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**What are the effects and impacts of GitHub Copilot on the coding community?**

Prompt: GitHub have recently released an AI (Artificial Intelligence) code suggestion tool named GitHub Copilot (https://copilot.github.com/) that uses AI to try to guess what code you might be trying to write, and automatically inserting it into your programme when asked. Supporters argue that it has the potential to save developers collectively millions of hours spent writing common functions. However, the launch has not been straightforward.

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**Abstract:**

A new coding tool has been announced by the cloud-based git repository company ‘GitHub’. This software is called GitHub Copilot, its announcement has caused a huge wave in the coding community resulting in two large divides in opinions. The supporters of the software who see it for its possible benefits and the dissenters who do not see eye to eye with the supporters and do not welcome the release of such a revolutionary software that could potentially put them out of their jobs and cause a massive upheaval in the software development industry.

Could this be the start of a new age of software development where humans' productivity skyrockets? Or could it be the beginning of a dark age where many lose their jobs as they are made redundant by the ever evolving and improving artificial intelligence’s?

**Introduction:**

What is GitHub Copilot you may ask? Well, GitHub Copilot is an AI pair programmer, or code completion tool, that works by taking any questions you have inputted as comments in your coding environment and turns them into code. It's basically like having an automatic Stack overflow built into your computer, or an improved version of Gmail’s suggested next words in your email but built for coding rather than sending emails.

This would allow for a lot more convenience in coding basic functions by suggesting entire lines of code for you based on its collection of data. And as GitHub has recently been purchased by Microsoft who currently own ‘VSCode’ and the ‘Atom’ code editors they will have quite a lot of data on peoples coding projects to use as a basis for suggestions.

GitHub Copilot’s neural network is ‘trained’ on all the open-source code that has been uploaded to GitHub which according to google contains “400,000 GitHub repositories, 1 billion files, 14 terabytes of code” and the amount of code that it has available to it to draw from will always increase with the more users that the software has. This self-learning AI is similar to the way that Tesla's self-driving cars improved by gathering more data from people who have purchased and driven tesla cars.

The tests for GitHub Copilot are all automated which will be widely accepted by the coding community as many people dislike running tests on their code and find them annoying regardless of how necessary they are to find out if there are any issues with their code. (ForrestKnight, 2021)

**Main body:**

GitHub Copilot works by having the user first commenting out some instructions such as //create a loop that calculates the amount of water in a lake. And then starting a single line of code. For example, if the user writes instructions and then initialises a function GitHub Copilot will suggest up to 10 possible ways to complete that function that will calculate the amount of water in a lake that the user can choose between.

Software developers tend to try to save themselves both time and effort by automating their work wherever it is possible to do so, GitHub Copilot is simply a godsend for these people as they can simply gloss over the more mundane tasks that will be auto completed by Copilot and can focus on harder tasks that will push them to grow and improve their repertoire as a developer.

According to a blog post by Devon H. O'Dell “Software developers spend 35-50 percent of their time validating and debugging software. The cost of debugging, testing, and verification is estimated to account for 50-75 percent of the total budget of software development projects, amounting to more than $100 billion annually.” (H. O'Dell, 2017).

This use of GitHub Copilot could greatly reduce the time and money spent on debugging software as the developers will spend their time on debugging the suggested code rather than their own, the solutions implemented by Copilot are faster than even the best of developers, but their errors need to be checked by humans who understand how to code properly.

The GitHub CEO Nat Friedman once stated that “GitHub Copilot draws context from the code you're working on, suggesting whole lines or entire functions”. This shows how useful the software is and that it can boost developers' productivity by a large margin as they can code more efficiently but also raises questions about whether it can put people's jobs at risk.

Even Sam Altman the CEO of OpenAI the company that created the technology that GitHub Copilot runs on predicted that “AI will cause the price of work that can happen in front of a computer to decrease much faster than the price of work that happens in the physical world.” (노마드 코더 Nomad Coders, 2021)

In 2019 Microsoft invested one billion dollars into OpenAI, a company that was founded by some of the greatest minds of today such as Elon Musk, showing their interest in the prospects of GitHub Copilot. This leads many people to wonder what exactly Microsoft’s goal was. Was it to completely replace developers due to them being way too expensive? In the past Microsoft has definitely spent a lot of money on hiring developers and if in the future they can have an AI do their job instead then only stand to profit. Not to mention that they could sell GitHub Copilot as a commercial product allowing other companies to profit from this as well and reduce the need for developers in the industry.

Just as many accountants feared losing their jobs once the calculator came out many software developers wonder if the release of this revolutionary new software will make their jobs obsolete or replace the need for human developers entirely. GitHub Copilot is said to be a tool that will make coding more efficient and boost people's productivity but how useful exactly is it?

