GitHub Copilot Developers Training

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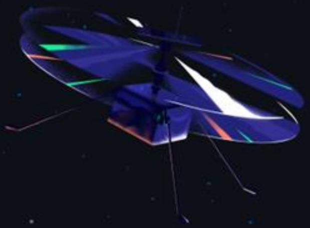


GitHub Copilot

Resources

- Getting started with GitHub Copilot
- Configuring GitHub Copilot in your environment
- Using GitHub Copilot Chat in your IDE - GitHub Docs
- Video - Get Started with the Future of Coding: GitHub Copilot
- Tutorial: GitHub Copilot and VS Code
- Copilot Exercises

GitHub Copilot Workshop Tracks

Workshop for those who want to see how to build web application

Primary IDE: VS Code
Primary OS: Independent

Workshop for those who want to see how to build Java applications

Primary IDE: IntelliJ
Primary OS: Independent

Workshop for those who want to see how to build .NET applications

Primary IDE: Visual Studio IDE
Primary OS: Windows

AGENDA

GitHub Copilot - Introduction

Best practices & prompt engineering

Secure coding

Wrap-up, Q&A

Outcome of this training

You will achieve...

- ✓ Examine use case scenarios
- ✓ Build Copilot skills by following examples presented by your instructor.
- ✓ Learn tips and tricks and best practices on how to best utilize GitHub Copilot

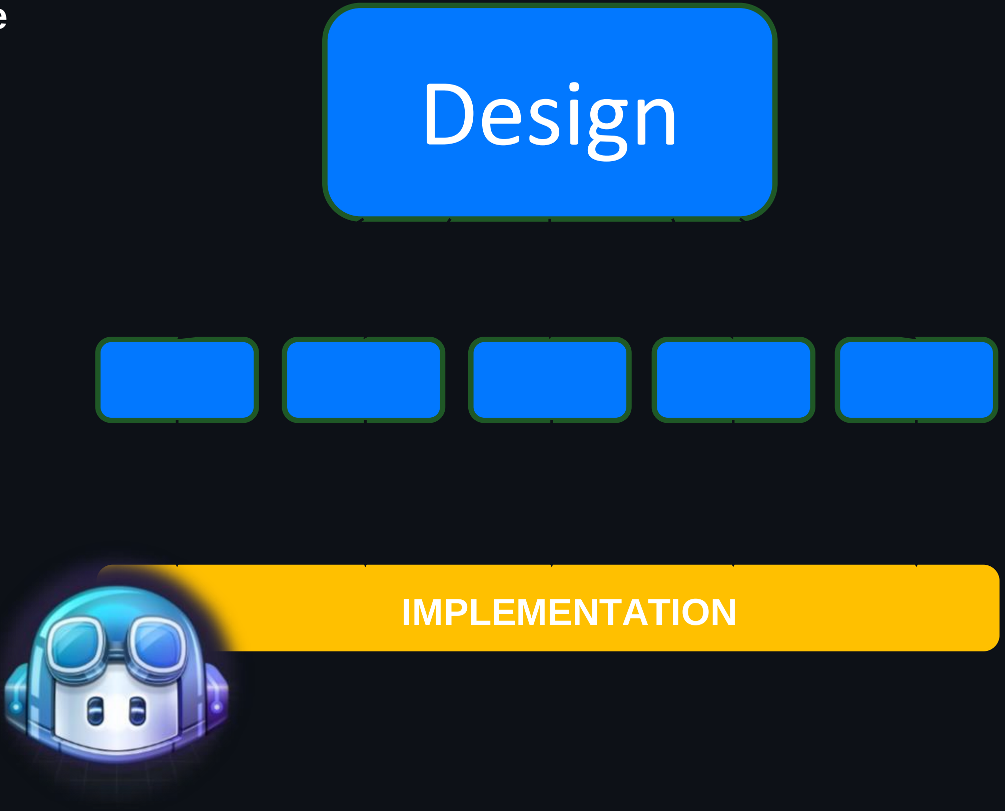
GitHub Copilot Fundamentals Recap

The software process can be broken down into two steps:

1) **Design**
2) **Implementation**

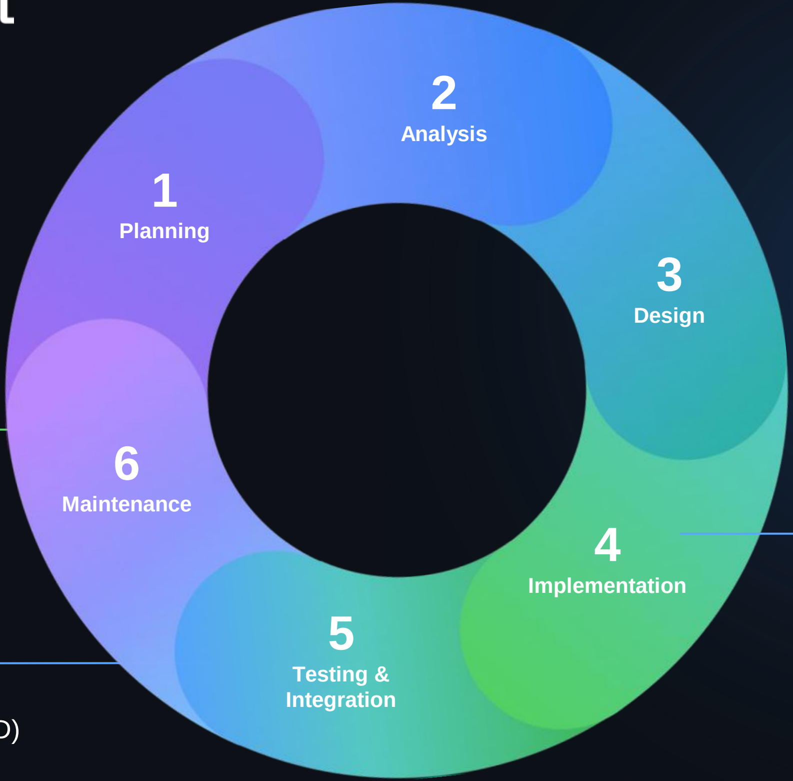
The first step is driven by you.

