



A Cloud-based Web Application for Generalized Virtual Metrology of Semiconductor Manufacturing

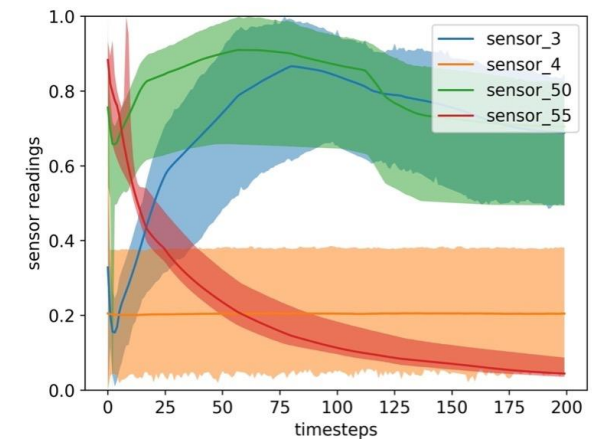
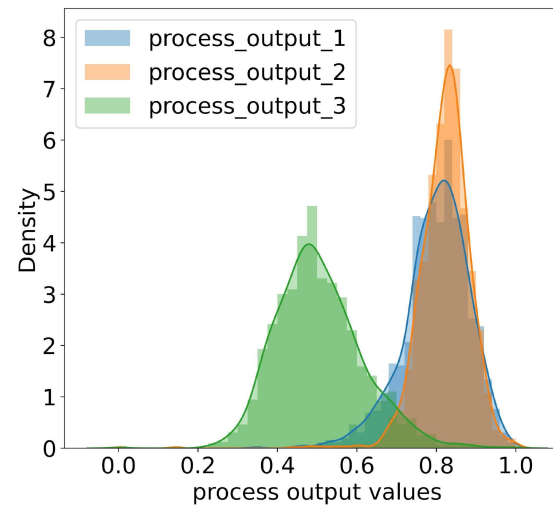
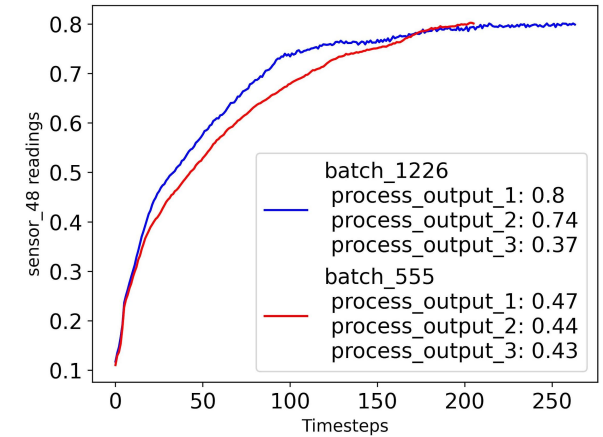
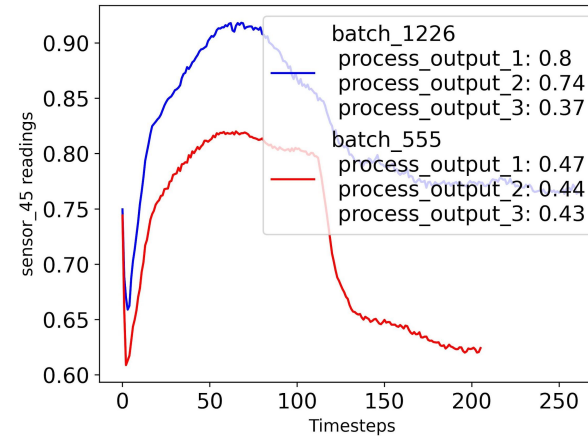
Cloud Computing Fellowship Project 2023