As GitHub Copilot attains more knowledge and proficiency on coding it will inevitably outgrow the need for the developers that are ‘feeding’ it with data to learn from, this will lead to them being out of their jobs. (ForrestKnight, 2021)

There is also the chance that due to developers increased productivity via the use of this software development teams will get smaller. For example, a team of 6 developers working on a project may be cut down to 3 developers as they are efficient enough to get the job done alone. This would result in a lower number of jobs being posted in the computer science field by companies that develop software and applications or games.

Although Copilot has built-in support for most coding languages it is best used with ones such as Python, Go and HTML5. It has been shown to suggest almost perfect HTML (Hypertext Mark-up Language) code due to the simple nature of HTML’s syntax and its relatively strict rules.

However, it is not perfect, GitHub Copilot does occasionally make mistakes, mistakes that would require a seasoned developer to look for and fix which means that this software will not extinguish the need for developers as a whole. At least not in its current state.

The reason for this is that the AI does not know how to actually code, it only knows what code usually looks like due to its large banks of data on coding, so while it can suggest you some code to add into your program it will not always suggest the correct or most aptly fitting code for the situation. (노마드 코더 Nomad Coders, 2021)

Even on the GitHub website, it is stated that “GitHub Copilot doesn’t actually test the code it suggests, so the code may not even compile or run.” This shows that the software is not perfect and cannot completely replace the need for developers.

There is also an issue with the fact that not all of the code that has been collected for the AI’s ‘learning purposes’ is of high quality, or even correct so there may be issues with quality in your suggestions that you will need to filter out manually.

According to academics, nearly 40% of the suggested code is erroneous from a security standpoint, it is theorised that the reason for this is due to the fact that some of not all of the code from the AI’s training set is working as it is supposed to be and may be buggy. (Sharma, 2021)

Due to the way the AI was ‘taught’ using open-source GitHub repositories that are publicly available there is a chance that the code could be blatantly copied from somewhere else, GitHub even states this on their own website saying that the code is copied ‘0.1% of the time’ from the training set and the rest of the time it is uniquely generated.

One example of code being stolen by Copilot is a large chunk of code from the videogame Quake 3 being ripped with the original comments intact, another occurrence happened when a user asked Copilot to create an about me page and it ripped a page with of a random person. (Bergdahl, 2021)

This brings into question the ethics of teaching the AI on these repositories without the creator's consent, especially since GitHub plans to make this software a commercial product in the future.

If this problem is not fixed in the future users of the product could unknowingly be breaking copyright laws by using other people's code in their projects.

Due to this it has been advised by some people to wait until this problem has been remedied so you do not unknowingly use any copyrighted or copylefted content. (Dependency Heaven, 2021)

**Conclusions:**

In conclusion, GitHub Copilot is merely a useful tool and not a threat to the livelihood of software developers. If it gains traction in the coding community it could pose a threat to some low-level coding jobs but if developers are willing to adapt and grow their technical skills, they will not be out of a job. As what Developers were doing a decade ago is quite different than what current developers do and will probably be vastly different when compared to future developers.

Just like how website building platforms such as Wix and WordPress revolutionised the web development industry I believe that GitHub Copilot will do the same for the software development industry, allowing more people to get into coding and allowing developers to learn more.

Even if the software does eventually evolve to the point that it can flawlessly create code it would still need human supervision for logic and problem solving.

I believe GitHub Copilot will not remove the need for developers, it would instead act as a better alternative for websites like stack overflow due to it being much more convenient. Even so this will take some time as currently I can imagine stack overflow being flooded with questions like ‘why is this code suggested by GitHub Copilot not working?.’

I also personally think that many similar services that use AI and machine learning to help complete code will be created in the near future however unless they are created and ‘taught’ in an ethical way without any law infringements I do not think they will become an industry standard.

Even if code completion tools do become truly ‘perfect’ in the future they will not completely remove the need for developers and will cause an evolution in the coding community where humans can do so much more than now. But it will be just that, an evolution not a revolution, they will not take over coding jobs completely as they cannot actually make informed decisions as of yet.

For those few that are still wary of GitHub Copilot and think it is a threat to their jobs, one user has quite excellently said “Your mother-in-law is not going to install Copilot and start knocking out web apps. Tools like this allow programmers to become more productive, which increases demand for the skills. “ (Maindola, 2021)

Just like the name says it is a co-pilot, it does not run on autopilot, and it is not the actual pilot, that is you and the software is merely there to assist you.

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**My 5YP Personal Tutoring Skills Audit**

DATE: 16/10/2021

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The following questionnaire will help you to identify areas of strength and areas where you may wish to spend time developing. Ideally, you will complete this skills audit multiple times as part of the My5YP programme, to identify those areas where you have made progress in improving your level of competence, and where you still have some work to do. Please keep all completed copies safe to help track your personal development. To get the most out of the exercise, please answer the audit as honestly and openly as possible.