The second step is where Copilot can assist you with the development effort.



GitHub Copilot

Helps developers stay in the flow throughout the entire SDLC



1 Planning

2 Analysis

3 Design

4 Implementation

5 Testing & Integration

6 Maintenance

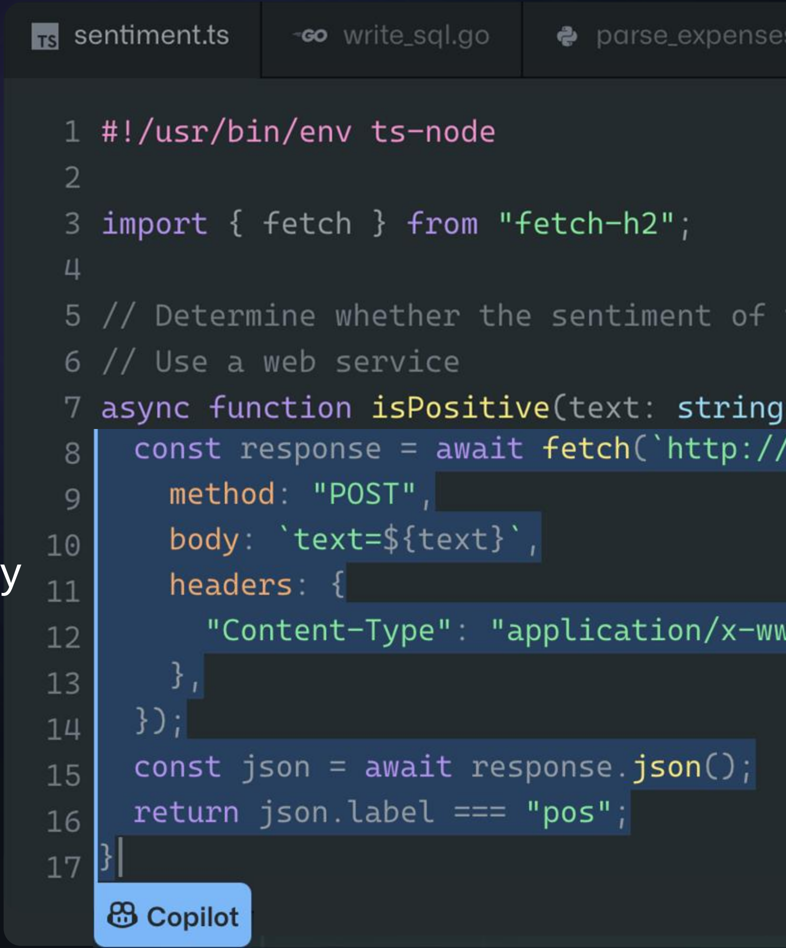
Refactoring code (code translate)
Reviewing code (code explain)
Documentation

Convert comments to code
Autofill for repetitive code
Show alternatives

Unit testing (TDD and BDD)
Finding code errors
Debugging
Code review
AI Pull Requests

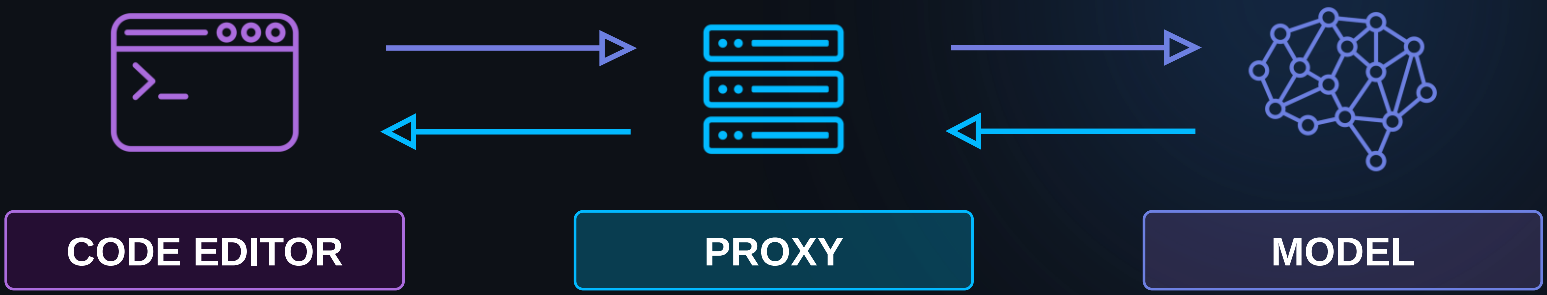
GitHub Copilot

- An intelligent pair programmer
- Draws context from comments & code in open tabs to suggest individual lines and whole functions
- Powered by OpenAI Codex
    - Copilot uses a transformative model
    - Trained on large datasets to ensure accuracy
- Available as extensions to popular IDEs
- Programming Languages and Technology available in Public code base all are supported



```
#!/usr/bin/env ts-node

import { fetch } from "fetch-h2";

// Determine whether the sentiment of
// Use a web service
async function isPositive(text: string
  const response = await fetch(`http://
    method: "POST",
    body: `text=${text}`,
    headers: {
      "Content-Type": "application/x-ww
    },
  });
  const json = await response.json();
  return json.label === "pos";
}
```

