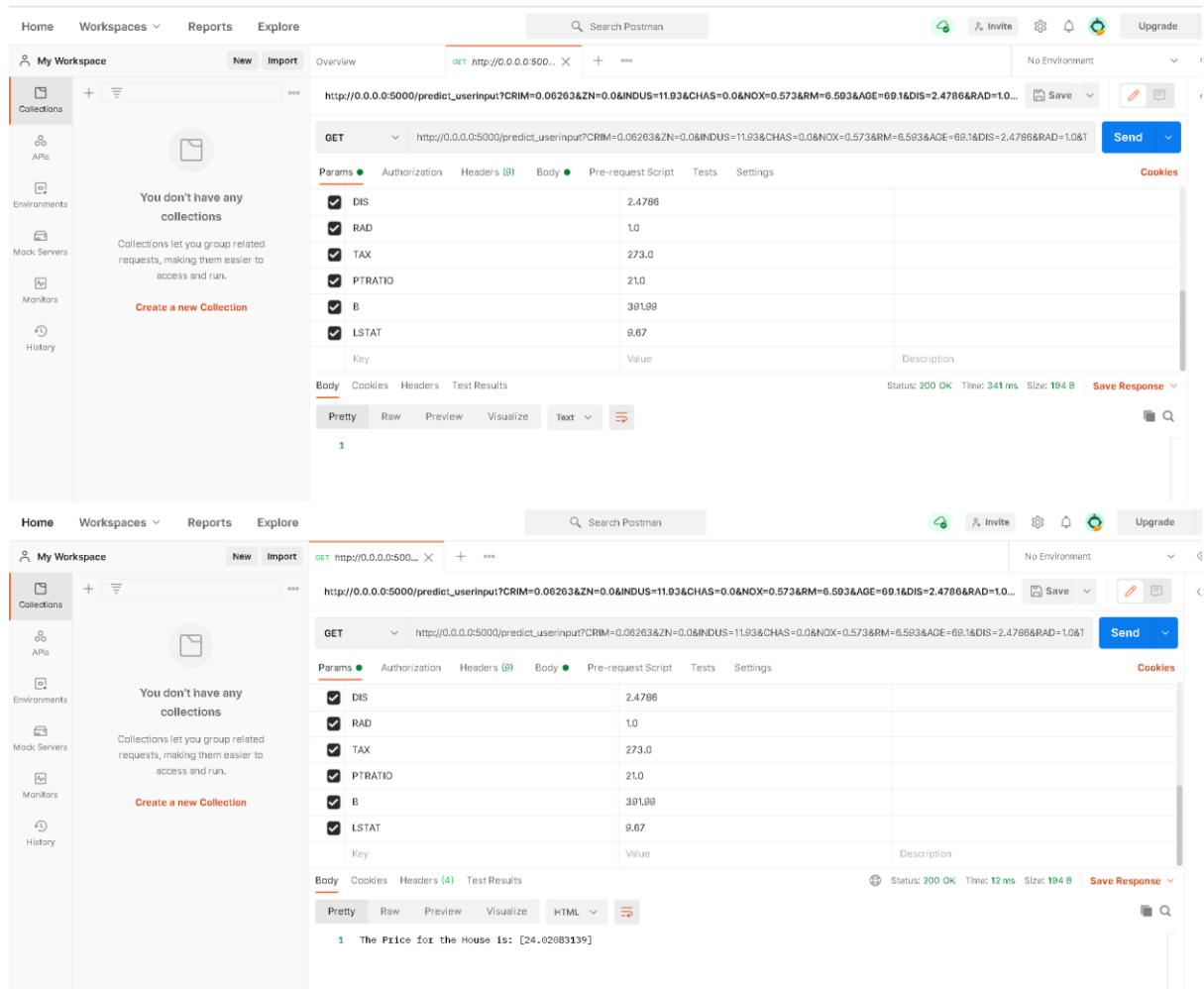


Building ML model, Creating an API for the model using Flask, Dockerizing Flask Web App, and Deploying on Azure Cloud

- Priyanka Naikade

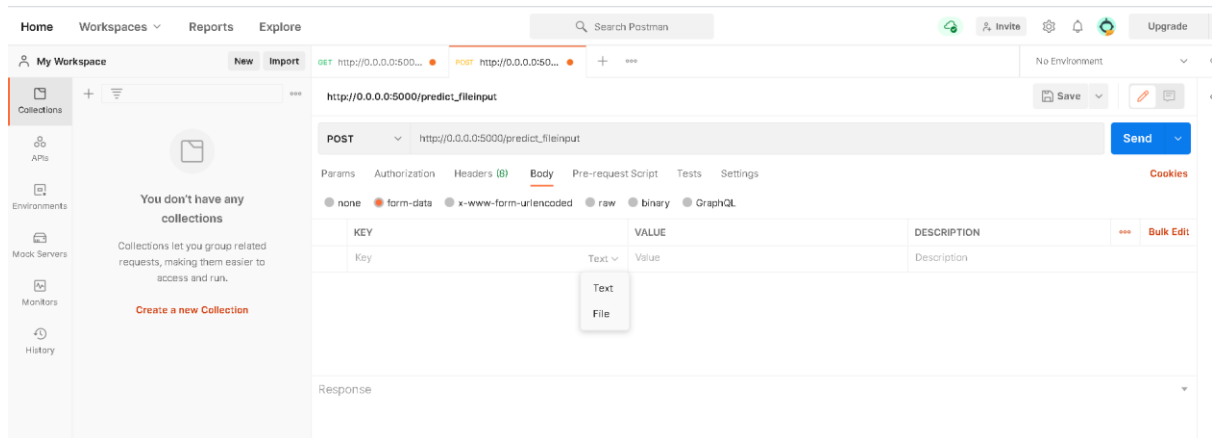
Steps:

1. Trained and developed a machine learning model (Multiple Linear Regression Model) for predicting the price of a house. The model is saved as a pickle file.
2. Created a web application using Flask (a lightweight web framework for python that can be used to build and host an API). The web application deserializes the 'model.pkl' file and loads the model for making predictions on the input data.
3. Tested the API using POSTMAN.



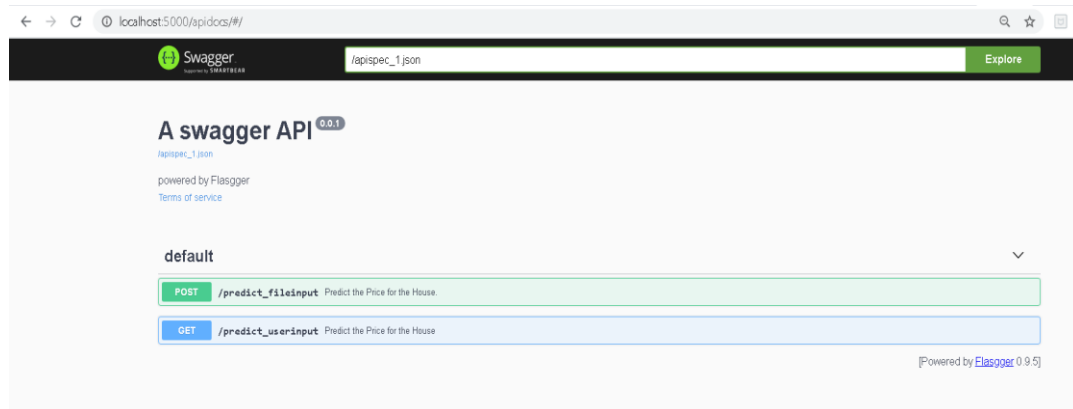
Testing for file input:

Select 'POST' request, Under Body ->form-data, Select key as 'File' from the drop-down.

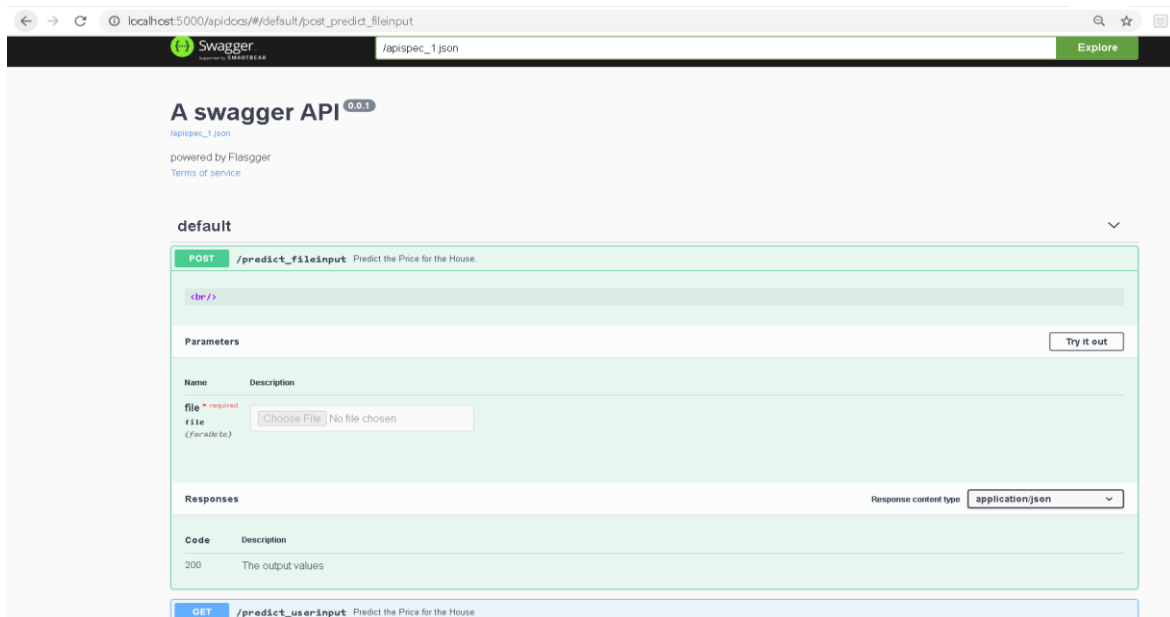


- Created a front-end UI for the Web application using Flasgger's Swagger module. Model Predictions were made for single user input (a single record of input features) and file input.