Presented by: Ritam Guha

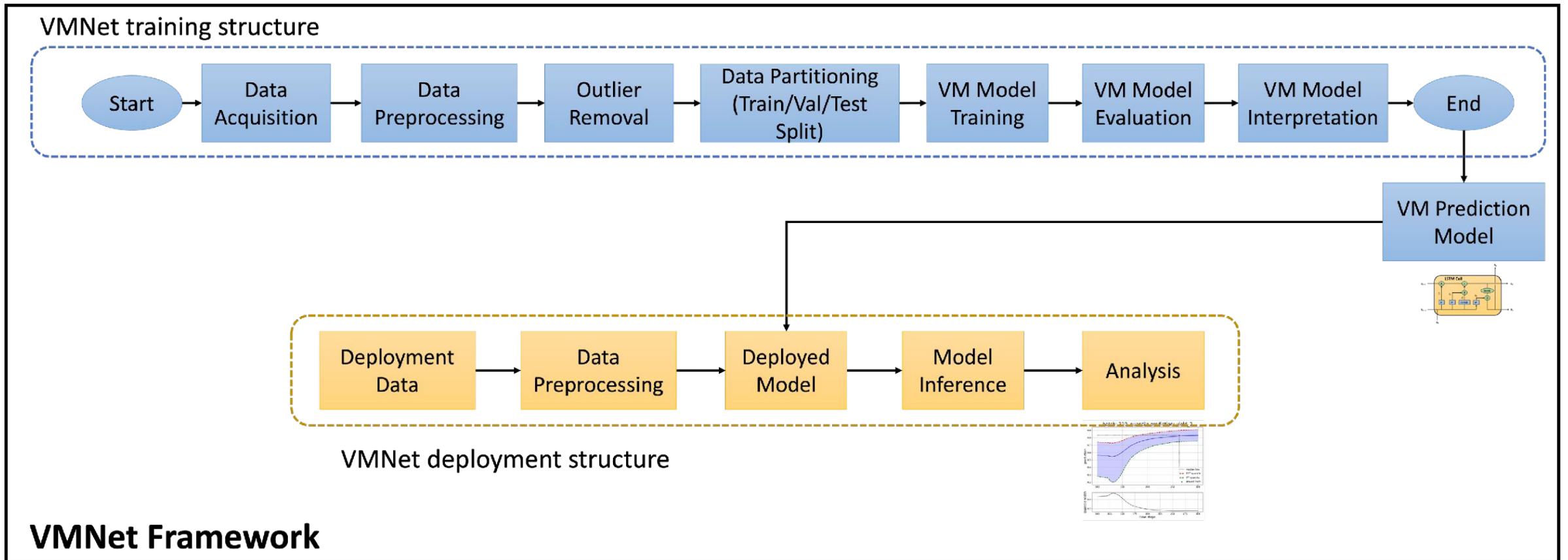
Date: 05/01/2023

Virtual Metrology Background

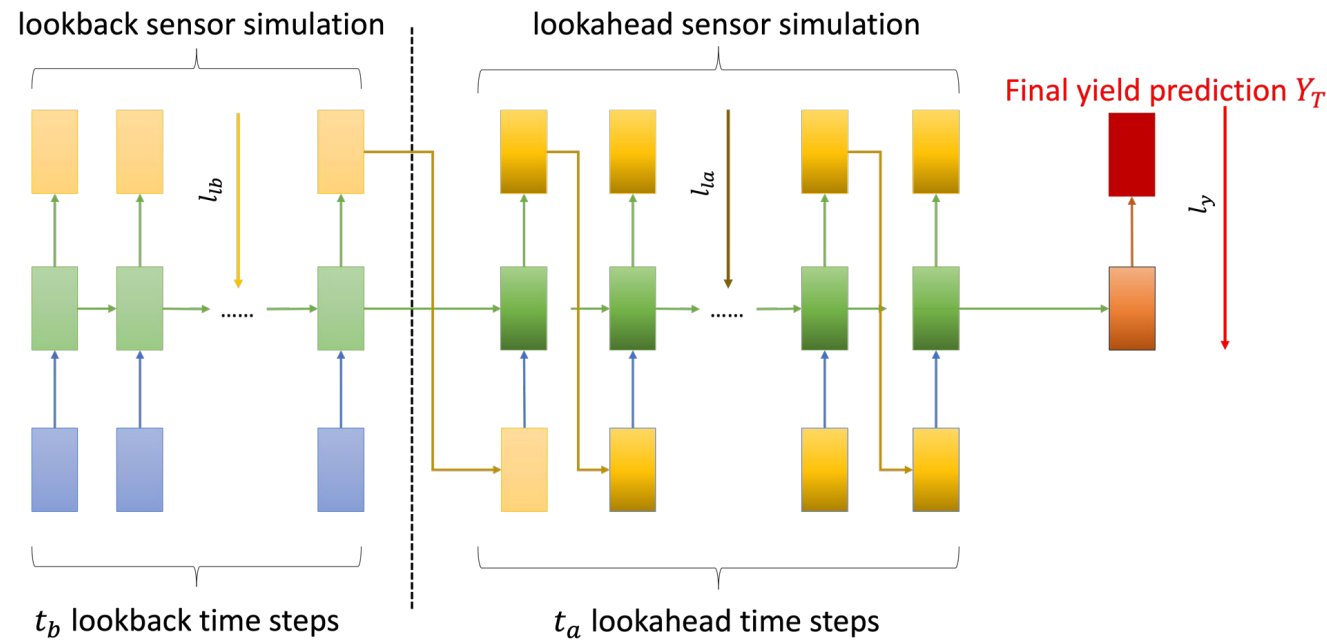
- Virtual Metrology: Automated estimation of the manufacturing properties using the data sensed from the process without physical metrology operations.
- Data is recorded after fixed intervals using multiple sensors and finally the product details are noted down.
- Expensive data – to generate one sample in the data, it requires approximately 4 days of manufacturing.