Data flow through the Copilot ecosystem

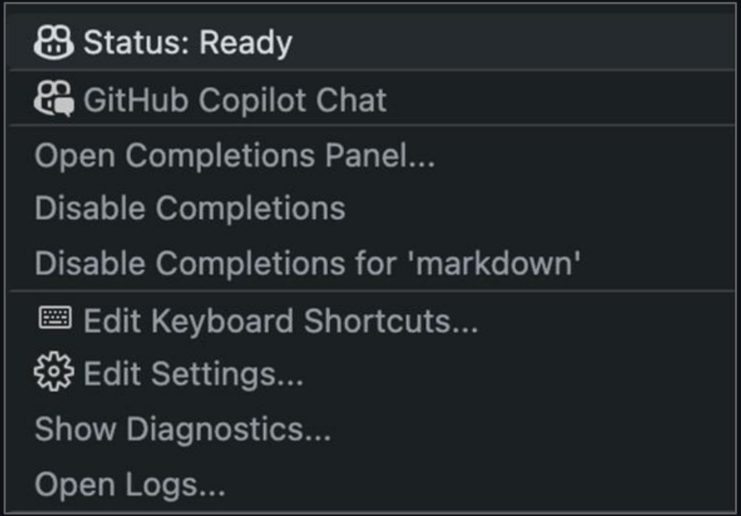


PII
Toxicity
Code classifier

PII
Toxicity
Code classifier
Code quality
Duplicate detection

VS Code Settings

Configuration Options



Status: Ready

GitHub Copilot Chat

Open Completions Panel...

Disable Completions

Disable Completions for 'markdown'

Edit Keyboard Shortcuts...

Edit Settings...

Show Diagnostics...

Open Logs...

Configuring GitHub Copilot in your environment

Coding and Prompt Engineering

Copilot vs Copilot Chat

Copilot	Copilot Chat
Direct Code Writing	In-Depth Assistance
Seamless IDE Integration	Learning & Teaching
Solo Development	Collaborative Scenarios

Copilot Prompt Engineering

What

Prompt engineering is the process of designing and creating high-quality prompts that can be used to generate accurate and useful code suggestions with Copilot.

Why

- Maximizes utility of Copilot
- Minimizes repeated iterations
- Determines code suggestion quality
- Skill prompts guide Copilot to understand context & nuances
- Refined interactions reduces misunderstandings

How

- Neighboring Tabs
- Zero-Shot Prompting
- One-Shot Prompting
- Few-Shot Prompting
- Let's Think Step by Step

Providing Context

To help Copilot generate accurate suggestions:

- Add a top-level comment block describing the purpose of the file
- Front load as many imports as needed (import / include / requires / etc.)
- Create a detailed comment block describing the purpose of an operation or UDT
- Use sample code as a starting point
- Have related content open in other tabs

Helpful Patterns

* Use descriptive variable names to make your intentions clear.

```
totalSampleCount = 1000
```

* Maintain consistent naming conventions for variables and functions.

  i.e. using camelCase for variable names consistency

* Define method signatures with unambiguous parameter names and types.

```
double calculateAverageSampleSize(unsigned long samples[], size_t size)
```

* Use comments to explain the purpose of the code.

```
This function 'palindrome' takes an array of strings
as input and returns  true if a palindrome is found.
```

Helpful Patterns

```
* Specify error handling scenarios.

    Exit where the input is NULL and throw and
    exception if the input out of range [min, max] inclusive.

* Describe control flow structures.

    Write a while loop to print the first 'n' values in the fibonnaci sequence.

* Show examples of how to use the code.

    int samples[] = {1, 2, 3, 4, 5};
    double average = calculateAverageSampleSize(samples, 5);
    printf("Average: %f\n", average); // Average: 3.0

* Test your code.

    Write a test suite to verify the correctness of the code.
```

Prompting Techniques

In the realm of GitHub Copilot, Zero-shot, One-shot, and Few-shot prompting refer to guiding the AI with varying levels of examples.

Zero-shot prompting doesn't provide any prior examples, expecting Copilot to understand and generate relevant code purely from the given task description.

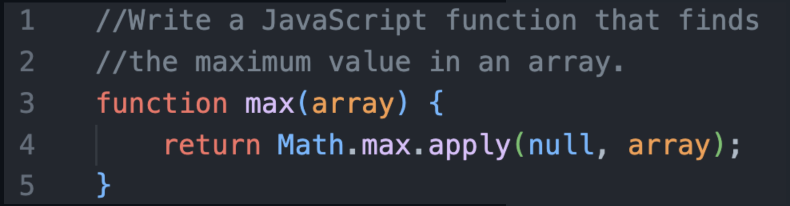
One-shot prompting provides a single example to set the context, assisting Copilot in generating a similar outcome.