Testing Web application via a local server (http://localhost:5000/apidocs)



Prediction for input file data: Click on 'Try it out' button to enable the 'Choose file' option.



default

POST
/predict_fileinput
Predict the Price for the House.

Parameters
Cancel

Name	Description
<div> file required </div> <div> file </div> <div> (formData) </div>	<div> Choose File No file chosen </div>

Execute

Responses
Response content type
application/json

Code	Description
200	The output values

GET
/predict_userinput
Predict the Price for the House

(Powered by [Flasooer](#) 0.9.5)

Parameters
Cancel

Name	Description
<div> file required </div> <div> file </div> <div> (formData) </div>	<div> Choose File test_file.csv </div>

Execute

Clear

Responses
Response content type
application/json

Curl

```
curl -X POST "http://127.0.0.1:5000/predict_fileinput" -H "accept: application/json" -H "Content-Type: multipart/form-data" -F "file=test_file.csv;type=application/vnd.ms-excel"
```

Request URL

```
http://127.0.0.1:5000/predict_fileinput
```

Server response

Code	Details
200	<div> Response body </div> <div> The Price for the 2 Houses are: [24.020831385479152, 7.3407198857402975] </div> <div> Download </div>

Prediction for a single record-

Enter Input Value:

CRIM=0.06263&ZN=0.0&INDUS=11.93&CHAS=0.0&NOX=0.573&RM=6.593&AGE=69.1&DIS=2.4786&RAD=1.0&TAX=273.0&PTRATIO=21.0&B=391.99&LSTAT=9.67

GET
/predict_userinput
Predict the Price for the House

Parameters
Cancel

Name	Description
<div> CRIM required </div> <div> number </div> <div> (query) </div>	<div> CRIM </div>
<div> ZN required </div> <div> number </div> <div> (query) </div>	<div> ZN </div>
<div> INDUS required </div> <div> number </div> <div> (query) </div>	<div> INDUS </div>
<div> CHAS required </div> <div> number </div> <div> (query) </div>	<div> CHAS </div>
<div> NOX required </div> <div> number </div> <div> (query) </div>	<div> NOX </div>
<div> RM required </div> <div> number </div> <div> (query) </div>	<div> RM </div>

B * required
number
(query)

LSTAT * required
number
(query)

391.99

9.67

Execute Clear

Responses Response content type application/json

Curl

```
curl -X GET "http://127.0.0.1:5000/predict_userinput?CRIM=0.062638270.061INDUS=11.938CHAS=0.08NOX=0.5738R=6.593AGE=69.18DIS=2.4786RAD=1.08TAX=273.08PTRATIO=21.8B=391.99LSTAT=9.67" -H "accept: application/json"
```

Request URL

```
http://127.0.0.1:5000/predict_userinput?CRIM=0.062638270.061INDUS=11.938CHAS=0.08NOX=0.5738R=6.593AGE=69.18DIS=2.4786RAD=1.08TAX=273.08PTRATIO=21.8B=391.99LSTAT=9.67
```

Server response

Code	Details
200	<p>Response body</p> <p>The Price for the House is: [34.02083139]</p> <p>Download</p>

Responses Response content type application/json

Curl

```
curl -X GET "http://127.0.0.1:5000/predict_userinput?CRIM=0.062638270.061INDUS=11.938CHAS=0.08NOX=0.5738R=6.593AGE=69.18DIS=2.4786RAD=1.08TAX=273.08PTRATIO=21.8B=391.99LSTAT=9.67" -H "accept: application/json"
```

Request URL

```
http://127.0.0.1:5000/predict_userinput?CRIM=0.062638270.061INDUS=11.938CHAS=0.08NOX=0.5738R=6.593AGE=69.18DIS=2.4786RAD=1.08TAX=273.08PTRATIO=21.8B=391.99LSTAT=9.67
```

Server response

Code	Details
200	<p>Response body</p> <p>The Price for the House is: [34.02083139]</p> <p>Download</p> <p>Response headers</p> <pre>content-length: 41 content-type: text/html; charset=utf-8 date: Sat, 27 Feb 2021 22:40:12 GMT server: Werkzeug/1.0.1 Python/3.8.5</pre>

Responses

Code	Description
200	The Output values

[Powered by [Flasooer](#) 0.9.51]

5. **Dockerized the web application**, i.e., deployed the web app into a Docker container.
 - 5.1. Installed the Docker Desktop app.
 - 5.2. Created a Docker file in the same directory where the model file, environment requirements file (modules with specific versions that are required for running the model) exists. Docker file basically consists of a set of instructions/commands.
 - 5.3. Built the docker image (an image is created when the docker file is executed by the docker engine during runtime). Docker image is an executable package built from the docker file using the 'docker build' command.
 - 5.4. Docker Container (a live instance of docker image) is created using the 'docker run' command. Run the docker container locally from the docker image and test the application before publishing it on the cloud.

Screenshots for Step 5 Process:

Install Docker Desktop for Windows and check if the docker is installed and working properly or not.

- By checking the version, list of images, pulling one sample image and running to check if it's working or not.

```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.19041.804]
(c) 2020 Microsoft Corporation. All rights reserved.

C:\WINDOWS\system32>docker version
Client: Docker Engine - Community
 Cloud integration: 1.0.7
 Version: 20.10.2
 API version: 1.41
 Go version: go1.13.15
 Git commit: 2291f61
 Built: Mon Dec 28 16:14:16 2020
 OS/Arch: windows/amd64
 Context: default
 Experimental: true

Server: Docker Engine - Community
 Engine:
  Version: 20.10.2
  API version: 1.41 (minimum version 1.12)
  Go version: go1.13.15
  Git commit: 8891c58
  Built: Mon Dec 28 16:15:28 2020
  OS/Arch: linux/amd64
  Experimental: false
 containerd:
  Version: 1.4.3
  GitCommit: 269548fa27e0089a8b8278fc4fc781d7f65a939b
 runc:
  Version: 1.0.0-rc92
  GitCommit: ff819c7e9184c13b7c2607fe6c30ae19403a7aff
 docker-init:
  Version: 0.19.0
  GitCommit: de40ad0

C:\WINDOWS\system32>docker images
REPOSITORY          TAG             IMAGE ID        CREATED         SIZE
docker/getting-started latest          3c156928aeec   10 months ago  24.8MB

C:\WINDOWS\system32>docker pull hello-world
Using default tag: latest
latest: Pulling from library/hello-world
0e03bdcc26d7: Pull complete
Digest: sha256:7e02330c713f93b1d3e4c5003350d0dbe215ca269dd1d84a4abc577908344b30
Status: Downloaded newer image for hello-world:latest
docker.io/library/hello-world:latest

C:\WINDOWS\system32>docker images
REPOSITORY          TAG             IMAGE ID        CREATED         SIZE
docker/getting-started latest          3c156928aeec   10 months ago  24.8MB
hello-world         latest          bf756fb1ae65   14 months ago  13.3kB
```

```
C:\WINDOWS\system32>docker images
REPOSITORY          TAG          IMAGE ID        CREATED         SIZE
docker/getting-started latest       3c156928aeec    10 months ago  24.8MB

C:\WINDOWS\system32>docker pull hello-world
Using default tag: latest
latest: Pulling from library/hello-world
0e03bdcc26d7: Pull complete
Digest: sha256:7e02330c713f93b1d3e4c5003350d0dbe215ca269dd1d84a4abc577908344b30
Status: Downloaded newer image for hello-world:latest
docker.io/library/hello-world:latest

C:\WINDOWS\system32>docker images
REPOSITORY          TAG          IMAGE ID        CREATED         SIZE
docker/getting-started latest       3c156928aeec    10 months ago  24.8MB
hello-world         latest       bf756fb1ae65    14 months ago  13.3kB

C:\WINDOWS\system32>docker run hello-world

Hello from Docker!
This message shows that your installation appears to be working correctly.

To generate this message, Docker took the following steps:
 1. The Docker client contacted the Docker daemon.
 2. The Docker daemon pulled the "hello-world" image from the Docker Hub.
    (amd64)
 3. The Docker daemon created a new container from that image which runs the
    executable that produces the output you are currently reading.
 4. The Docker daemon streamed that output to the Docker client, which sent it
    to your terminal.

To try something more ambitious, you can run an Ubuntu container with:
$ docker run -it ubuntu bash

Share images, automate workflows, and more with a free Docker ID:
https://hub.docker.com/

For more examples and ideas, visit:
https://docs.docker.com/get-started/
```

