PySpark Development Made Simple

Using VS Code, Jupyter Notebooks, and Docker

Jason Clarke · Follow

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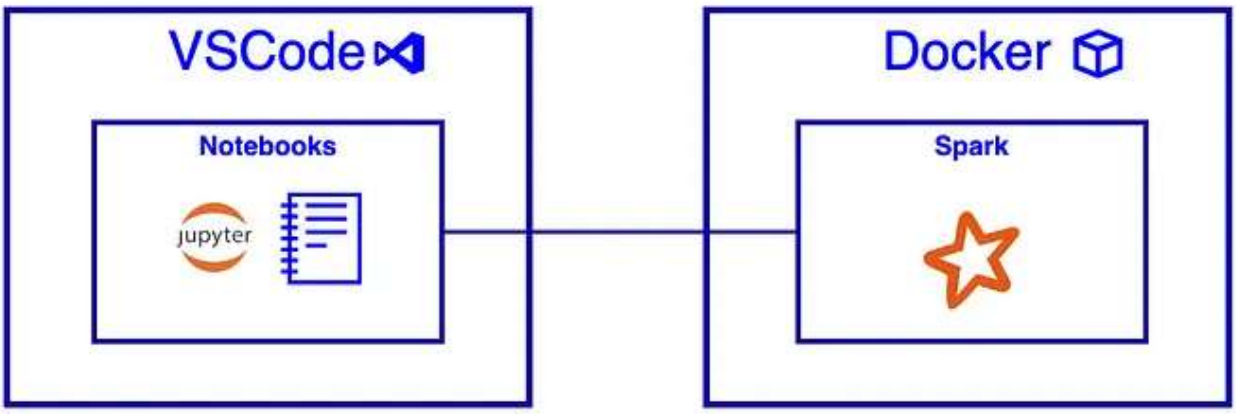

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A few weeks back, I was searching for that holy grail of a tutorial describing how to use VS Code with Jupyter Notebooks and PySpark… on a Mac. And surprisingly, I couldn't find any. Well, none that passed my "explain-it-like-I'm-five" litmus test.

This article is the result of an agonising Saturday afternoon.

The Path of Least Resistance: REPLs to the Rescue

These days I have very little, if any, free time for playing around with new tech. When I do, I want it to be as painless as possible. And most importantly, I want it to be fun — otherwise, why bother?

Moreover, nothing is worse than wasting hours of your free time configuring a development environment. It's just painful.

VS Code with Jupyter Notebooks

I'm a big fan of REPLs for rapid development — for example, evaluating a new framework, analysing data, data fixes, etc.

In these situations, I don't want to configure a new project and get bogged down with trivial set-up complexities. I simply need a scratchpad to thrash out some code.

Jupyter Notebooks are a REPL-based system designed to analyse, visualise, and collaborate on data. They are also great as a scratchpad.

What is a REPL?

> *A read–eval–print loop (REPL), also termed an interactive top level or language shell, is a simple interactive computer programming environment that takes single user inputs, executes them, and returns the result to the user; a program written in a REPL environment is executed piecewise.*
> *Wikipedia*

Visual Studio code has native support for Notebooks, including Jupyter.

Setup

Prerequisites

- Install Docker
  If you're using a Mac and cannot install Docker Desktop due to licensing restrictions, check out Colima.

- Install VS Code

VS Code Development Container

1. Create a new directory for your project.

2. Create a Docker file within the root of the project directory using the code below. At the time of writing this, the current PySpark version is 3.3.0. I would check here to ensure you're using the latest version.

```
ARG IMAGE_VARIANT=slim-buster
ARG OPENJDK_VERSION=8
ARG PYTHON_VERSION=3.9.8

FROM python:${PYTHON_VERSION}-${IMAGE_VARIANT} AS py3
FROM openjdk:${OPENJDK_VERSION}-${IMAGE_VARIANT}

COPY --from=py3 / /

ARG PYSPARK_VERSION=3.3.0

RUN pip --no-cache-dir install pyspark==${PYSPARK_VERSION}
RUN pip --no-cache-dir install pandas
RUN pip --no-cache-dir install ipykernel

ENTRYPOINT ["bash"]
```

Dockerfile hosted with ❤ by GitHub view raw

3. Create a directory with the name `.devcontainer`.

4. Within the `.devcontainer` directory, add the following JSON configuration.

```
{
    "name": "Dockerfile",
    "context": "../",
    "dockerFile": "../Dockerfile",
    "extensions": ["ms-python.python", "ms-toolsai.jupyter"],
    "settings": {
        "terminal.integrated.shell.linux": null
    },
    "forwardPorts": [4050]
}
```

devcontainer.json hosted with ❤ by GitHub view raw

5. On the bottom left corner of VS Code, click the Open Remote Window button → Open In Container.

Click here to learn more about remote development within VS Code.