Few-shot prompting involves offering multiple examples to establish a clearer pattern for the desired code output.

By understanding these techniques, developers can better instruct Copilot, ensuring more accurate and context-aware code suggestions.

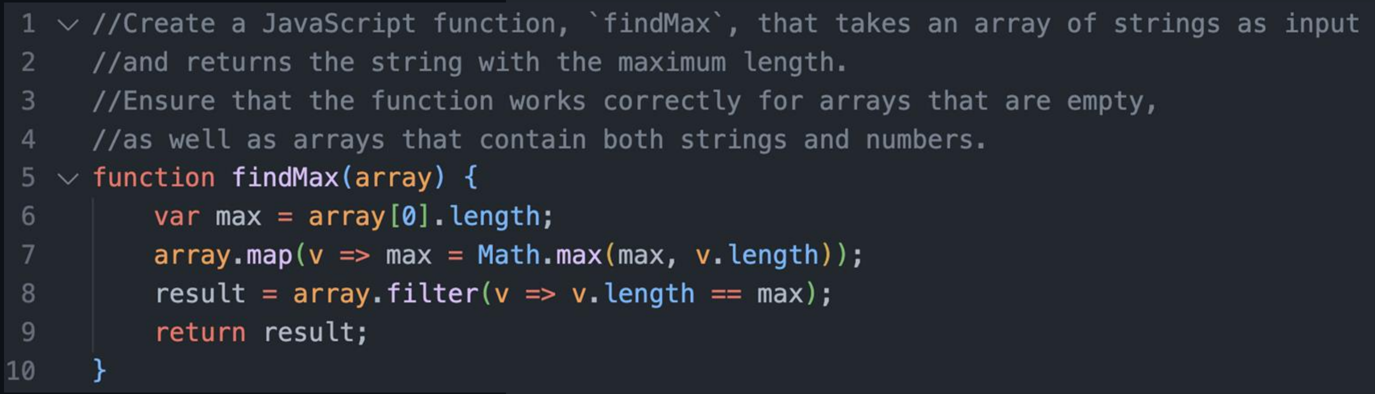
If at first you don’t succeed, iterate!

Zero Shot Prompt



```
//Write a JavaScript function that finds
//the maximum value in an array.
function max(array) {
    return Math.max.apply(null, array);
}
```

One-Shot Prompt



```
//Create a JavaScript function, `findMax`, that takes an array of strings as input
//and returns the string with the maximum length.
//Ensure that the function works correctly for arrays that are empty,
//as well as arrays that contain both strings and numbers.
function findMax(array) {
    var max = array[0].length;
    array.map(v => max = Math.max(max, v.length));
    result = array.filter(v => v.length == max);
    return result;
}
```

Recap

Improving results

○ **Provide references**
Improve relevance of the response by providing an example and context

○ **Write clear instructions**
Refine your prompt, provide context, write clearly, and give Copilot ample input for better results

○ **Split up big tasks**
Breaking down complex tasks minimizes errors and utilizes previous outcomes for efficiency

○ **Allow time to think**
Requesting Copilot’s thought process will enhance Copilot accuracy, but it may prolong wait times.

○ **Test changes systematically**
Measure performance, watch for prompt changes' side effects, and use test suites for implementation

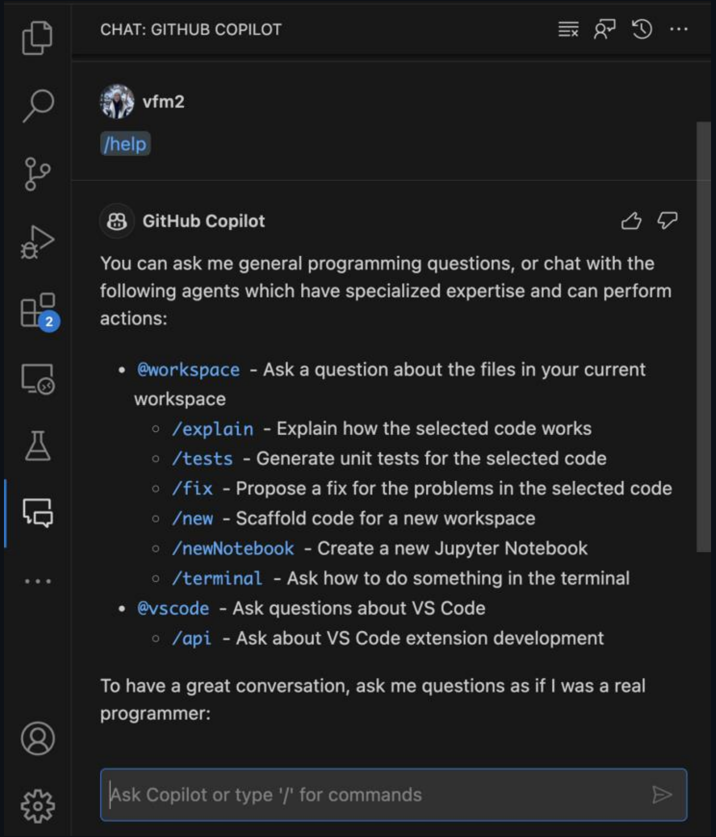
Using Copilot Chat

GitHub Copilot Chat

- ○ Refactor Code
- ○ Generate Tests
- ○ Debug
- ○ Create Workspace
- ○ Documentation