Go to the current project directory (where the code file, docker file, and requirements file exist) in the local system.

```
(base) C:\Users\Priyanka Naikade>docker images
REPOSITORY          TAG         IMAGE ID      CREATED        SIZE
docker/getting-started latest      3c156928aeec  10 months ago  24.8MB
hello-world          latest      bf756fb1ae65  14 months ago  13.3kB

(base) C:\Users\Priyanka Naikade>cd C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>dir
Volume in drive C is Windows
Volume Serial Number is E897-3D83

Directory of C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction

28-02-2021  01:38    <DIR>          .
28-02-2021  01:38    <DIR>          ..
27-02-2021  17:00    <DIR>          .ipynb_checkpoints
28-02-2021  00:48                3,317 app.py
27-02-2021  21:18            3,775,328 Boston_House_Price_Prediction.ipynb
28-02-2021  01:38                644 Dockerfile
27-02-2021  21:18                644 model.pkl
27-02-2021  19:58                114 requirements.txt
26-02-2021  04:27                191 test_file.csv
                6 File(s)      3,780,238 bytes
                3 Dir(s)    779,109,097,472 bytes free

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>
```

Build the docker image

>> docker build -t dock-hprice-app .

```
(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker build -t dock-hprice-app .
[+] Building 88.9s (10/10) FINISHED
=> [internal] load build definition from Dockerfile                                2.2s
=> => transferring dockerfile: 683B                                              0.3s
=> [internal] load .dockerignore                                                  2.5s
=> => transferring context: 2B                                                    0.1s
=> [internal] load metadata for docker.io/library/python:3.8.5-slim              3.7s
=> [auth] library/python:pull token for registry-1.docker.io                    0.0s
=> [internal] load build context                                                  0.8s
=> => transferring context: 4.32kB                                                0.3s
=> [1/4] FROM docker.io/library/python:3.8.5-slim@sha256:502cd057453744145010eceb5a4af1e4f04ebed54f6e1e8d23d29e 21.8s
=> => resolve docker.io/library/python:3.8.5-slim@sha256:502cd057453744145010eceb5a4af1e4f04ebed54f6e1e8d23d29e 0.0s
=> => sha256:502cd057453744145010eceb5a4af1e4f04ebed54f6e1e8d23d29e2afdb6d 1.86kB / 1.86kB 0.0s
=> => sha256:7eae34b43d562e5dcd08c0c637e14f0f66a21209fe2591660ff37c7b7e5fa9bb 1.37kB / 1.37kB 0.0s
=> => sha256:6cf621cb132714e451d5f6d8f7567b890f379db9f85e53cbb4862ab52f658d45 7.69kB / 7.69kB 0.0s
=> => sha256:d121f8d1c4128ebc1e95e5bfad90a0189b84eadbbb2fbaad20cbb26d20b2c8a2 27.09MB / 27.09MB 4.2s
=> => sha256:776716b0aa87537801fc2287d4c3796c233bfe1ce6568038494d101ed2e3f291 10.42MB / 10.42MB 3.5s
=> => sha256:ca572574cc82ba635292c0aba70b719de39faffe7a40a802bb0f8c22663b51ac 2.75MB / 2.75MB 2.8s
=> => sha256:c37461631ba3a30c811c3427aa9e32b65c94551d6d8d2fbd26bc39bc54c98219 233B / 233B 4.3s
=> => extracting sha256:d121f8d1c4128ebc1e95e5bfad90a0189b84eadbbb2fbaad20cbb26d20b2c8a2 1.9s
=> => sha256:bdb458dd27ea53bf3830e3e158cff3c11d3580fa6bf7b9691022da4e963ab4c3 2.41MB / 2.41MB 5.9s
=> => extracting sha256:ca572574cc82ba635292c0aba70b719de39faffe7a40a802bb0f8c22663b51ac 0.3s
=> => extracting sha256:776716b0aa87537801fc2287d4c3796c233bfe1ce6568038494d101ed2e3f291 0.6s
=> => extracting sha256:c37461631ba3a30c811c3427aa9e32b65c94551d6d8d2fbd26bc39bc54c98219 0.0s
=> => extracting sha256:bdb458dd27ea53bf3830e3e158cff3c11d3580fa6bf7b9691022da4e963ab4c3 0.3s
=> [2/4] WORKDIR /pricepredapp                                                    4.6s
=> [3/4] COPY . /pricepredapp                                                      1.5s
=> [4/4] RUN pip3 install --no-cache-dir -r requirements.txt                      50.7s
=> exporting to image                                                              4.3s
=> => exporting layers                                                            3.8s
=> => writing image sha256:d20ece7d74df1c30a707d957474f60a2fb9b32edd0cf6bbaaa4d740cf1a29e59 0.1s
=> => naming to docker.io/library/dock-hprice-app                                0.1s

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>
```

Check the list of docker images

```
(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker images
REPOSITORY          TAG         IMAGE ID      CREATED        SIZE
dock-hprice-app      latest      d20ece7d74df  5 minutes ago  416MB
docker/getting-started latest      3c156928aeec  10 months ago  24.8MB
hello-world          latest      bf756fb1ae65  14 months ago  13.3kB

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>
```

No container running as of now

```
(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED        STATUS        PORTS        NAMES
(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>
```

Run the docker image 'dock-hprice-app'

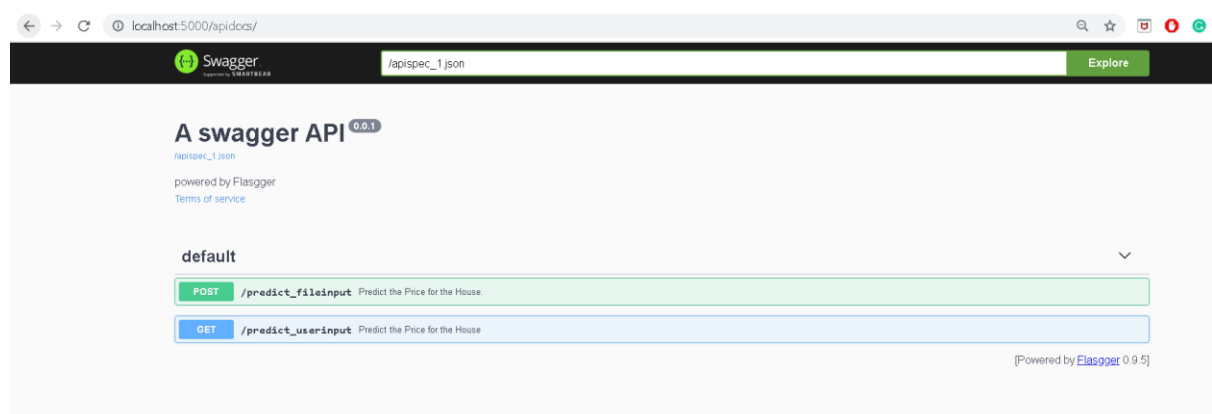
>> docker run -p 5000:5000 dock-hprice-app

```
(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker run -p 5000:5000 dock-hprice-app
* Serving Flask app "app" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://0.0.0.0:5000/ (Press CTRL+C to quit)
172.17.0.1 - - [28/Feb/2021 08:06:11] "GET / HTTP/1.1" 200 -
172.17.0.1 - - [28/Feb/2021 08:06:19] "GET /apidocs/ HTTP/1.1" 200 -
172.17.0.1 - - [28/Feb/2021 08:06:19] "GET /apispec_1.json HTTP/1.1" 200 -

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED        STATUS        PORTS        NAMES
e0d07fafa220  dock-hprice-app "python app.py"         38 seconds ago Up 35 seconds  0.0.0.0:5000->5000/tcp  angry_agnes
i

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>
```

Given the container is running, we will test the web app on **localhost:5000/apidocs/**



localhost:5000/apidocs/#/default/post_predict_fileinput

A swagger API 0.0.1

/apispec_1.json
powered by Flasgger
[Terms of service](#)

default

POST /predict_fileinput Predict the Price for the House.