***You do not need to share your skills audit with anyone else, but you can do so at your own discretion.***

INSTRUCTIONS

1. For each skill listed below you have a list of traits related to that skill. Add a X to the rating (1 to 3) that you feel represents your level of competence, with 3 indicating full competence.
2. For each skill, give yourself an overall rating by adding an X to the box you believe reflects your current level of competence. The boxes are colour coordinated as follows.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Purple |  | Orange |
| I do not feel competent in my skills in this area. | | I have begun to develop some competence in this area, but still need to improve. | |
|  | Green |  | Blue |
| I feel competent in this area but am not sure what examples I could give as evidence. | | I feel competent in this area and have a range of examples to evidence my skills. | |

1. For each skill, think about what evidence you could give to demonstrate that you have practiced and become competent in that skill. For example, you may have developed good teamwork skills through taking part in hackathons, game jams, or other team-based events.

**Time & Self-Management**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | 1 | 2 | 3 |
| I am always able to organise my time so that I comfortably meet all my assignment deadlines. | | | | |  | X |  |
| I keep a diary or calendar so that I always know when I have to attend lectures, seminars, and other key activities e.g., employer events and submit my assessments. | | | | | X |  |  |
| I always arrive in good time for classes, appointments, and meetings. | | | | |  | X |  |
| I am aware of things that cause me to waste time and I am able to avoid them when I have work to complete. | | | | | X |  |  |
| I have future targets in mind regarding my education /career and use these to help me focus on current tasks. | | | | | X |  |  |
| I always attend my timetabled classes. | | | | |  |  | X |
| **How I rate myself for this skill** |  |  | X |  |  | | |
| Evidence:  I am quite good at managing time as I always meet my deadlines for assigned work but could improve by doing work straight away instead of some of it at the last minute. | | | | | | | |

**Critical Thinking & Problem Solving**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | 1 | 2 | 3 |
| I am able to use different methods for exploring a problem (academic and non-academic), such as considering different points of view or options. | | | | |  |  | X |
| I am able to consider a range of alternative solutions to a problem. | | | | |  | X |  |
| I am able to break down a complex problem (e.g., an assignment, a seminar question or where to live) into simple parts. | | | | |  |  | X |
| I am able to work productively with others to solve problems. | | | | |  |  | X |
| **How I rate myself for this skill** |  |  | X |  |  | | |
| Evidence:  I have learnt computational thinking and use it in my coursework. | | | | | | | |

Commercial Awareness

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | 1 | 2 | 3 |
| I have a good understanding of the industry/sector I want to work in. | | | | |  | X |  |
| I follow industry news to keep up to date with changes in the sector. | | | | | X |  |  |
| I understand the importance of knowing the culture and values of an organisation. | | | | |  |  | X |
| I know how to research an organisation and its competitors to identify likely changes in the future. | | | | | X |  |  |
| **How I rate myself for this skill** |  | X |  |  |  | | |
| Evidence:  I am not very commercially aware of the software dev field, I need to fix this by studying it. | | | | | | | |

**Confidence**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | 1 | 2 | 3 |
| I know how to access support for my course and career ideas. | | | | |  |  | X |
| I can deliver presentations (academic/job related). | | | | |  | X |  |
| I like meeting new people and make the most of every opportunity to do so. | | | | |  | X |  |
| **How I rate myself for this skill** |  | X |  |  |  | | |
| Evidence: I am very confident in regards to interpersonal skills and conversations but not so much in a professional environment due to my lack of experience in it. | | | | | | | |

**Numeracy**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | 1 | 2 | | 3 |
| I have the numerical and statistical skills needed to succeed on my course. | | | | | X |  |  | |
| I am able to interpret information presented in graphs, charts, tables, and diagrams. | | | | | X |  |  | |
| **How I rate myself for this skill** | **X** |  |  |  |  | | | |
| Evidence:  I do not have particularly good numerical skills and need to practice them; without a calculator I am slow at calculations. | | | | | | | | |

**Oral Communication**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | 1 | 2 | | 3 |
| In group discussions, I listen to others, and I value and respond to their contribution even if I do not agree. | | | | |  |  | X | |
| I am confident that I can contribute ideas and opinions in a group discussion. | | | | |  |  | X | |
| I think of relevant follow-up questions as people are speaking and ask them once they have finished. | | | | |  | X |  | |
| I am confident explaining new concepts to other people. | | | | | X |  |  | |
| I would be confident in giving a new presentation to my peers. | | | | |  | X |  | |
| **How I rate myself for this skill** |  | X |  |  |  | | | |
| Evidence: My oral communication skills are not the beast for large projects such as speaking or presenting to a large audience, but they are fine for interpersonal conversations. I could improve my explanatory skills though as I am lacking in that area. | | | | | | | | |