Copilot Chat: Slash Commands

/help to find available commands in your IDE



vfm2

/help

GitHub Copilot

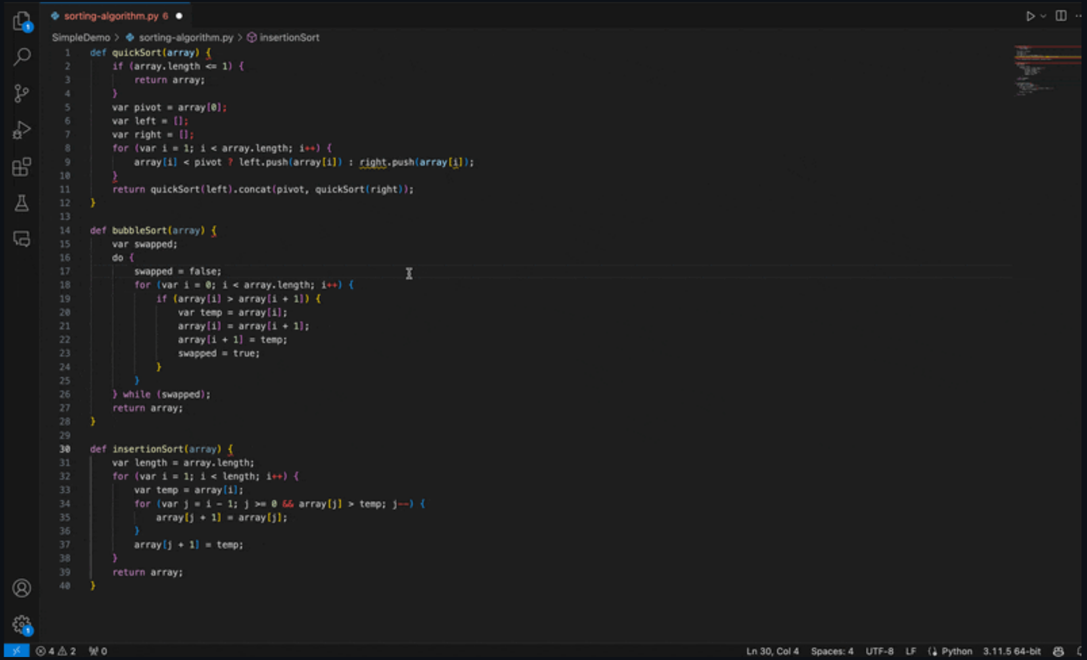
You can ask me general programming questions, or chat with the following agents which have specialized expertise and can perform actions:

- `@workspace` - Ask a question about the files in your current workspace
  - `/explain` - Explain how the selected code works
  - `/tests` - Generate unit tests for the selected code
  - `/fix` - Propose a fix for the problems in the selected code
  - `/new` - Scaffold code for a new workspace
  - `/newNotebook` - Create a new Jupyter Notebook
  - `/terminal` - Ask how to do something in the terminal
- `@vscode` - Ask questions about VS Code
  - `/api` - Ask about VS Code extension development

To have a great conversation, ask me questions as if I was a real programmer:

In-file Copilot Chat

Copilot offers in-file Copilot feature to selectively improve


sorting-algorithm.py 6
SimpleDemo > sorting-algorithm.py > insertionSort
⊗ 4 ⚠ 2 0
Ln 30, Col 4 Spaces: 4 UTF-8 LF {} Python 3.11.5 64-bit