Parameters Cancel

Name	Description
file * required	
file	<input type="button" value="Choose File"/> test_file.csv
(formData)	

Responses Response content type application/json

Code	Description
200	The output values

GET /predict_userinput Predict the Price for the House.

localhost:5000/apidocs/#/default/post_predict_fileinput

Name	Description
file * required	
file	<input type="button" value="Choose File"/> test_file.csv
(formData)	

Responses Response content type application/json

Curl

```
curl -X POST "http://localhost:5000/predict_fileinput" -H "accept: application/json" -H "Content-Type: multipart/form-data" -F "file=test_file.csv;type=application/vnd.ms-excel"
```

Request URL

```
http://localhost:5000/predict_fileinput
```

Server response

Code	Details
200	<p>Response body</p> <pre>The Price for the 2 Houses are: [24.020831386479152, 7.240719885740308]</pre> <p><input type="button" value="Download"/></p> <p>Response headers</p> <pre>content-length: 71 content-type: text/html; charset=utf-8 date: Sun, 28 Feb 2021 08:09:45 GMT server: Werkzeug/1.0.1 Python/3.8.5</pre>

Responses

Code	Description
200	The output values

```
(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED        STATUS        PORTS                               NAMES
e0d07fafa220   dock-hprice-app  "python app.py"         38 seconds ago Up 35 seconds  0.0.0.0:5000->5000/tcp             angry_agnesi

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED        STATUS        PORTS                               NAMES
e0d07fafa220   dock-hprice-app  "python app.py"         5 minutes ago  Up 5 minutes  0.0.0.0:5000->5000/tcp             angry_agnesi

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>
```

We can now stop the docker container

```
(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED        STATUS        PORTS                               NAMES
e0d07fafa220   dock-hprice-app  "python app.py"         5 minutes ago  Up 5 minutes  0.0.0.0:5000->5000/tcp             angry_agnesi

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker stop e0d07fafa220
e0d07fafa220

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED        STATUS        PORTS                               NAMES

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>
```

Created another image after changing requirements.txt

```
(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker images
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE
dock2-price-app  latest    e09495fed141   7 minutes ago  441MB
dock-hprice-app  latest    3971acf0a999   16 hours ago   416MB
docker/getting-started  latest    3c156928aeec   10 months ago  24.8MB
hello-world     latest    bf756fb1ae65   14 months ago  13.3kB

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED        STATUS        PORTS                               NAMES
04b0255557ea   dock2-price-app  "python app.py"         About a minute ago Up 25 seconds  0.0.0.0:5000->5000/tcp             tender_wilbur

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED        STATUS        PORTS                               NAMES
04b0255557ea   dock2-price-app  "python app.py"         3 minutes ago  Up 2 minutes  0.0.0.0:5000->5000/tcp             tender_wilbur

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker stop 04b0255557ea
04b0255557ea

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED        STATUS        PORTS                               NAMES

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker images
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE
dock2-price-app  latest    e09495fed141   10 minutes ago  441MB
dock-hprice-app  latest    3971acf0a999   16 hours ago   416MB
docker/getting-started  latest    3c156928aeec   10 months ago  24.8MB
hello-world     latest    bf756fb1ae65   14 months ago  13.3kB

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker tag
```

6. Publishing the docker image to docker hub repository which could be accessed from anywhere

6.1. Created a public repository in docker hub.

6.2. Tagged the image to the repository

```
(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker tag dock2-price-app priyankanaikade/myrepo-hpred:dtag1

(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>
```

6.3. Pushed the docker image to the repository

```
(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>docker push priyankanaikade/myrepo-hpred:dtag1
The push refers to repository [docker.io/priyankanaikade/myrepo-hpred]
434366b74fe1: Pushed
afba96b65a6a: Pushed
230a236c642b: Pushed
bb38c3f3fcc5: Mounted from library/python
9f72a1f4c21f: Mounted from library/python
6280b41d048d: Mounted from library/python
bd8e6688d36c: Mounted from library/python
07cab4339852: Mounted from library/python
dtag1: digest: sha256:0374091fac016cde8c8b21b1da4a2a7ed34fca67082bb33f885e7fa1c2ff0a52 size: 1997
(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>
```

General

Tags

Builds

Collaborators

Webhooks

Settings

priyankanaikade / myrepo-hpred

This repository does not have a description

Last pushed: 15 minutes ago

Docker commands

To push a new tag to this repository,

docker push priyankanaikade/myrepo-hpred:tagname

Tags and Scans

VULNERABILITY SCANNING - DISABLED

Enable

This repository contains 1 tag(s).

TAG	OS	PULLED	PUSHED
dtag1		15 minutes ago	15 minutes ago

See all

Recent builds

Link a source provider and run a build to see build results here.

7. Hosting the docker container on Azure

7.1. Open Azure Portal -> Select 'Create a Resource' -> Web App

- Resource group -> Existing or create a new one if required.
- Publish -> Docker Container. Since we already created the docker container.

Microsoft Azure

Upgrade

Search resources, services, and docs (G+/I)

Home

New

Create Web App

Basics

Docker

Monitoring

Tags

Review + create

App Service Web Apps lets you quickly build, deploy, and scale enterprise-grade web, mobile, and API apps running on any platform. Meet rigorous performance, scalability, security and compliance requirements while using a fully managed platform to perform infrastructure maintenance. [Learn more](#)

Project Details

Select a subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription

Free Trial

Resource Group

(New) MLResources

Create new

Instance Details

Name

housepricepred

azurewebsites.net

Publish

Code

Docker Container

Operating System

Linux

Windows

Region

Central US

Not finding your App Service Plan? Try a different region.

Microsoft Azure

Upgrade

Search resources, services, and docs (G+/?)

priyanka

Home > New >

Create Web App

Resource Group *

(New) MLResources

Create new

Instance Details

Name *

housepricepred

.azurewebsites.net

Publish *

☐ Code

☒ Docker Container

Operating System *

☒ Linux

☐ Windows

Region *

Central US

Not finding your App Service Plan? Try a different region.

App Service Plan

App Service plan pricing tier determines the location, features, cost and compute resources associated with your app. [Learn more](#)

Linux Plan (Central US) *

(New) ASP-MLResources-99e2

Create new

Sku and size *

Free F1

1 GB memory

Review + create

< Previous

Next : Docker >

- Select Image source as 'Docker Hub' and give its details (Docker Image with Tag).

Microsoft Azure

Upgrade

Search resources, services, and docs (G+/?)

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Home > New >

Create Web App

Basics

Docker

Monitoring

Tags

Review + create

Pull container images from Azure Container Registry, Docker Hub or a private Docker repository. App Service will deploy the containerized app with your preferred dependencies to production in seconds.

Options

Single Container

Image Source

Docker Hub

Docker hub options

Access Type *

Public

Image and tag *

priyankaikade/myrepo-hpred:tag1

Startup Command

Review + create







< Previous

Next : Monitoring >

Microsoft Azure

Upgrade

Search resources, services, and docs (G+J)

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[Home](#) > [New](#) >


Create Web App

[Basics](#) [Docker](#) [Monitoring](#) [Tags](#) [Review + create](#)

Application Insights is a code-less attach to provide detailed observability in to your application. [Learn more](#)

Application Insights

Enable Application Insights * ☒ No ☐ Yes



Application Insights code-less monitoring isn't supported with your selections of subscription, runtime stack, operating system, publish type, region, or resource group. If you want to keep these selections, you can use the Application Insights SDK to monitor your app.







[Review + create](#) [< Previous](#) [Next: Tags >](#)

- Under Tags: Add the PORT field and specify the port number as 5000.

Microsoft Azure

Upgrade

Search resources, services, and docs (G+J)

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[Home](#) > [New](#) >

Create Web App

[Basics](#) [Docker](#) [Monitoring](#) [Tags](#) [Review + create](#)

Tags are name/value pairs that enable you to categorize resources and view consolidated billing by applying the same tag to multiple resources and resource groups.

Note that if you create tags and then change resource settings on other tabs, your tags will be automatically updated.

Name	Value	Resource
PORT	5000	2 selected
		2 selected

[Review + create](#) [< Previous](#) [Next: Review + create >](#)

- Click 'Review + Create'

Microsoft Azure Upgrade Search resources, services, and docs (G+/J)

Home > New >

Create Web App

Basics Docker Monitoring Logs **Review + create**

Summary

Web App
by Microsoft

Free sku
Estimated price - Free

Details

Subscription	005856b6-9777-475b-8cbe-8b5be4849e26
Resource Group	MLResources
Name	housepricepred
Publish	Docker Container
ImageTag	priyanka-naikade/myrepo-hpred:tag1
Server URL	https://index.docker.io
Tags	PORT: 5000

App Service Plan (New)

Name	ASP-MLResources-99e2
Operating System	Linux
Region	Central US
SKU	Free
ACU	Shared infrastructure
Memory	1 GB memory

[Create](#) [< Previous](#) [Next >](#) [Download a template for automation](#)

- Click on Create.

