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USING AI IN SOFTWARE DEVELOPMENT: GITHUB COPILOT SYSTEM

GitHub Copilot is an AI pair programmer that offers autocomplete-style suggestions as you code. You can receive suggestions from GitHub Copilot either by starting to write the code you want to use, or by writing a natural language comment describing what you want the code to do. GitHub Copilot analyzes the context in the file you are editing, as well as related files, and offers suggestions from within your text editor. GitHub Copilot is powered by OpenAI Codex, a new AI system created by OpenAI.GitHub Copilot is available as an extension in Visual Studio Code, Visual Studio, Neovim and the JetBrains suite of IDEs.

This is certainly not the first "AI powered" program synthesis tool. GitHub's Natural Language Semantic Code Search in 2018 demonstrated finding code examples using plain English descriptions. Tabnine has provided "AI powered" code completion for a few years now. Where Copilot differs is that it can generate entire multi-line functions and even documentation and tests, based on the full context of a file of code.

There are few different ways to use Copilot.

You can start to type a signature of a function and Copilot will suggest a continuation of this function.

For example you can write:

int CalculateDaysBetweenDates(

Copilot will suggest you the whole function to add. To accept it you need to press the tab. If alternative suggestions are available, you can see these alternatives by pressing Alt+] or Alt+[. To reject all suggestions, press Esc.

Another way to work with Copilot is to simply write a prompt in a comment.

For example, type the following comment. GitHub Copilot will suggest an implementation of the function.

```
using System.Xml.Linq;
var doc = XDocument.Load("index.xhtml");
// find all images
```

2. To accept the suggestion, press Tab.

In a recent evaluation, GitHub found that users accepted on average 26% of all completions shown by GitHub Copilot. They also found that on average more than 27% of developers' code files were generated by GitHub Copilot, and in certain languages like Python that goes up to 40%. However, GitHub Copilot does not write perfect code. It is designed to generate the best code possible given the context it has access to, but it doesn't test the code it suggests so the code may not always work, or even make sense. GitHub Copilot can only hold a very limited context, so it may not make use of helpful functions defined elsewhere in your project or even in the same file. And it may suggest old or deprecated uses of libraries and languages. When converting comments written in non-English to code, there may be performance disparities when compared to English. For suggested code, certain languages like Python, JavaScript, TypeScript, and Go might perform better compared to other programming languages.

Copilot was created using the open source code from GitHub, therefore the code which Copilot gives you may be borrowed from someone else's project.

Copilot raises a number of important questions around who has actually authored a piece of software. "Open source" doesn't mean a complete free-for-all, and there are still license requirements to fulfill and attributions

to include, so if Copilot "borrows" code from one project and suggests it to the author of another project, will this open the floodgates to copyright infringement lawsuits? There has also been a whole heap of discussions around what constitutes fair-use, as well as lack-of-transparency questions that Copilot raises, with Software Freedom Conservancy's Bradley M. Kuhn penning an in-depth piece last year titled "If Software is My Copilot, Who Programmed My Software?".

Another problem that people see in Copilot is that it uses Open-Source code but at the same time it has a price. Some people see this as a betrayal of the open-source spirit. Also, this led the Software Freedom Conservancy (supported by a lot of big tech companies) to end its own use of GitHub internally, and introduce a program to help its member projects transition away from GitHub. On top of that, it said that it won't accept new members that don't have a clear plan to migrate their open source projects away from GitHub.

On March 22, 2023 GitHub announced Copilot X. This is a new version of Copilot, now based on ChatGPT-4. Copilot X will be embedded much deeper into the IDE, which will give it more vision about the context of your code, warning messages and other information. Also, Copilot X will have a chat window, so that will be a new way to work with it. A developer can get in-depth analysis and explanations of what code blocks are intended to do, generate unit tests, and get proposed fixes to bugs. And another huge new function is voice-to-code AI technology where developers can verbally give natural language prompts.

In conclusion, we can see that the name "Copilot" fits this project really well. It does not write a perfect code, it can use someone else's code, and you still need to verify everything it does. But at the same time, it still can give a lot of help, and give you a possibility to focus more on software architecture, debugging and optimization, than writing each function and thinking about how to implement them and what algorithm to use.