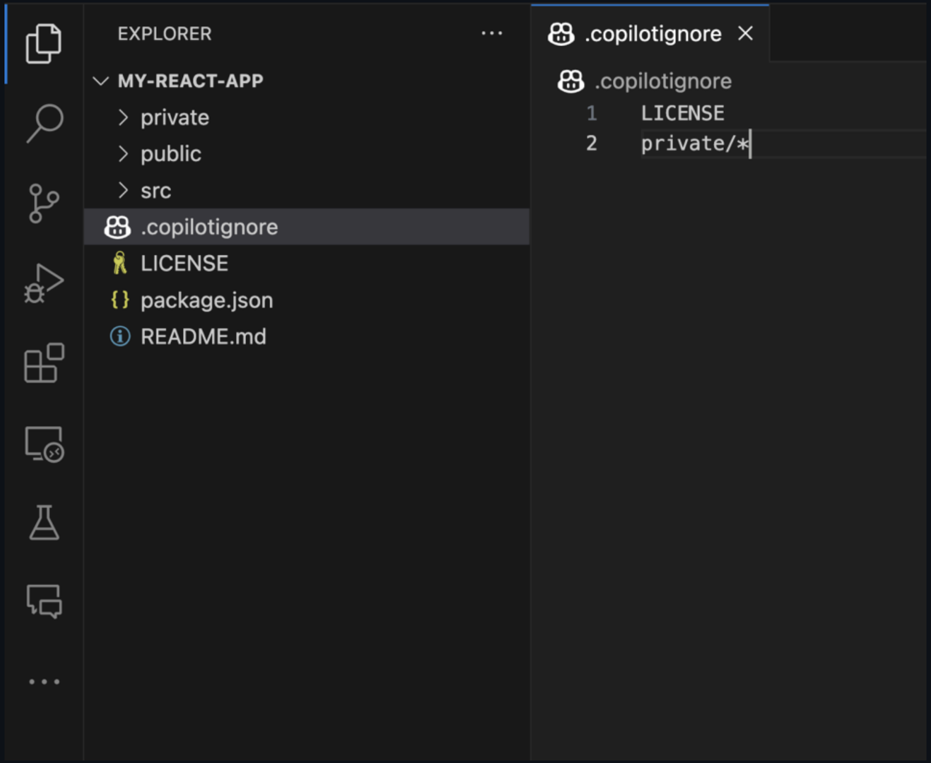
```
def quickSort(array) {
    if (array.length <= 1) {
        return array;
    }
    var pivot = array[0];
    var left = [];
    var right = [];
    for (var i = 1; i < array.length; i++) {
        array[i] < pivot ? left.push(array[i]) : right.push(array[i]);
    }
    return quickSort(left).concat(pivot, quickSort(right));
}

def bubbleSort(array) {
    var swapped;
    do {
        swapped = false;
        for (var i = 0; i < array.length; i++) {
            if (array[i] > array[i + 1]) {
                var temp = array[i];
                array[i] = array[i + 1];
                array[i + 1] = temp;
                swapped = true;
            }
        }
    } while (swapped);
    return array;
}

def insertionSort(array) {
    var length = array.length;
    for (var i = 1; i < length; i++) {
        var temp = array[i];
        for (var j = i - 1; j >= 0 && array[j] > temp; j--) {
            array[j + 1] = array[j];
        }
        array[j + 1] = temp;
    }
    return array;
}
```

GitHub Copilot Chat (default)

Secure coding

Block files from Copilot

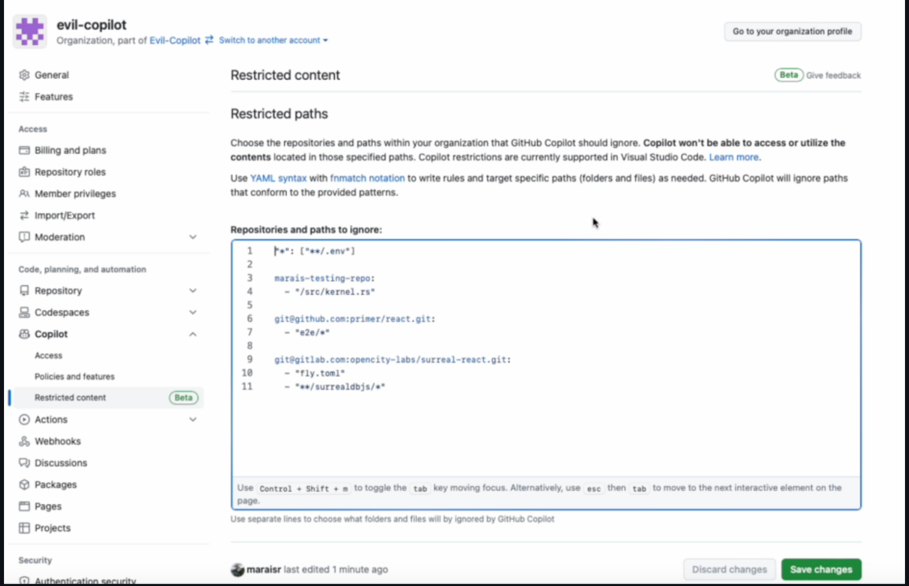
Use .copilotignore to block files and folders from being used by Github Copilot



```
LICENSE
private/*
```

Block files from Copilot

Ignore specific
repositories and paths
in Restricted Content



Restricted content

Restricted paths

Choose the repositories and paths within your organization that GitHub Copilot should ignore. **Copilot won't be able to access or utilize the contents** located in those specified paths. Copilot restrictions are currently supported in Visual Studio Code. Learn more.

Use YAML syntax with fnmatch notation to write rules and target specific paths (folders and files) as needed. GitHub Copilot will ignore paths that conform to the provided patterns.

Repositories and paths to ignore:

```yaml
"*": ["**/.env"]

marais-testing-repo:
  - "/src/kernel.rs"

git@github.com:primer/react.git:
  - "e2e/*"

git@gitlab.com:opencity-labs/surreal-react.git:
  - "fly.toml"
  - "**/surrealdbjs/*"
```