Microsoft Azure Upgrade Search resources, services, and docs (G+/J)

Home >

Microsoft.Web-WebApp-Portal-ed4751a5-a7b5 | Overview

Deployment

Search (Ctrl+J) Delete Cancel Redeploy Refresh

We'd love your feedback →

Deployment is in progress

Deployment name: MicrosoftWeb-WebApp-Portal-ed4751a5-a7b5 Start time: 3/1/2021, 1:52:15 AM
Subscription: Free Trial Correlation ID: 40999814-88a0-46fc-a15e-a4bb68092990
Resource group: MLResources

Deployment details (Download)

Resource	Type	Status	Operation details
No results.			

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Azure experts are service provider partners that can help manage your assets on Azure, your first line of support.
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https://portal.azure.com/?quickstart=truet# Microsoft Azure Upgrade Search resources, services, and docs (G+/J)

Home >

Microsoft.Web-WebApp-Portal-ed4751a5-a7b5 | Overview

Deployment

Search (Ctrl+J) Delete Cancel Redeploy Refresh

We'd love your feedback →

Your deployment is complete

Deployment name: MicrosoftWeb-WebApp-Portal-ed4751a5-a7b5 Start time: 3/1/2021, 1:52:15 AM
Subscription: Free Trial Correlation ID: 40999814-88a0-46fc-a15e-a4bb68092990
Resource group: MLResources

Deployment details (Download)

Next steps

[Manage deployments for your app.](#) Recommended

[Protect your app with authentication.](#) Recommended

[Go to resource](#)

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Secure your apps and infrastructure
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Work with an expert
Azure experts are service provider partners that can help manage your assets on Azure, your first line of support.
[Find an Azure expert >](#)

https://portal.azure.com/?quickstart=truet#

The screenshot shows the Microsoft Azure portal interface. At the top, there's a navigation bar with 'Microsoft Azure', an 'Upgrade' button, a search bar, and user information. Below this, the breadcrumb trail shows 'Home > Microsoft.Web-WebApp-Portal-ed4751a5-a7b5 | Overview'. The main content area is titled 'Deployment' and shows a message 'Your deployment is complete' with a green checkmark. It lists deployment details: 'Deployment name: Microsoft.Web-WebApp-Portal-ed4751a5-a7b5', 'Subscription: Free Trial', 'Resource group: MLResources', 'Start time: 3/1/2021, 1:52:15 AM', and 'Correlation ID: 40999814-88a0-46fc-af5e-a4bb68092990'. A table titled 'Deployment details' shows two resources: 'housepricepred' (Microsoft.Web/sites) and 'ASP-MLResources-99e2' (Microsoft.Web/serverfarms), both with a status of 'OK'. Below the table, 'Next steps' are listed: 'Manage deployments for your app' and 'Protect your app with authentication', both recommended. A 'Go to resource' button is at the bottom. On the right sidebar, there are links for 'Security Center', 'Free Microsoft tutorials', and 'Work with an expert'.

- Click on 'Go to resource'

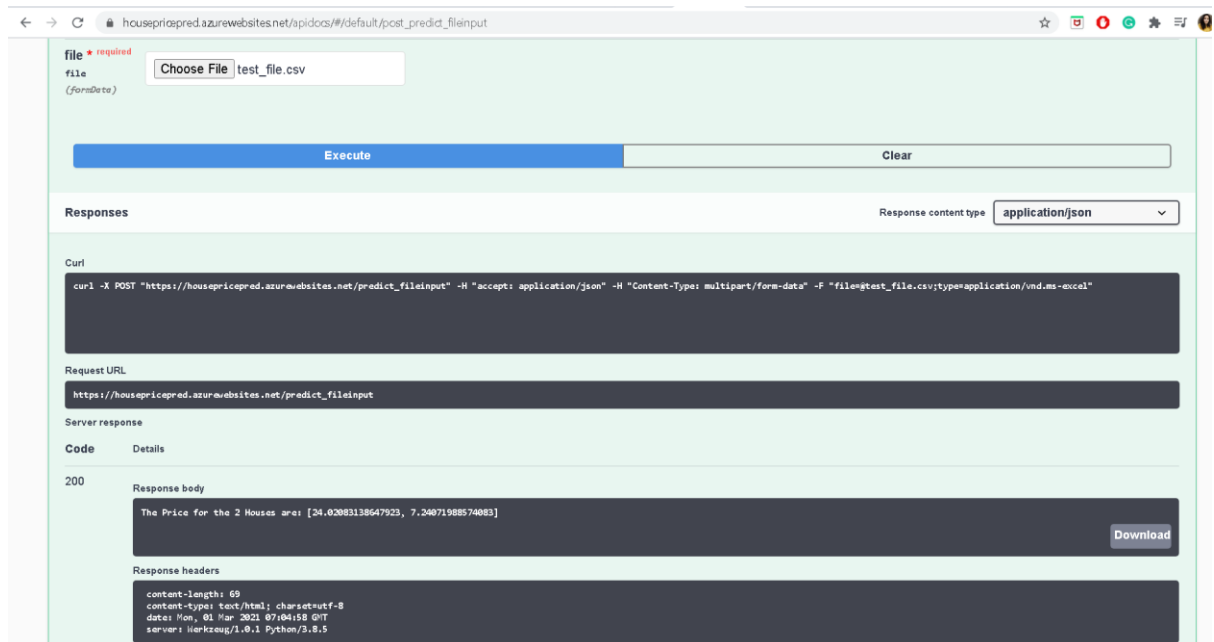
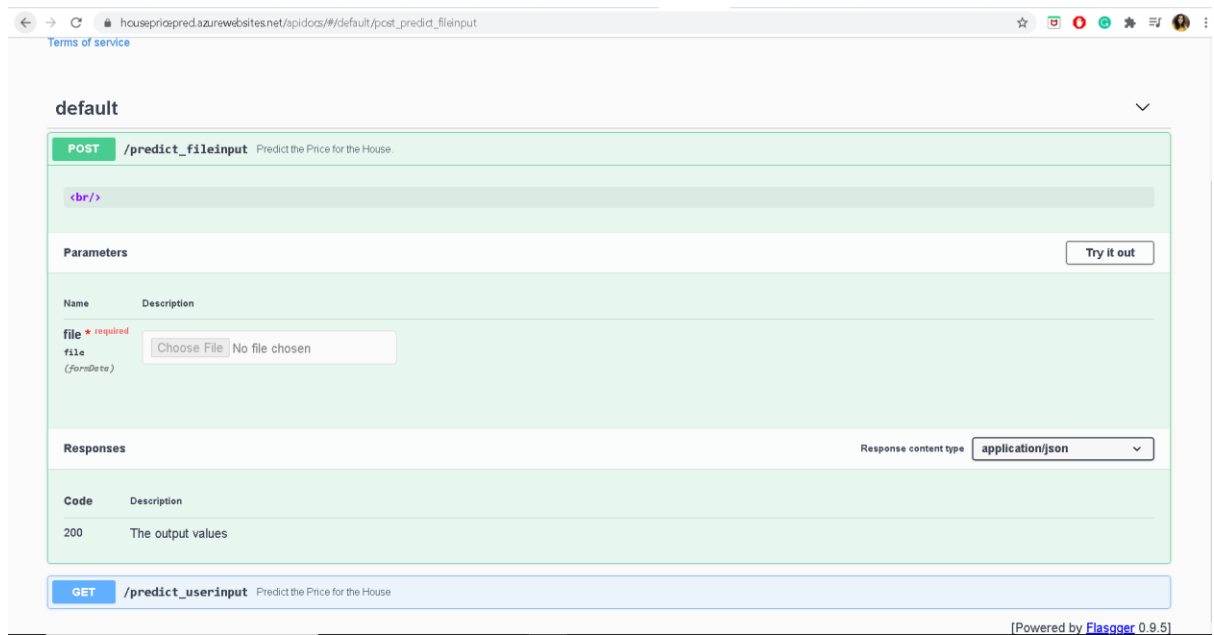
The screenshot shows the Microsoft Azure portal interface for the 'housepricepred' App Service. The breadcrumb trail is 'Home > Microsoft.Web-WebApp-Portal-ed4751a5-a7b5 > housepricepred'. The main content area is titled 'Overview' and shows the app's status as 'Running'. It lists details: 'Resource group (change): MLResources', 'Status: Running', 'Location: Central US', 'Subscription (change): Free Trial', 'Subscription ID: 005856b6-9777-475b-8dbe-8b5be4849e26', and 'Tags (change): PORT: 5000'. The URL is 'https://housepricepred.azurewebsites.net'. Below this, there are sections for 'Diagnose and solve problems' and 'App Service Advisor'. At the bottom, there are three panels: 'Http Sox', 'Data In', and 'Data Out', each with a list of values. The 'Http Sox' panel shows values from 100 to 400. The 'Data In' panel shows values from 1000 to 400. The 'Data Out' panel shows values from 1000 to 400.

We can see that the status is running and now we can test the app using the URL mentioned.