Proposed Pipeline: VMNet

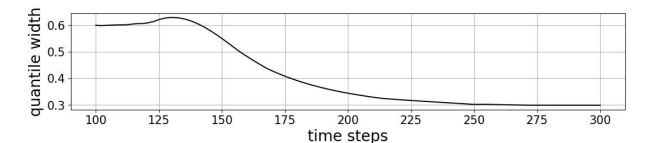
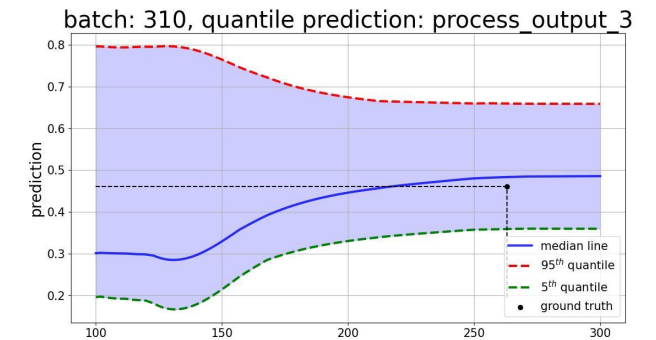
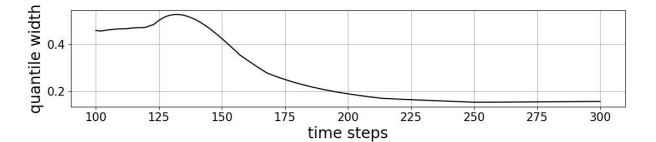
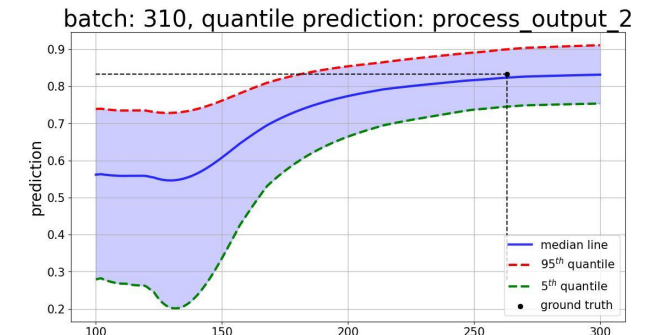