**Written Communication**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | 1 | 2 | 3 |
| I can structure an assignment in paragraphs and using signposting language in order to communicate my ideas effectively. | | | | |  | X |  |
| I can write in an appropriate academic style for my subject. | | | | |  |  | X |
| My written work has no grammatical, punctuation or spelling errors before I submit it. | | | | |  |  | X |
| I have an effective method for organising and planning the information that I want to put into a written assignment such as an outline plan or a ‘mind map.’ | | | | | X |  |  |
| I can use sources effectively to make my argument convincing and show that I am well informed about the topic. | | | | |  | X |  |
| I am able to produce useful and meaningful written notes from a lecture, presentation or demonstration that capture the key points. | | | | |  | X |  |
| **How I rate myself for this skill** |  |  | X |  |  | | |
| Evidence: I have written a report for his subject and a few in the past for high school and college to train my skills in written communication, I can also create a formal email for study/work purposes. | | | | | | | |

**Leadership**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | 1 | 2 | 3 |
| I inspire confidence in others. | | | | |  | X |  |
| I can give constructive feedback to support others. | | | | |  | X |  |
| I am confident making decisions. | | | | |  | X |  |
| I am confident delegating tasks to others. | | | | |  |  | X |
| **How I rate myself for this skill** |  | X |  |  |  | | |
| Evidence: I have a high confidence in myself and my skills, I do not have much experience with leadership roles however and must work on this in future group presentations by volunteering for the role. | | | | | | | |

**Teamwork**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | 1 | 2 | 3 |
| I work well with others in a variety of teams (academic/work). | | | | |  |  | X |
| I understand how I can contribute to different team tasks. | | | | |  |  | X |
| I feel confident when working in teams with new people. | | | | |  |  | X |
| **How I rate myself for this skill** |  |  |  | X |  | | |
| Evidence: I have no problem with talking to new people and am confident in doing so, I have done this in university as I can help others who are sitting near me with their help even if I am not familiar with them or have talked to them before at all. | | | | | | | |

Reflection will be below on a new page

**Reflection on the skills audit**

I am quite confident in most of the skills that the skills audit has touched upon.

I developed the skills of Time & Self-Management through doing my homework and revision in high school and college.

I developed the skills of Critical Thinking & Problem Solving naturally due to being curious about many subjects such as computer science and asking a lot of questions, this led to me needing to consider many opinions that may not coincide with my own. My skills of problem-solving mostly grew in college due to learning about computational thinking and how to split large problems into many smaller ones and solving them in order of the highest priority first.

I could develop my skills of Commercial Awareness by doing more research into the computing and software development industry, a few ways I can do this besides independent research is subscribing to some computing news youtubers such as ‘linustechtips’ who cover all of the latest things to do with software and hardware, I could also subscribe to an online email list for a newsletter such as ‘morning brew’ that sends you an email every few days on recent happenings in the industry

I developed my confidence skills by putting myself out there and talking to new people but I do not have much experience with formal presentations so I may not be very good at that yet, but I expect to improve in this regard with group presentations in university. I also don’t spend as much time as I could socialising and meeting new people but when I am put into those kinds of situations, I do my best to talk to new people.

I could develop my numeracy skills by studying maths more, especially computational and discrete maths as that directly pertains to my course. I do not have much experience with graphs, charts, tables, and diagrams so I could do some work on those in a personal project to improve my skills with those.

I have developed my Oral Communication skills by being a good listener and attempting to give well thought, structured responses to people that are helpful to them or pertain to the subject at hand. I am not, however, good at explaining new concepts to people as I stumble over my words a lot if I am not well informed and fully confident on the subject I am explaining.

I have developed my Written Communication skills by doing lots of assignments and reports in college and I intend to perfect this skill in university through using it as I have in the assignment, I did on GitHub Copilot for the first half of this assessment. I could have done the report better if I mapped it out though so I should work on planning some more in future assignments.

I have not properly developed my Leadership skills and do not have much experience with it which I could change by volunteering for leadership roles in group projects or classwork.

I am very confident in my Teamwork skills and have developed them all my life through my education where I have done a lot of group work, even when meeting new people and doing work with them I do not fell as if I am at a disadvantage and attempt to contribute as best as I can.

I have added the goal of learning a new language to my 5-year plan, I may pick between Italian, Spanish, Korean or Arabic. I have chosen this goal because I am looking into studying abroad for either 1 summer or an entire year, it would also be useful for many other cases such as getting a job or going on holiday.