URL opens: 'Welcome to home page'

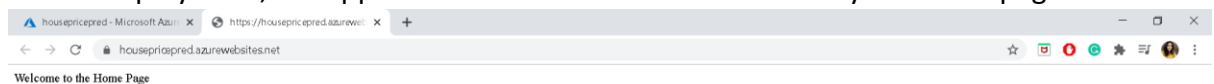
To open the app add '/apidocs/' at the end of the URL.

<https://housepricepred.azurewebsites.net/apidocs/>

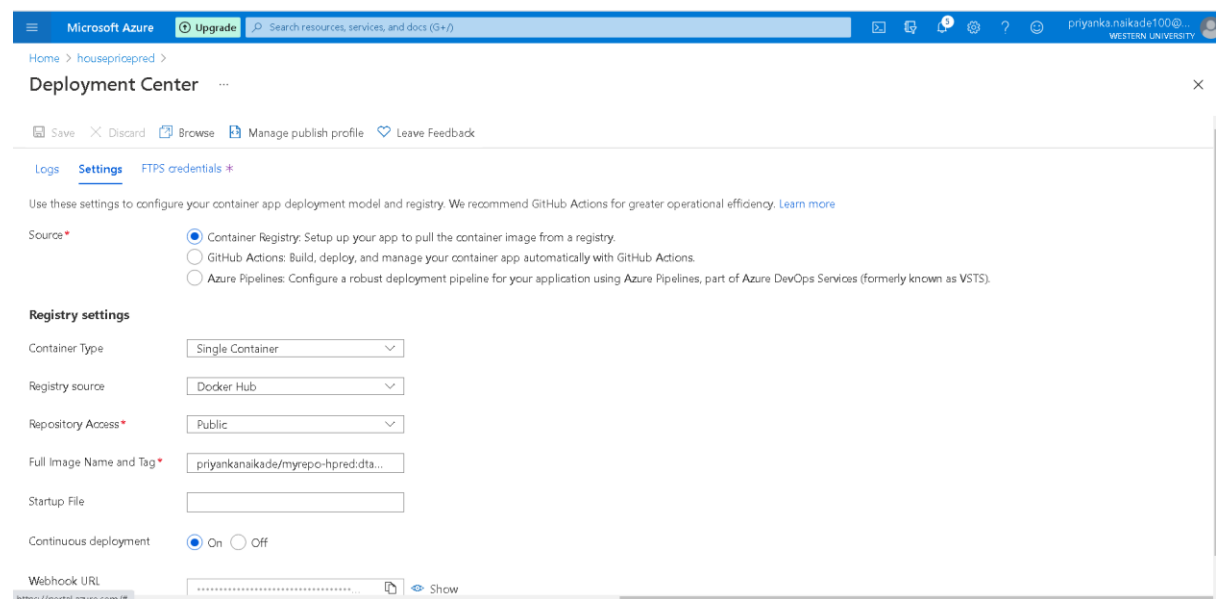
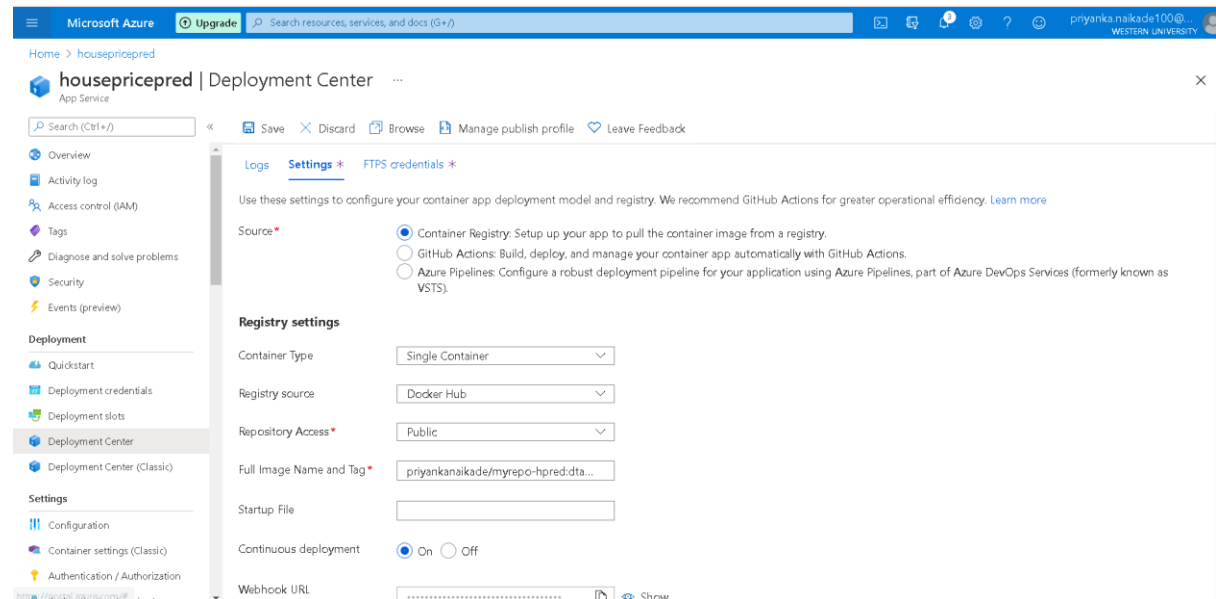


8. Continuous Integration and Continuous Deployment (CI/CD)

Before deployment, the application looks like this. We will modify this homepage.



8.1 Azure Web Service Settings: To ensure continuous integration and deployment, Go to Deployment Center -> turn 'On' the Continuous Deployment (CD) option. Go to Container settings -> set CD = 'On'



8.2 Code Modification: Modified the home page using a HTML file and added a button that will redirect Swagger webpage. Updates made to app.py and a new file homepage.html under templates folder is added to the project directory.

```
app.py x Dockerfile x requirements.txt x homepage.html x
1 <!DOCTYPE html>
2
3 <html>
4   <head>
5     <meta charset = "utf-8">
6     <title> House Price Prediction </title>
7   </head>
8
9   <body>
10    <h1> Boston House Price Prediction </h1>
11    <button id = "btn" > Click here for Prediction </button>
12    <script>
13      var btn = document.getElementById("btn");
14      btn.onclick = function() {
15        window.open("https://housepricepred.azurewebsites.net/apidocs/");
16      }
17    </script>
18  </body>
19
20 </html>
```

```
(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>dir
Volume in drive C is Windows
Volume Serial Number is E897-3D83

Directory of C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction

12-03-2021  05:09    <DIR>          .
12-03-2021  05:09    <DIR>          ..
12-03-2021  05:09                3,365 app.py
28-02-2021  18:25                638 Dockerfile
28-02-2021  18:12                656 model.pkl
28-02-2021  18:09            2,316 pricepredmodel.py
28-02-2021  06:30                66 requirements.txt
12-03-2021  05:47    <DIR>          templates
                    5 File(s)              7,041 bytes
                    3 Dir(s)  772,416,737,280 bytes free

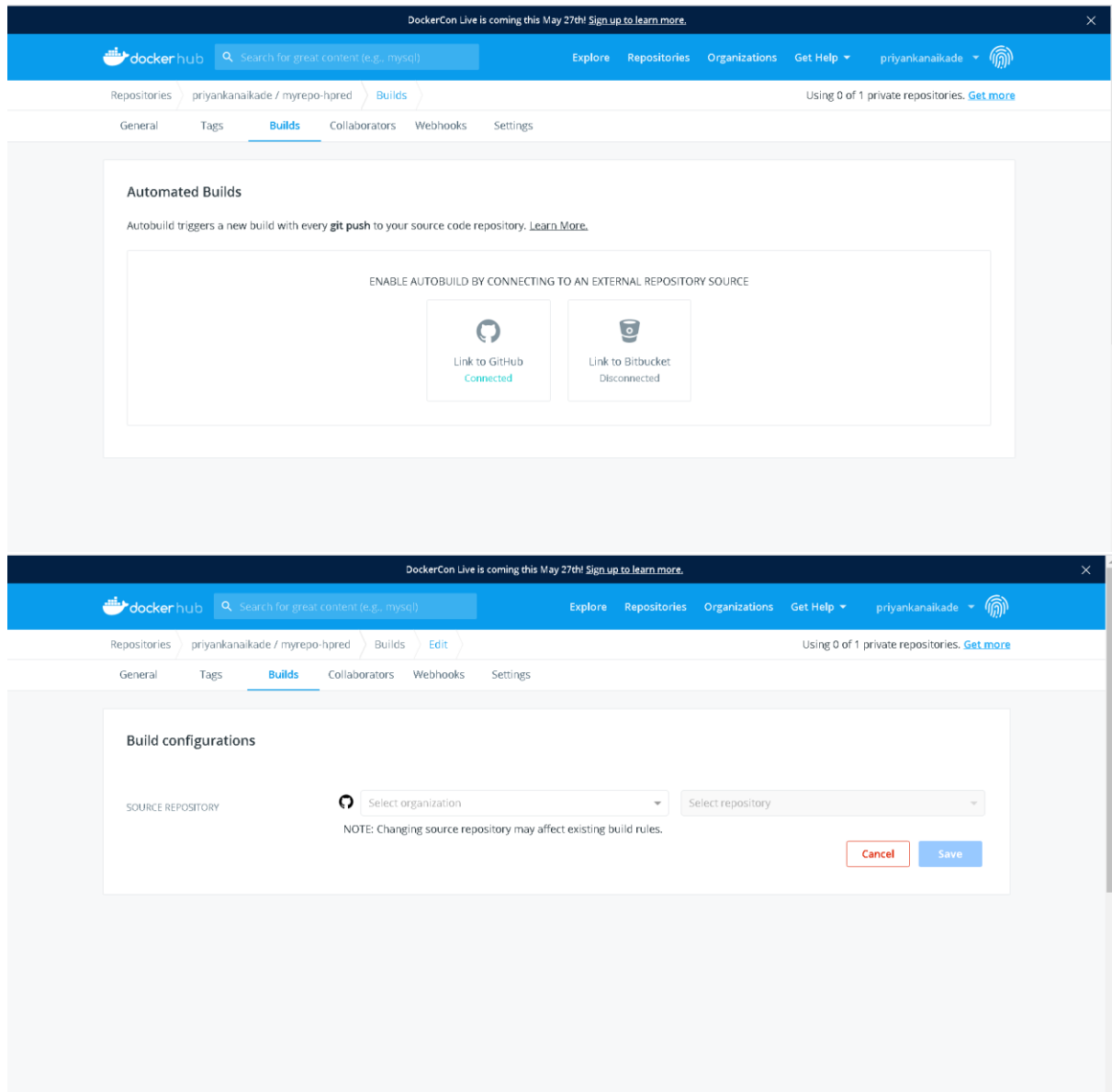
(base) C:\Users\Priyanka Naikade\Desktop\House-Price-Prediction>
```