Final Process Outputs



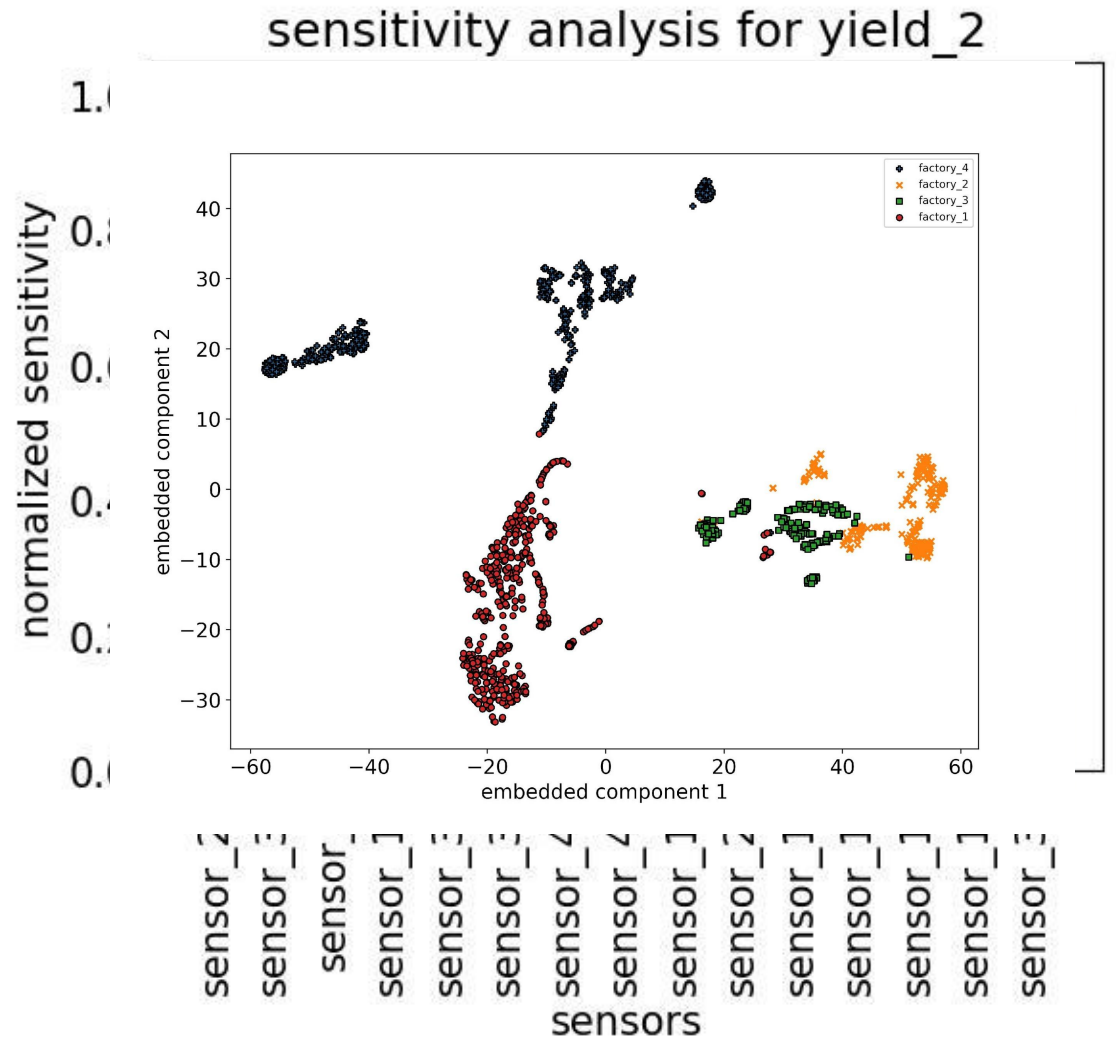
10 hours of information
fed to the pipeline

80 hours of information predicted
by the pipeline



Utilization

- Automating the stopping time
- Sensitivity Analysis
- Correlation analysis and resolving
- Multiple other use cases



Why Cloud Computing?

- Collecting data is expensive - one company's data is not sufficient to improve the pipeline.
- Get feedback from other companies and improve - needs collaborative effort. Scaled collaboration requires a way to give access to the product while concealing the underlying code.
- Especially in the time of chip shortage, it is a very important to squeeze out all the optimization we can from manufacturing pipeline.



Aim for the Project

- Create a web application to test out the pipeline around the world.
- Initial Aim:
 - Upload the entire pipeline on cloud.
 - Do the data processing on cloud.
 - Do the model training on cloud.
 - Generate results – collect feedback.
- Final Aim:
 - Upload a trained model on cloud.
 - Let the user upload the data and generate the results.