VS Code will restart the IDE and connect to the VS Code development container — instantiated from the Docker image defined in step 2.

That's it for the setup.

Developing Your First PySpark Application

Creating a notebook

1. Create a new file within your project directory with the extension .ipynb.
2. Open the file — you should see the VS Code notebook experience.

Test data

1. Within the root directory, add a new folder called data.
2. Within the data directory, create a new CSV file called `users.csv` and add the data below:

```
name,age,gender
jon,45,male
sarah,32,female
jane,65,female
jim,70,male
joe,22,male
```

users.txt hosted with ❤ by GitHub view raw

Example: Spark application

This section assumes you've installed Docker, configured a VS Code development container, and created an empty notebook.

```
In [ ]:
from pyspark.sql import *
import pandas as pd
```

```
In [ ]:
spark = SparkSession\
            .builder\
            .appName("test-app")\
            .getOrCreate()
```

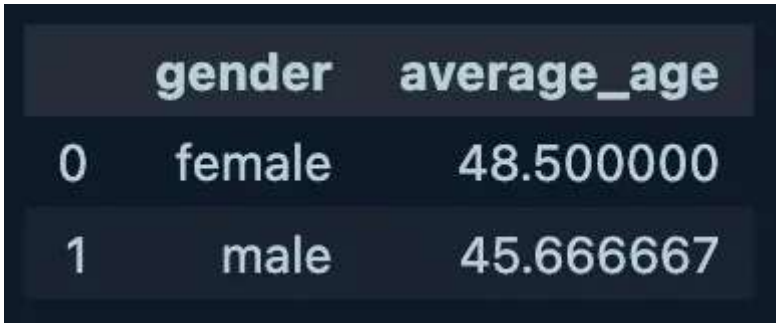
```
In [ ]:
df = spark.read.csv("./data/users.csv",
                            header="true",
                            inferSchema="true"

df.createOrReplaceTempView("users")
```

```
In [ ]:
sql = """
SELECT gender, AVG(age) as average_age
FROM users
GROUP BY gender
"""
query = spark.sql(sql)
query.toPandas()
```

pyspark-users.ipynb hosted with ❤ by GitHub view raw

OK, let's break this down cell by cell.

1. Import Libraries: The first cell imports the PySpark and Pandas Python libraries.
2. Connection to Spark: The second cell is where we define the connection to Spark. As we're running in local mode, we don't need to worry about a connection string.
3. Reading CSV into a Temp View: In the third cell, we ingest a CSV file from the local file system into Spark — the CSV contains test data.
   The second step creates a temporary view called 'users' — this allows us to query the table using plain old SQL.
4. Query: In the last cell, we define a SQL query that will return the average age of all users by gender. The function call toPandas(), converts the Spark dataframe to Panda's dataframe — allowing us to use VS Code's dataframe rendering.



	gender	average_age
0	female	48.500000
1	male	45.666667

5. Click Run All at the top to execute all cells within the notebook. If it works, you should see a two-row dataframe — as depicted in the image above.

Final Thoughts

Using Visual Studio code with Jupyter notebooks and Docker is a simple way to get started with PySpark.

If you have any tips for improving the development workflow outlined above, please let me know in the comments.

I hope you found this interesting.

The Yam Yam Architect.