8.3 Update the docker image in the docker hub.

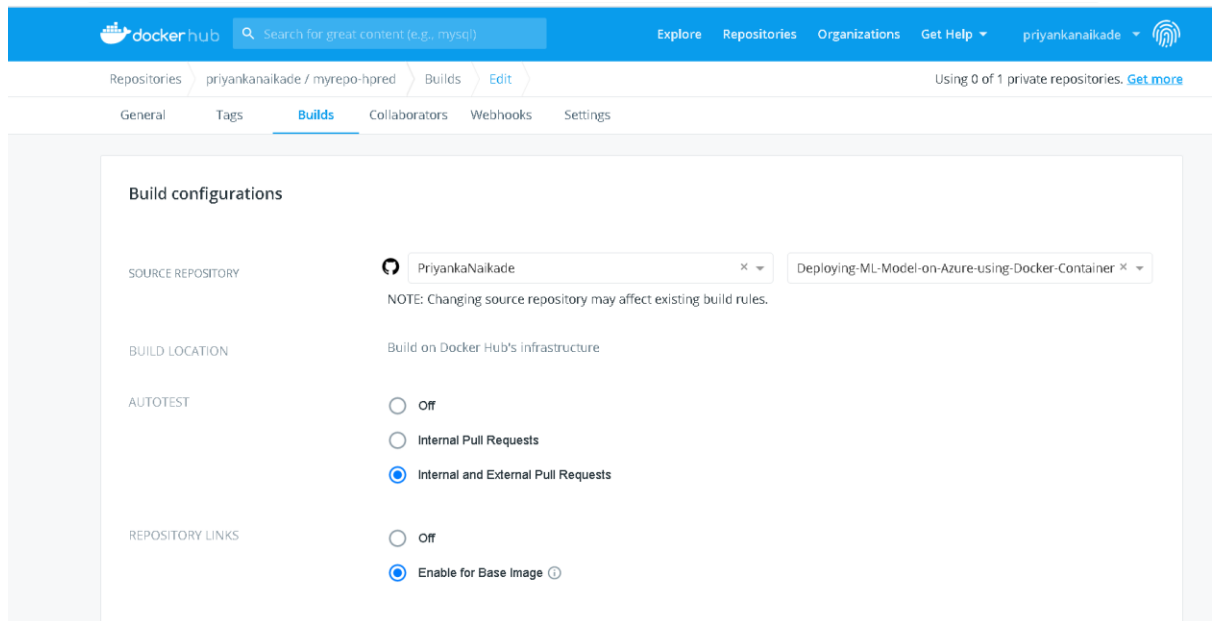
It should be an automated process.

We link the docker hub account to our git hub account under account settings. Then configure the automated build settings. Go to public repository that we created in docker hub -> Builds ->

The screenshot shows the Docker Hub interface for a repository named 'priyankanaikade/myrepo-hpred'. The page includes a search bar, navigation links (Explore, Repositories, Organizations, Get Help), and a user profile dropdown. The repository page has tabs for General, Tags, Builds, Collaborators, Webhooks, and Settings. The 'General' tab is active, showing the repository name, a description field, and the last push time (11 days ago). On the right, there are 'Docker commands' and a 'Public View' button. Below, there are sections for 'Tags and Scans' (showing one tag 'dtag1') and 'Recent builds'.



Set the Build Configurations so that whenever there is a new push in the git repository the docker hub will create a new build or update the docker image



The screenshot shows the Docker Hub interface for configuring builds. The top navigation bar includes the Docker Hub logo, a search bar, and links for Explore, Repositories, Organizations, Get Help, and a user profile. The breadcrumb trail indicates the path: Repositories > priyankanaikade / myrepo-hpred > Builds > Edit. The page title is 'Using 0 of 1 private repositories. Get more'. The 'Builds' tab is selected in the sub-navigation bar.

Build configurations

SOURCE REPOSITORY: A dropdown menu shows 'PriyankaNaikade' and a tag 'Deploying-ML-Model-on-Azure-using-Docker-Container'. A note states: 'NOTE: Changing source repository may affect existing build rules.'

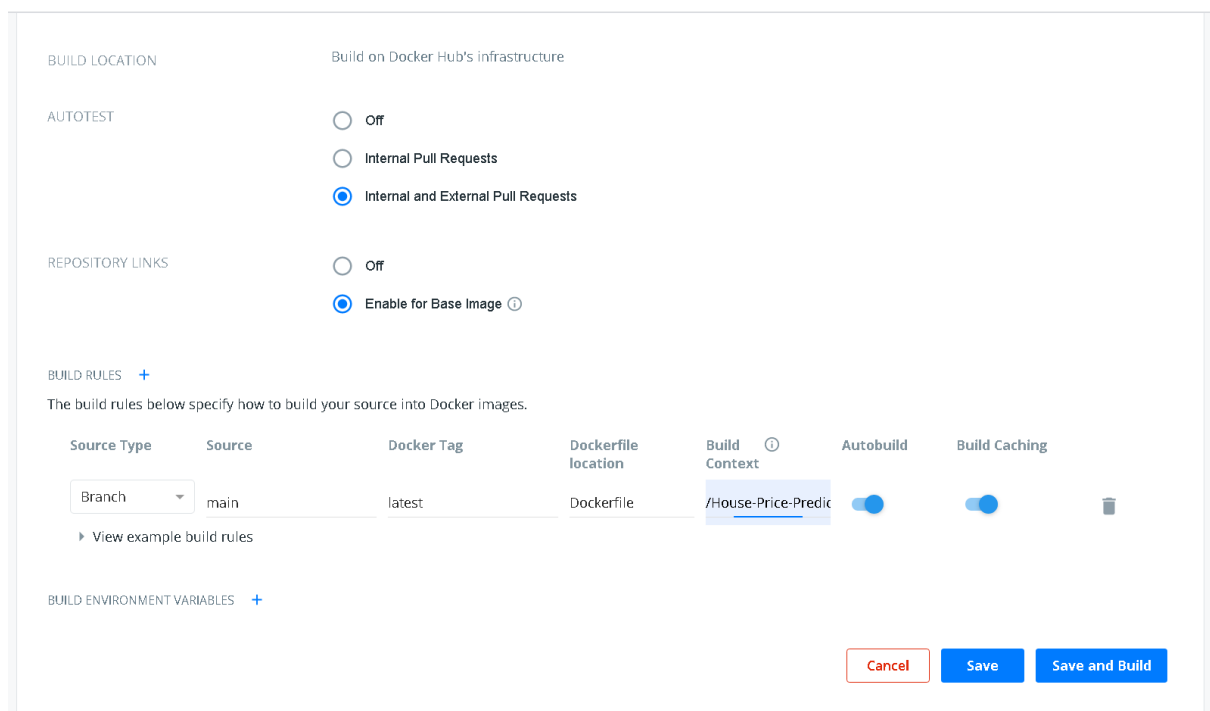
BUILD LOCATION: Build on Docker Hub's infrastructure

AUTOTEST: Three radio button options: 'Off', 'Internal Pull Requests', and 'Internal and External Pull Requests' (which is selected).