Cloud Computing Resources

Resource Name	Rate	Duration	Subtotal
B1 Web App	\$14/month	3 months	\$42
P1V2 Web App	\$82/month	1 month	\$82

- 1) **B1 Web App:** It is the basic version of web app available on Azure with 100 Azure Compute Units (ACUs) and 1.75 GB of memory. This is typically used to develop or test a web application and run for small scale data and computations. I want to use this while developing the web application connected to my Github repository.
 - 2) **P1V2 Web App:** This web app is a production level application with 210 ACUs and 3.5 GB memory. I want to use this web app server when the development phase is over, and the application is production-ready for deployment.
-

Deployment Option 1

Github workflow

Source	GitHub Disconnect
GitHub	
Signed in as	Ritam-Guha
Organization	Ritam-Guha
Repository	VM_CCF22_dev
Branch	main 🔗
Build	
Build provider	GitHub Actions
Runtime stack	Python
Version	Python 3.10

```
# Docs for the Azure Web Apps Deploy action: https://github.com/Azure/webapps-deploy
# More GitHub Actions for Azure: https://github.com/Azure/actions
# More info on Python, GitHub Actions, and Azure App Service: https://aka.ms/python-webapps-actions

name: Build and deploy Python app to Azure Web App - VMWebApp

on:
  push:
    branches:
      - main
  workflow_dispatch:

jobs:
  build:
    runs-on: ubuntu-latest

    steps:
      - uses: actions/checkout@v2

      - name: Set up Python version
        uses: actions/setup-python@v1
        with:
          python-version: '3.10'

      - name: Create and start virtual environment
        run: |
          python -m venv venv
          source venv/bin/activate

      - name: Install dependencies
        run: pip install -r requirements.txt
```

Deployment Option 2

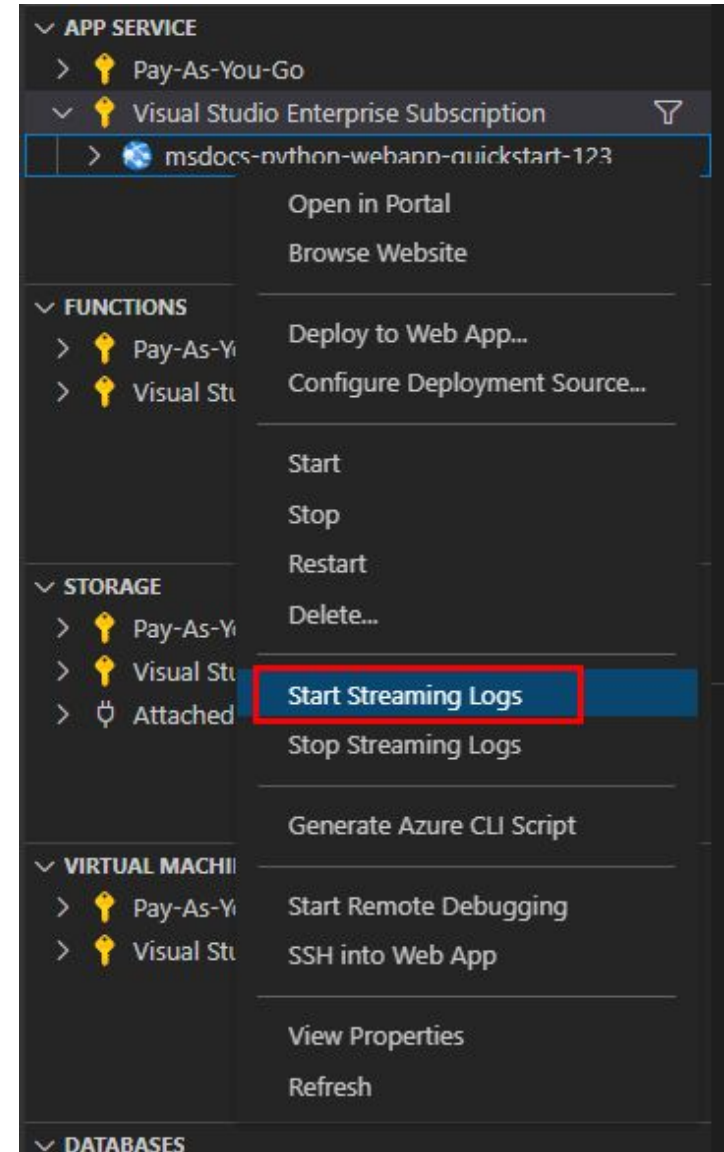
- Azure CLI

```
az login
```

```
az webapp up --runtime PYTHON:3.9 --sku B1 --logs
```

VScode Integration

Deployment Option 3



Some Moments!!

✖ Add or update the Azure App Service build and deployment wo...