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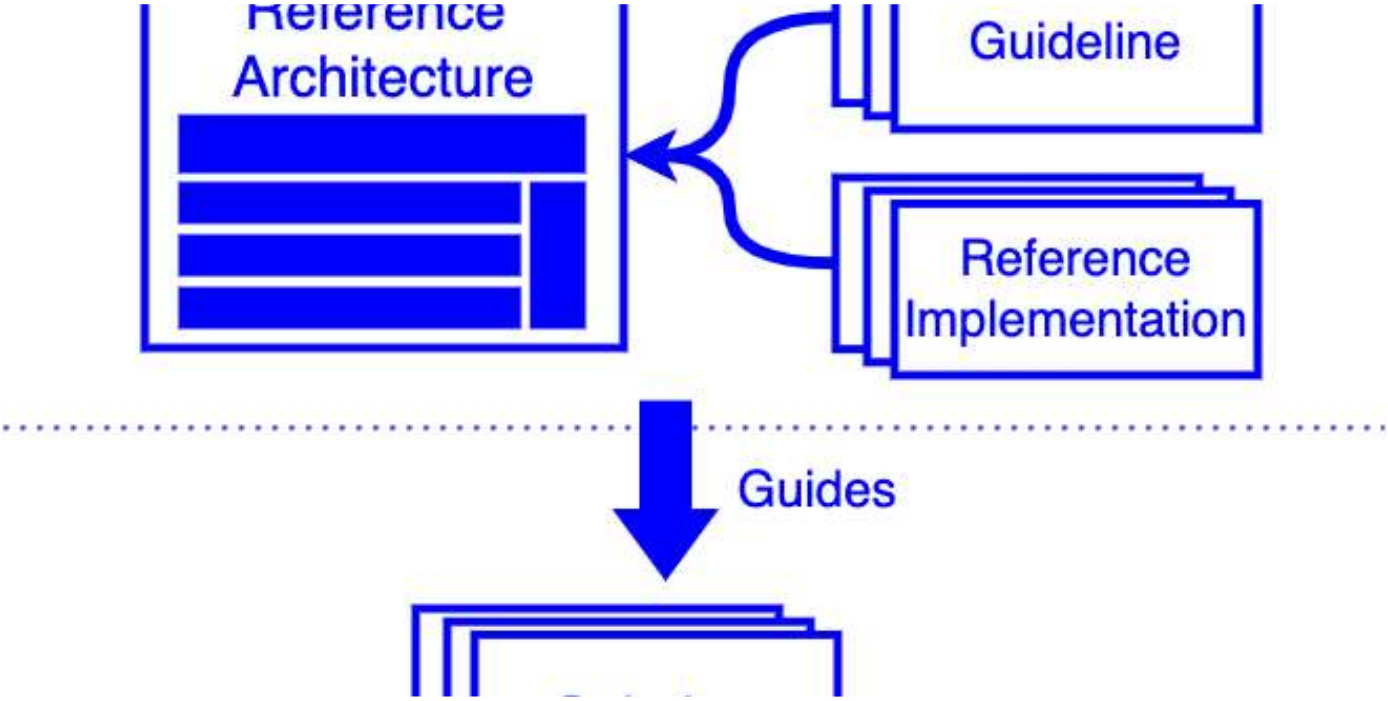

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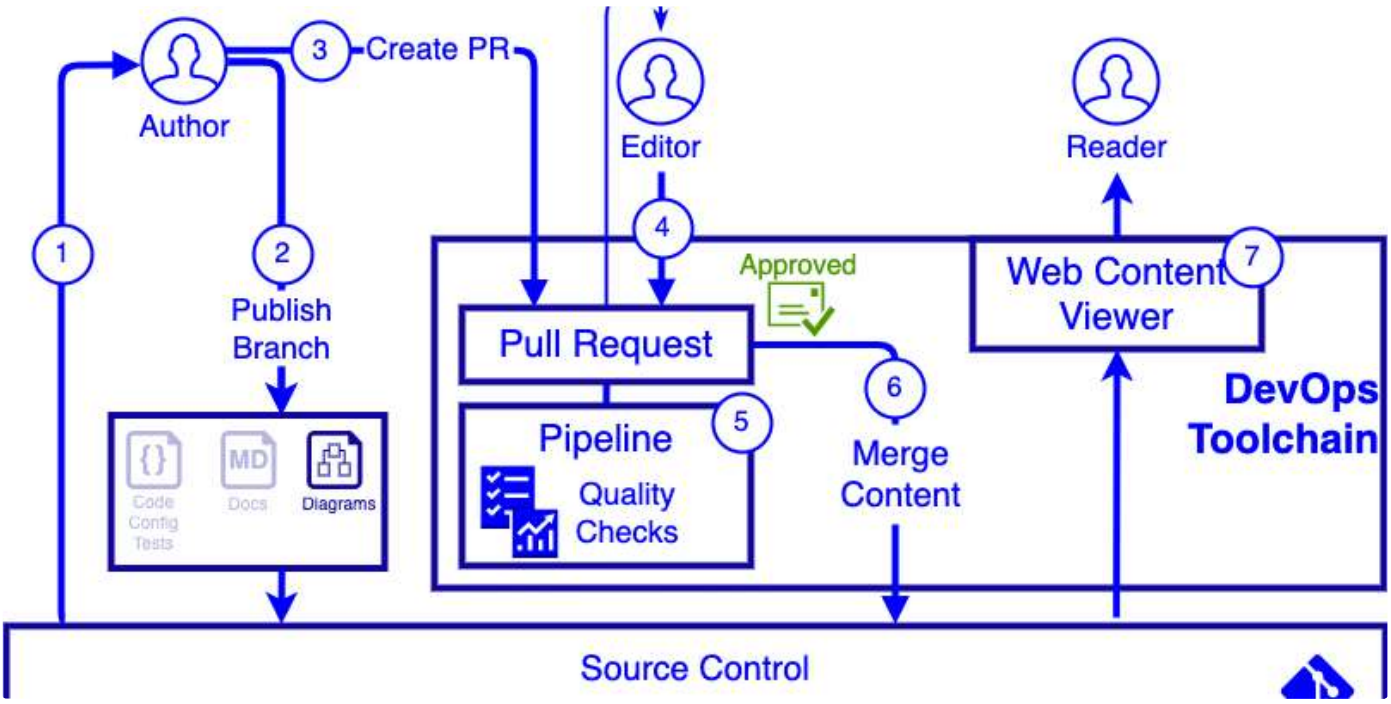

