between the two studies, and present ways to avoid a similar instance in the future.

Conclusion

This prospectus investigates the effects misinformation on social media had on society during the past decade by analyzing case studies revolving around the 2016 presidential election and the COVID-19 pandemic. Furthermore, the technical deliverable will present a solution using cloud computing and artificial intelligence to combat the issue of misinformation. Additionally, the paper will define relationships between entities in the context of misinformation and use wicked problem-framing to investigate the ever-changing problem. While exploring misinformation, the paper aims to identify ways policymakers can combat the issue or highlight computer science topics that can be used to ensure the integrity of information on social media networks.

References

Alcadipani, Rafael, and John Hassard. "Actor-Network Theory, Organizations and Critique: Towards a Politics of Organizing." *Organization*, vol. 17, no. 4, 2010, pp. 419–435., https://doi.org/10.1177/1350508410364441.

Allcott, Hunt, and Matthew Gentzkow. "Social Media and Fake News in the 2016 Election." 2017, doi:10.3386/w23089.

Barnhart, Brent. "How to Rise above Social Media Algorithms." *Sprout Social*, 13 Apr. 2022, https://sproutsocial.com/insights/social-media-algorithms/.

Biancovilli, Priscila, et al. "Misinformation on Social Networks during the Novel Coronavirus Pandemic: A Quali-Quantitative Case Study of Brazil - BMC Public Health." *BioMed Central*, BioMed Central, 23 June 2021, bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-021-11165-1.

Brown, Sara. "MIT Sloan Research about Social Media, Misinformation, and Elections." *MIT Sloan*, 5 Oct. 2020, https://mitsloan.mit.edu/ideas-made-to-matter/mit-sloan-research-about-social-media-misinformation-and-elections.

Cressman, Darryl. "Actor-Network Theory." *The Blackwell Encyclopedia of Sociology*, 2018, pp. 1–2., doi:10.1002/9781405165518.wbeosa009.pub2.

"The Danger of Fake News in the 2016 Election." *Center for Information Technology and Society - UC Santa Barbara*, https://www.cits.ucsb.edu/fake-news/danger-election.

"FB Papers: How Meta Became the Biggest Hub of Covid-19 Misinformation." *Gizmodo*, 20

      Oct. 2022, https://gizmodo.com/facebook-papers-covid-19-coronavirus-misinformation-

      1849667132.

"Global Data Center Storage Capacity Used 2015-2021." *Statista*, 23 May 2022,

      https://www.statista.com/statistics/638613/worldwide-data-center-storage-used-

      capacity/.

"A Guide to Anti-Misinformation Actions around the World." *Poynter*, 14 Aug. 2019,

      www.poynter.org/ifcn/anti-misinformation-actions/#us.

"How Many People Use Social Media for News in 2022? (Full Stats)." EarthWeb, 30 Oct. 2022,

      earthweb.com/how-many-people-use-social-media-for-news/.

"News: Fake News, Misinformation & Disinformation." *Library Guides*,

      https://guides.lib.uw.edu/c.php?g=345925&p=7772376.

"Our Company." *Capital One*, https://www.capitalone.com/about/corporate-information/our-

      company/.

Seager, Thomas, et al. "Sustainable Engineering Science for Resolving Wicked Problems."

      Journal of Agricultural and Environmental Ethics, vol. 25, no. 4, 2011, pp. 467–484.,

      doi:10.1007/s10806-011-9342-2.

Soll, Jacob, et al. "The Long and Brutal History of Fake News." *POLITICO Magazine*, 18 Dec.

      2016, https://www.politico.com/magazine/story/2016/12/fake-news-history-long-violent-

      214535/.

"What Are Wicked Problems?" *The Interaction Design Foundation*, www.interaction-

design.org/literature/topics/wicked-

problems#:~:text=Wicked%20problems%20lack%20clarity%20in,attempts%20to%20fin

d%20a%20solution.

"What is Cloud Computing?" *Amazon Web Services*, https://aws.amazon.com/what-is-cloud

computing/.