**Script Kiddies and GitHub Copilot:**

**A Review of GitHub Copilot’s Proficiency in Generating Various Types of Common Malware from Simple User Prompts**

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ABSTRACT

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**CCS CONCEPTS**

• Software and its use cases → Assessing the impact of GitHub Copilot on novice programming development.

• Cybersecurity → Assessing the ease and quality of malware produced by GitHub Copilot

**KEYWORDS**

GitHub, Copilot, Malware, Artificial Intelligence, OpenAI, Script Kiddie, Cybersecurity, Software Development, Python, Code Climate, Software

**RELATED WORK**

*† Eric Burton Martin is a student at Colorado State University and is currently pursuing a master’s degree in computer science. He previously obtained a chemistry degree in 2013 and has worked as an analytical chemist. Currently, his interests are in AI/ML, cybersecurity, and blockchain technology*

As GitHub Copilot is relatively new, there is not a large body of literature assessing quality of code output and testing. With that said though, I will be referencing and deriving motivations from the paper [4] by Nguyen and Nadi as they provide straightforward and easily replicated approaches for evaluating GitHub Copilot suggestions.

1 INTRODUCTION

I am a second bachelors’ candidate at Colorado State University working towards my B.S in Computer Science. My graduation date for my B.S is December 2022 and following that I will be working towards my M.S in Computer Science through the newly forged accelerated master’s program. My previous degree was in chemistry from CSU and was awarded in 2013. Although my career in chemistry was fun and I worked with a plethora of amazing people, the salary ceiling was too low and career growth potential was limited as a B.S chemist. Having interacted with computer scientists throughout my time as a chemist and having quite an aptitude in the realm of computers eventually made me take a second shot at schooling and work towards a computer science degree. My initial plan was that I would minor in data science and concentrate in Artificial Intelligence (AI) and Machine Learning (ML) and use those skills to help manage the massive amounts of data in the scientific sectors. Well, here I am today, months from graduating and I did not concentrate in AI/ML, nor did I minor in data science. I ended up feeling limited by that path and wanted to try a bit of everything, so I put my focus towards software engineering, cybersecurity, and AI/ML in the general concentration. So, why did I decide on going to graduate school and what is my guiding area of interest? Throughout my two and a half years as a computer science undergraduate, I have spoken with plenty of professors about their research and I have ended up ‘narrowing’ my interests down to a few areas: AI/ML, Cybersecurity, and Blockchain. It is within these three categories that I have been investigating potential research opportunities within the computer science department at CSU.

2 HYPOTHESES

Throughout the semester in CS501 - Introduction to Research in Computer Science, we have had to reflect on what it is we hope to accomplish, and I have successfully determined that I would like to work towards M.S. Plan B research project. This decision was based on the fact that I am a returning student and would like to get back to the workforce as soon as possible while still pursuing research. Throughout the semester, I have spoken with various professors in the computer science department about potential research assistant positions and the prospects are looking good. To my surprise, I have even been approached by two cybersecurity professors in the department and offered a research assistantship position. This, from my understanding, was most likely due to my presence at the weekly cybersecurity meetings as well as my extracurricular activity as one of the leaders of the cybersecurity club. These offers are on the table currently, but I have not hastily accepted their gracious offers because I truly want to have a vested interest in the project I will be working on before agreeing. The first offer was to work on a project that did not interest me, so Dr. Indrakshi Ray and I are meeting with the CEO of a company to talk about another research project focusing on phishing emails that bypass filtering techniques, which sparks my interest. The other project I am interested in is with Dr. Indrajit Ray which involves healthcare compliance and blockchain, but I need to continue our conversation to learn more about the project and how I can contribute. I have also spoken with Dr. Altarawneh about potential projects in the blockchain space and have been attending the weekly blockchain meetings to further the conversations. It seems funding is not a guaranteed thing at the moment, but I believe there is a good opportunity to work with her as well. The last professor I am interested in conversing with is Dr. Chuck Anderson. He recently discussed his research in his machine learning class that I attend, and it sparked my interest since it is bordering the realms of AI, ML, and neuroscience. I let him know I am interested in his work and look forward to scheduling a meeting.

As you can see, I am very lucky to even have a research assistant opportunity, but I am also feeling the burden of not hastily accepting the offers on the table. I only have one chance at my master’s, and I truly want to ensure that I make a choice that inspires me.

3 EXPLORATION

Throughout the semester we have had the opportunity to learn about a variety of professors’ research and scratched the surface of the topics they are versed in. It was from some of these talks that I learned more about the interesting research taking place at CSU. Outside of class, I had done my own research into various professors and looked at their previous and current projects they have worked on to get a better understanding of the knowledge I would be required to gather and utilize to be a good candidate. Aside from online sleuthing and information gathering, I also sat in on the CS 793 Seminar in Cybersecurity every week throughout the semester to learn even more about projects in the department and foster my relationships with fellow students and faculty. Alongside CS 793, I also attended the weekly Blockchain meetings hosted by Dr. Altarawneh. By attending these two meetings every week, I had furthered my knowledge in the fields of cybersecurity and blockchain and made new relationships within the computer science department.

A little less often, I attended Dr. Blanchard’s research group meetings per his request and got to personally see how his group interacts and learn more about the research they are pursuing. More recently though, I had learned about Dr. Anderson’s research and have set up a meeting to discuss more about his team and to answer questions similar to those assigned this semester. One other form of exploration I will be performing prior to the end of the semester is that I will be attending the preliminary exam of Don Neumann on December 13th to get a glimpse into the realm of bioinformatics which sparks my interest due to my chemistry background.

4 PLAN

From what you can infer, I have spoken to quite a few professors throughout this semester and have learned a lot. Through this process I have noticed that a lot of doors seem to be opening and new opportunities are beginning to arise. With that said though, I feel as though I need to begin focusing my attention down to one project and advisor as soon as possible so as to not lose any opportunities that are being presented. Research assistantships are a competitive space and I need to not take the opportunities that come my way for granted. These next two weeks I will reach out to the professors mentioned in this paper to try to determine what next semester will look like for me. Currently, if all goes well during the meeting with Dr. Indrakshi Ray and the CEO of a company (unsure of the company), I may be getting involved as a research assistant working on a project to identify how certain phishing emails bypass company filters. If this is the case, my winter break will most surely entail a deep dive into a review of phishing email detection methods and studies on the skillsets and techniques needed to do well on this project. My fun project idea is to further work on my final project in CS 545 - Machine Learning to attempt bring the project to a new level prior to CS 540 – Artificial Intelligence next semester where I plan on leveraging my newfound knowledge to bolster my idea and create something I can truly be proud of.