

Copilot

Getting started

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June 2, 2023

Outline

- ▶ What is Copilot?
- ▶ Some examples
- ▶ How to get started (for free)



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Disclaimer 2: I am not an expert, I just got copilot to work. Feel free to pitch in with your experiences.

What is (Github) Copilot?

- ▶ A tool that suggests code based on your comments
- ▶ Trained on billions of lines of code
- ▶ Uses OpenAI's Codex
- ▶ Works with Python, JavaScript, TypeScript, Ruby, and Go
- ▶ Works with VS Code, Atom, and GitHub Codespaces
- ▶ Works with private repositories

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(according to copilot itself)

What is (Github) Copilot (according to Felix)?

- ▶ A tool that suggests code (like giga-autocomplete)
- ▶ Pretrained (GPT) plus open Github repositories for training
- ▶ Builds on GPT-3
- ▶ Works with lots of languages (fine with Julia)
- ▶ Works with VS Code, Neovim, Visual Studio and JetBrains (off the shelf)
- ▶ Future version Copilot X is GPT-4 powered.

Example of Latex Code



Control Example

Copilot does not build a project by itself, it can only fill in the blanks. We need a code skeleton.

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✦ Model: GPT-4

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I am a researcher in automatic control, and I want to write a short demonstration on how to write code using Github copilot. The demo should include visualization, simulation and control of a very simple control process. Please suggest a language for the code, a control application for the example, and a layout of the different files that would need to be written to complete the example.

Control Example



Sounds like a great project! Here is a suggestion:



Programming Language: Python. It's highly readable, widely used, and it has numerous packages for simulation, visualization, and control systems. Furthermore, Github Copilot is highly trained in Python, so it would be quite beneficial for this demonstration.

Control Application: Inverted pendulum. This is a classic control problem and is often used as a benchmark in control theory. The inverted pendulum problem involves balancing a pendulum in the upright position by applying a force to the cart it is mounted on. It demonstrates the principles of feedback control, such as stability and disturbance rejection, and is nonlinear, which makes it a bit more challenging than a linear system.

Control Example

Layout:

1. `main.py`: Main script that will call other files and orchestrate the simulation.
2. `pendulum.py`: This file would contain the class definition for the inverted pendulum, including methods for pendulum dynamics and state updates.
3. `controller.py`: This file would contain the class definition for the controller. This could be a simple PID controller, a state feedback controller, or something more complex like an LQR controller, depending on how advanced you want the demonstration to be.
4. `simulator.py`: This script would handle the simulation of the system. Given the pendulum object, the controller object, and some initial conditions, it would simulate the system's behavior over time, including the effects of control and any disturbances.
5. `visualizer.py`: This script would handle the visualization of the simulation results. It could plot the pendulum's position over time, the control input, the phase portrait, etc.
6. `utils.py`: This script would contain any utility functions that might be needed, such as functions to compute the linearization of the system, or to design the controller.

Some funny anecdotes

```
TeX main.tex ●  
TeX main.tex  
1 % beamer presentation  
2 % Created by zhengma on 2010-05-18
```

```
pendulum.py 3 ●  
pendulum.py > ...  
1 """A class representing an inverted pendulum  
2  
3 Author: Russ Tedrake <  
4 """  
5 class Pendulum:  
6  
7     def __init__(self):  
8         # initiate parameters and state  
9  
10  
11     def update_state
```

Some funny anecdotes

Sometimes it needs a nudge:

```
"# Update pendulum state"
```

$$\ddot{\theta} = u \quad (1)$$

Some funny anecdotes

Sometimes it needs a nudge:

"# Update pendulum state"

$$\ddot{\theta} = u \quad (1)$$

"# Update pendulum state, WHILE TAKING GRAVITY INTO ACCOUNT"

$$\ddot{\theta} = u - mg/l\sin(\theta) \quad (2)$$

Some funny anecdotes

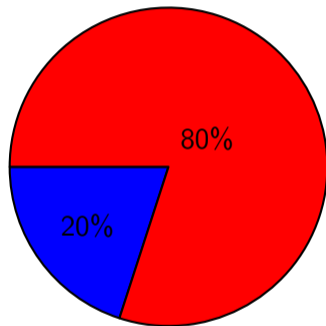
Sometimes it hallucinates resources or functions:

```
\begin{frame}{Final slide}
  % a nice final slide for my presentation
  \centering
  \includegraphics[width=\textwidth]{images/last_slide.jpg}
\end{frame}
\end{document}
```

images/last_slide.jpg does not exist.

My thoughts on when/why to use this

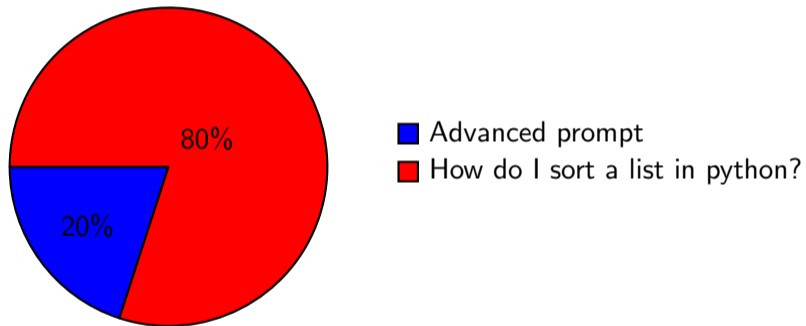
How I use Chat-GPT:



- Advanced prompt
- How do I sort a list in python?

My thoughts on when/why to use this

How I use Chat-GPT:



Makes you comment your code because that's how you write the code.

Free Copilot

Make sure your control-email is listed under your github account



Felix Agner (FelixAgner)

Your personal account

Go to

Public profile

Account

Appearance

Accessibility

Notifications

Access

Billing and plans

Emails

Emails

felix.agner@hotmail.com - Primary ⓘ



- Visible in emails ⓘ
- Receives notifications ⓘ

felix.agner@control.lth.se



- Visible in emails ⓘ

Free Copilot

Grab a certificate of registration from:

ladok -> transcripts and certificates -> certificate of registration



LUNDS UNIVERSITET

Certificate of Registration

Print date
2023-04-26

Name

Felix Agner

Personal identity number

19940329-5158

The certificate includes registrations within the period 2023-04-12 - 2023-04-30

Registered on

Code

Name

Scope

Period

Notes



Free Copilot

When you have your certificate and your email is registered, follow [these instructions](#):
(Use your phone, it's easier if you can photograph your ladok certificate)

1. Go to <https://education.github.com/> and sign in.
2. Go to Benefits -> Individuals -> Get student benefits
3. Fill in the info, and use your camera to photo the certificate (they don't like PDF's, don't know why)
4. Once confirmed (can take a bit of time), go to <https://github.com/features/copilot>->start my free trial. It should notice that you are now a student, and give you free access.

VS Code integration

Just go into extensions, search for "copilot" and install. Then follow the trivial instructions for activation. You may have to restart vscode for installation to take effect.

Neovim

Talk to Nils

Thank you, happy coding

Want to talk more? Join `llm-tools` slack channel.