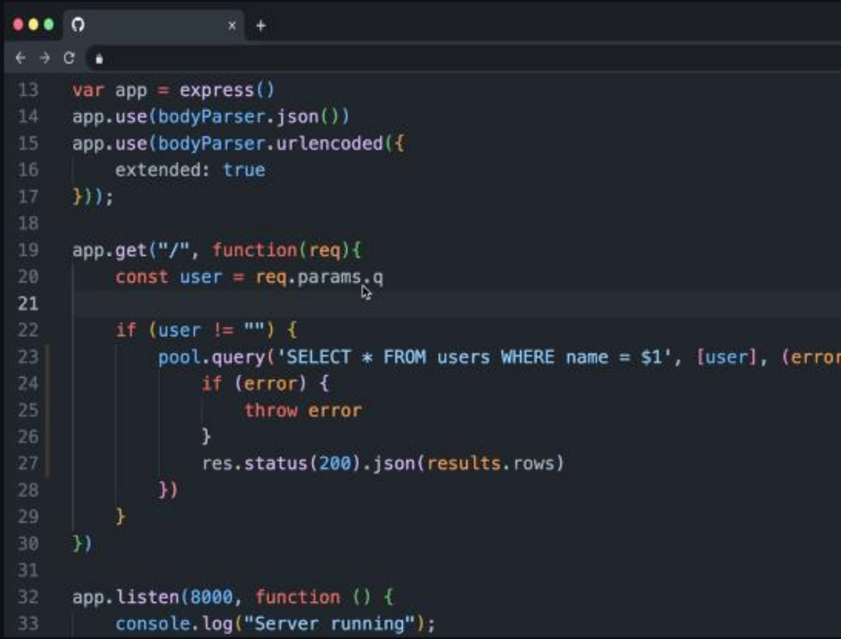
Use `Control + Shift + m` to toggle the `tab` key moving focus. Alternatively, use `esc` then `tab` to move to the next interactive element on the page.

Use separate lines to choose what folders and files will by ignored by GitHub Copilot

maraisr last edited 1 minute ago

Copilot and Secure Coding

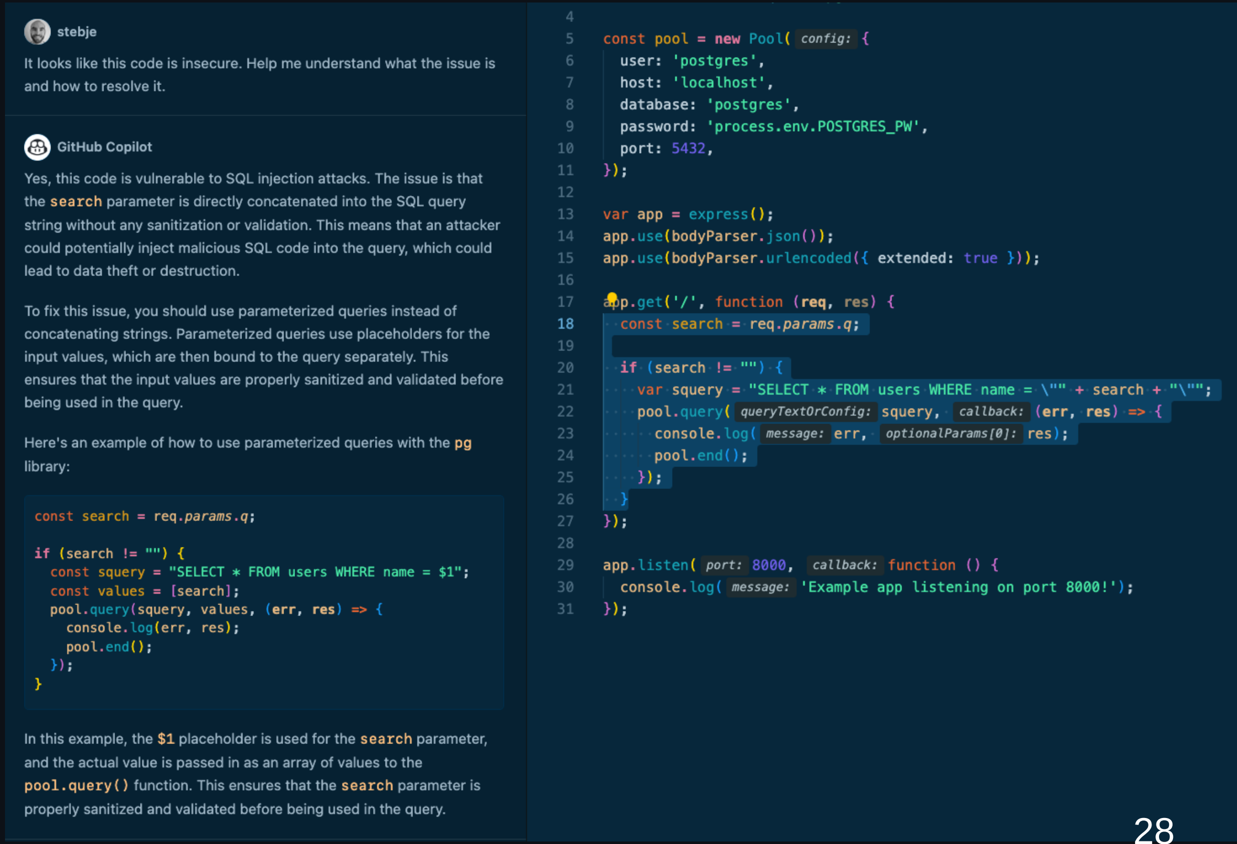
- AI-based vulnerability system that helps prevent insecure coding patterns (e.g. SQL script injection)
- Vulnerability filters are applied only to the Copilot-generated suggestion itself
    - ⊗ It cannot detect downstream vulnerabilities introduced by the code e.g. on deployment infrastructure
    - ⓘ **We recommend taking the same precautions you take with code written by engineers (linting, code scanning, etc.)**
- Copilot Chat can be used to query code for known vulnerabilities



```
var app = express()
app.use(bodyParser.json())
app.use(bodyParser.urlencoded({
    extended: true
}));

app.get("/", function(req){
    const user = req.params.q

    if (user != "") {
        pool.query('SELECT * FROM users WHERE name = $1', [user], (erro
            if (error) {
                throw error
            }
            res.status(200).json(results.rows)
        })
    }
})

app.listen(8000, function () {
    console.log("Server running");
```

Detection & Remediation

- Prompt for insecure coding patterns
- Use GHAS Code Scanning results
- Write custom CodeQL queries
- Increase your knowledge of secure coding patterns
- Create custom Secret Scanning patterns



stebje

It looks like this code is insecure. Help me understand what the issue is and how to resolve it.