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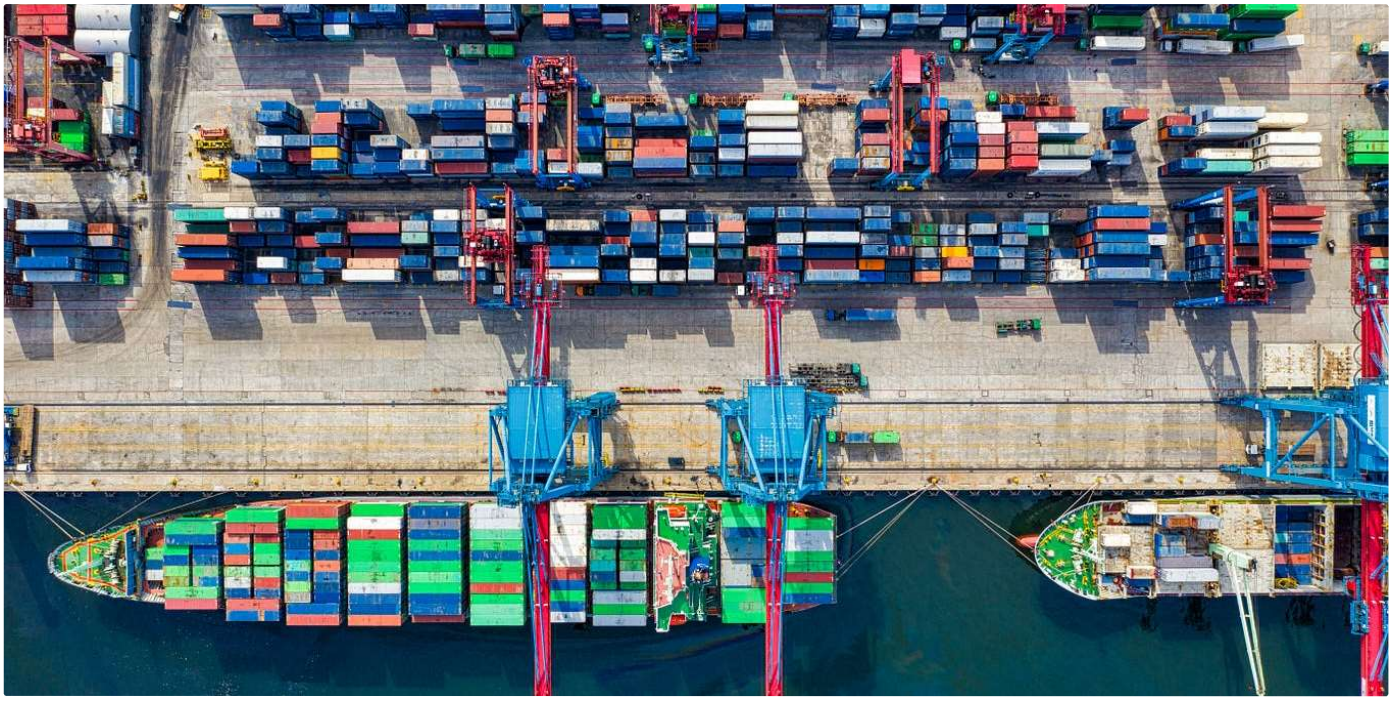

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