Build and deploy Python app to Azure Web App - VMWebApp #1: Commit 60d8837
pushed by Ritam-Guha

main

📅 2 months ago
🕒 25s

✖ [updated workflow](#)

Build and deploy Python app to Azure Web App - VMWebApp #7: Commit d0b0bfd
pushed by Ritam-Guha

main

📅 3 weeks ago
🕒 1m 50s

✖ Add or update the Azure App Service build and deployment wo...

Build and deploy Python app to Azure Web App - VMWebApp #2: Commit 60d8837
pushed by Ritam-Guha

main

📅 2 months ago
🕒 29s

✖ updated workflow

Build and deploy Python app to Azure Web App - VMWebApp #5: Commit 2d33511
pushed by Ritam-Guha

main

📅 3 weeks ago
🕒 26s

✖ updated workflow

Build and deploy Python app to Azure Web App - VMWebApp #7: Commit d0b0bfd
pushed by Ritam-Guha

main

📅 3 weeks ago
🕒 1m 50s

✖ Add or update the Azure App Service build and deployment wo...

Build and deploy Python app to Azure Web App - VMWebApp #4: Commit a61e284
pushed by Ritam-Guha

main

📅 3 weeks ago
🕒 28s

✖ added venv

Build and deploy Python app to Azure Web App - VMWebApp #3: Commit 8cd879a
pushed by Ritam-Guha

main

📅 2 months ago
🕒 30s

⚠ Add or update the Azure App Service build and deployment wo...

Build and deploy Python app to Azure Web App - VMWebApp #21: Commit d3a6fee
pushed by Ritam-Guha

main

📅 2 weeks ago
🕒 1h 20m 39s

✖ added zip optimization in the workflow

Build and deploy Python app to Azure Web App - VMWebApp #22: Commit df165fd
pushed by Ritam-Guha

main

📅 2 weeks ago
🕒 6h 0m 13s

✖ Add or update the Azure App Service build and deployment wo...

Build and deploy Python app to Azure Web App - VMWebApp #28: Commit ee7a22a
pushed by Ritam-Guha

main

📅 last week
🕒 6h 2m 15s



31 workflow runs

+

10 workflow runs

and

Why does Azure deployment take so long?

Asked 12 years, 2 months ago Modified 10 months ago Viewed 53k times  Part of [Microsoft Azure](#) Collective

Increasing response times when deploying to app service

New “Deploy an Azure App Service” task slow and sometimes fails

 Octopus Server server reliability resolved support

Community / Azure / Why Does Azure Deployment Take So Long?

Why does Azure deployment take so long? Later

Finally:

 **changed deployment**

Build and deploy Python app to Azure Web App - VMWebApp #14: Commit 0bf3bfb
pushed by Ritam-Guha

main



 2 weeks ago
 8m 51s

Scaling

✓	Dev/Test (For less demanding workloads)							
☐	Free F1	60 minutes/day...	N/A	1	1	N/A	Free	Free
☐	Basic B1	100	1	1.75	10	3	0.018 USD	13.14 USD
☐	Basic B2	100	2	3.5	10	3	0.035 USD	25.55 USD
☐	Basic B3	100	4	7	10	3	0.07 USD	51.10 USD
✓	Production (For most production workloads)							
☐	Premium v3 P1V3	195	2	8	250	30	0.17 USD	124.10 USD
☐	Premium v3 P2V3	195	4	16	250	30	0.34 USD	248.20 USD
☐	Premium v3 P3V3	195	8	32	250	30	0.68 USD	496.40 USD
☐	Standard S1	100	1	1.75	50	10	0.095 USD	69.35 USD
☐	Standard S2	100	2	3.5	50	10	0.19 USD	138.70 USD
☐	Standard S3	100	4	7	50	10	0.38 USD	277.40 USD
☒	Premium v2 P1V2	210	1	3.5	250	30	0.111 USD	81.03 USD
☐	Premium v2 P2V2	210	2	7	250	30	0.221 USD	161.33 USD
☐	Premium v2 P3V2	210	4	14	250	30	0.442 USD	322.66 USD



VMWebApp V1.0 Demo



- Link:
<https://vmwebapp.azurewebsites.net/>
 - The website needs a lot of work. For the time being, I am just showing sensor simulations and output predictions.
 - Add model training to the cloud.
- 

Future Extensions

1

Upload the entire pipeline to cloud.

2

Make the deployment automated to some extent.

3

Add data collection process based on permissions.

4

Monitor the scalability needs.

Thank You!