GitHub Copilot

Yes, this code is vulnerable to SQL injection attacks. The issue is that the `search` parameter is directly concatenated into the SQL query string without any sanitization or validation. This means that an attacker could potentially inject malicious SQL code into the query, which could lead to data theft or destruction.

To fix this issue, you should use parameterized queries instead of concatenating strings. Parameterized queries use placeholders for the input values, which are then bound to the query separately. This ensures that the input values are properly sanitized and validated before being used in the query.

Here's an example of how to use parameterized queries with the `pg` library:

```
const search = req.params.q;

if (search != "") {
  const squery = "SELECT * FROM users WHERE name = $1";
  const values = [search];
  pool.query(squery, values, (err, res) => {
    console.log(err, res);
    pool.end();
  });
}
```

In this example, the `$1` placeholder is used for the `search` parameter, and the actual value is passed in as an array of values to the `pool.query()` function. This ensures that the `search` parameter is properly sanitized and validated before being used in the query.

```

const pool = new Pool( config: {
  user: 'postgres',
  host: 'localhost',
  database: 'postgres',
  password: 'process.env.POSTGRES_PW',
  port: 5432,
});

var app = express();
app.use(bodyParser.json());
app.use(bodyParser.urlencoded({ extended: true }));

app.get('/', function (req, res) {
  const search = req.params.q;

  if (search != "") {
    var squery = "SELECT * FROM users WHERE name = \"" + search + "\"";
    pool.query( queryTextOrConfig: squery,  callback: (err, res) => {
      console.log( message: err,  optionalParams[0]: res);
      pool.end();
    });
  }
});

app.listen( port: 8000,  callback: function () {
  console.log( message: 'Example app listening on port 8000!');
});
```

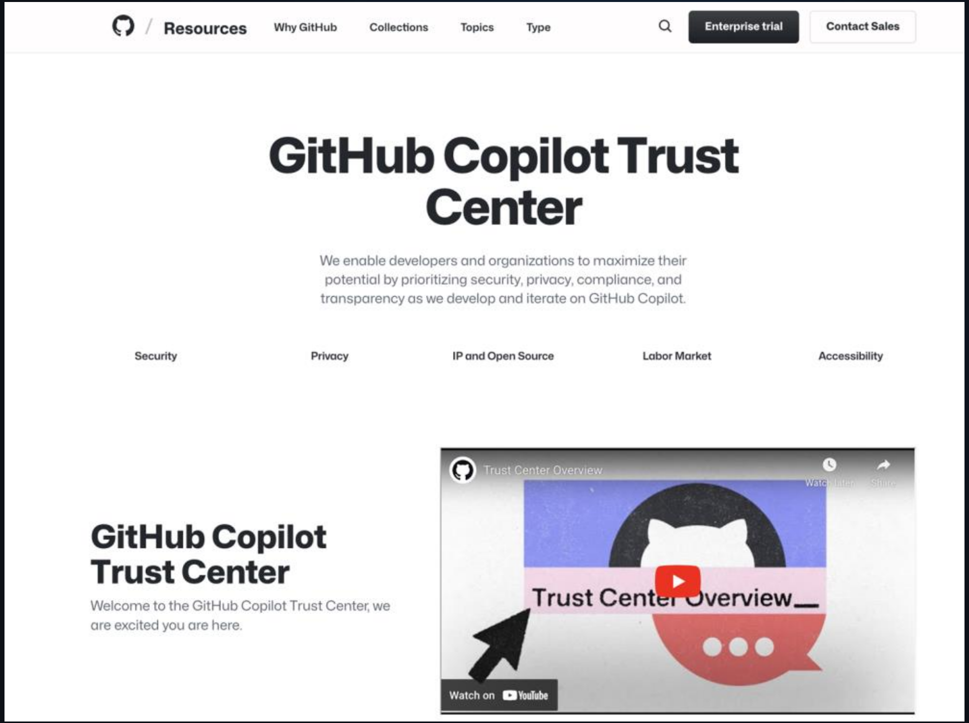
Copilot + GHAS

- Copilot is not a replacement of GHAS features
- Copilot can be used in tandem with GHAS features to detect and remediate vulnerabilities earlier during the SDLC
    - GHAS Code scanning results
    - GHAS Secret scanning

Security & Trust

Copilot Trust Center

- Security
- Privacy
- Data flow
- Copyright
- Labor market
- Accessibility
- Contracting



GitHub Copilot Trust Center

We enable developers and organizations to maximize their potential by prioritizing security, privacy, compliance, and transparency as we develop and iterate on GitHub Copilot.

GitHub Copilot Trust Center

Welcome to the GitHub Copilot Trust Center, we are excited you are here.

GitHub Copilot Trust Center - GitHub Resources

Wrap Up

Thank you