REPOSITORY LINKS: Two radio button options: 'Off' and 'Enable for Base Image' (which is selected).

To **Configure automated builds**: provide source repository, repository name, autotest on for internal pull requests, enable automated build creation for any update in the base image of hub and other details.


Set a rule to build the latest image



The screenshot shows the 'Build rules' configuration page. The 'BUILD LOCATION' is set to 'Build on Docker Hub's infrastructure'. The 'AUTOTEST' options are 'Internal and External Pull Requests' (selected). The 'REPOSITORY LINKS' options are 'Enable for Base Image' (selected).

BUILD RULES +

The build rules below specify how to build your source into Docker images.

Source Type	Source	Docker Tag	Dockerfile location	Build Context ⓘ	Autobuild	Build Caching	
Branch	main	latest	Dockerfile	/House-Price-Predic	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

▶ View example build rules

BUILD ENVIRONMENT VARIABLES +

Buttons at the bottom: Cancel, Save, Save and Build.

To maintain the different versions of the image, set another rule

BUILD LOCATION

AUTOTEST

☐ Off

☐ Internal Pull Requests

☒ Internal and External Pull Requests

REPOSITORY LINKS

☐ Off

☒ Enable for Base Image [?](#)

BUILD RULES [+](#)

The build rules below specify how to build your source into Docker images.

Source Type	Source	Docker Tag	Dockerfile location	Build Context ?	Autobuild	Build Caching	
Branch	main	latest	Dockerfile	/House-Price-Predic	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Tag	/^v([0-9.]*)\$/	{sourcerref}	Dockerfile	/House-Price-Predic	<input type="checkbox"/>	<input type="checkbox"/>	

[View example build rules](#)

BUILD ENVIRONMENT VARIABLES [+](#)

[Cancel](#) [Save](#) [Save and Build](#)

8.4 Push the new file/updated files from local machine to the github repo.

```
priyanka@LAPTOP-67BKDV1I:/mnt/c/Users/Priyanka Naikade/Desktop$ git clone https://github.com/PriyankaNaikade/Deploying-ML-Model-on-Azure-using-Docker-Container.git
Cloning into 'Deploying-ML-Model-on-Azure-using-Docker-Container'...
remote: Enumerating objects: 68, done.
remote: Counting objects: 100% (68/68), done.
remote: Compressing objects: 100% (66/66), done.
remote: Total 68 (delta 29), reused 0 (delta 0), pack-reused 0
Unpacking objects: 100% (68/68), done.
priyanka@LAPTOP-67BKDV1I:/mnt/c/Users/Priyanka Naikade/Desktop$ cd Deploying-ML-Model-on-Azure-using-Docker-Container/
priyanka@LAPTOP-67BKDV1I:/mnt/c/Users/Priyanka Naikade/Desktop/Deploying-ML-Model-on-Azure-using-Docker-Container$ ls
README.md
House-Price-Prediction
priyanka@LAPTOP-67BKDV1I:/mnt/c/Users/Priyanka Naikade/Desktop/Deploying-ML-Model-on-Azure-using-Docker-Container$ git status
On branch main
Your branch is up to date with 'origin/main'.

Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git checkout -- <file>..." to discard changes in working directory)

    modified:   House-Price-Prediction/app.py

Untracked files:
  (use "git add <file>..." to include in what will be committed)

    House-Price-Prediction/templates/

no changes added to commit (use "git add" and/or "git commit -s")
priyanka@LAPTOP-67BKDV1I:/mnt/c/Users/Priyanka Naikade/Desktop/Deploying-ML-Model-on-Azure-using-Docker-Container$ git add .
priyanka@LAPTOP-67BKDV1I:/mnt/c/Users/Priyanka Naikade/Desktop/Deploying-ML-Model-on-Azure-using-Docker-Container$ git status
On branch main
Your branch is up to date with 'origin/main'.

Changes to be committed:
  (use "git reset HEAD <file>..." to unstage)

    modified:   House-Price-Prediction/app.py
    new file:   House-Price-Prediction/templates/homepage.html

priyanka@LAPTOP-67BKDV1I:/mnt/c/Users/Priyanka Naikade/Desktop/Deploying-ML-Model-on-Azure-using-Docker-Container$ git commit -m "Modified HomePage using html for testing CI/CD"
[main 76b2490] Modified HomePage using html for testing CI/CD
```

```
priyanka@LAPTOP-67BKDV1I:/mnt/c/Users/Priyanka Naikade/Desktop/Deploying-ML-Model-on-Azure-using-Docker-Container$ git status
On branch main
Your branch is up to date with 'origin/main'.

Changes to be committed:
  (use "git reset HEAD <file>..." to unstage)

    modified:   House-Price-Prediction/app.py
    new file:   House-Price-Prediction/templates/homepage.html

priyanka@LAPTOP-67BKDV1I:/mnt/c/Users/Priyanka Naikade/Desktop/Deploying-ML-Model-on-Azure-using-Docker-Container$ git commit -m "Modified HomePage using html for testing CI/CD"
[main 76b2490] Modified HomePage using html for testing CI/CD
2 files changed, 22 insertions(+), 2 deletions(-)
create mode 100644 House-Price-Prediction/templates/homepage.html
priyanka@LAPTOP-67BKDV1I:/mnt/c/Users/Priyanka Naikade/Desktop/Deploying-ML-Model-on-Azure-using-Docker-Container$ git status
On branch main
Your branch is ahead of 'origin/main' by 1 commit.
  (use "git push" to publish your local commits)

nothing to commit, working tree clean
```

```
priyanka@LAPTOP-67BKDV1I:/mnt/c/Users/Priyanka Naikade/Desktop/Deploying-ML-Model-on-Azure-using-Docker-Container$ git status
On branch main
Your branch is ahead of 'origin/main' by 1 commit.
  (use "git push" to publish your local commits)

nothing to commit, working tree clean
priyanka@LAPTOP-67BKDV1I:/mnt/c/Users/Priyanka Naikade/Desktop/Deploying-ML-Model-on-Azure-using-Docker-Container$ git push
Username for 'https://github.com': priyanka.naikade100@gmail.com
Password for 'https://priyanka.naikade100@gmail.com@github.com':
Counting objects: 6, done.
Delta compression using up to 4 threads.
Compressing objects: 100% (5/5), done.
Writing objects: 100% (6/6), 784 bytes | 261.00 KiB/s, done.
Total 6 (delta 3), reused 0 (delta 0)
remote: Resolving deltas: 100% (3/3), completed with 3 local objects.
To https://github.com/PriyankaNaikade/Deploying-ML-Model-on-Azure-using-Docker-Container.git
   8595d95..76b2490  main -> main
priyanka@LAPTOP-67BKDV1I:/mnt/c/Users/Priyanka Naikade/Desktop/Deploying-ML-Model-on-Azure-using-Docker-Container$
```

As the push gets successful, the build creation is initiated automatically in the docker hub. The build is in progress right now.

Overview of your build activity of the last 2 builds

Automated Builds

Autobuild triggers a new build with every **git push** to your source code repository. [Learn More](#).

PriyankaNaikade/Deploying-ML-Model-on-Azure-using-Docker-Container | Use Docker Hub's Infrastructure | Autotests: Internal Pull Requests

Docker Tag	Source	Latest Build Status	Autobuild	Build caching
latest	main	IN PROGRESS	✓	✓
{sourcerefs}	/^v([0-9.]+)\$/		✗	✗

Recent Builds

Automated Builds

Autobuild triggers a new build with every **git push** to your source code repository. [Learn More](#).

PriyankaNaikade/Deploying-ML-Model-on-Azure-using-Docker-Container | Use Docker Hub's Infrastructure | Autotests: Internal Pull Requests

Docker Tag	Source	Latest Build Status	Autobuild	Build caching
latest	main	SUCCESS	✓	✓
{sourcerefs}	/^v([0-9.]+)\$/		✗	✗

[Trigger](#)

Recent Builds

Build in 'main/House-Price-Prediction' (76b2490a)	latest	76b2490	7 minutes ago
---	--------	---------	---------------

Once it's successful, we can check the application via Azure. Since the continuous deployment is set 'ON' as given in the screenshot below, Azure automatically pulls the updated image from the docker hub.

The screenshot shows the 'Deployment Center' configuration page in the Microsoft Azure portal. The 'Source' section has three radio buttons: 'Container Registry' (selected), 'GitHub Actions', and 'Azure Pipelines'. Under 'Registry settings', the 'Container Type' is 'Single Container', 'Registry source' is 'Docker Hub', 'Repository Access' is 'Public', and the 'Full Image Name and Tag' is 'priyankaikade/myrepo-hpred:latest'. The 'Continuous deployment' toggle is set to 'On'. The 'Webhook URL' field is empty with a 'Show' button next to it.

The latest application opened via Azure:



We fixed the navigation part to Swagger webpage by adding a button to the homepage which will navigate to Swagger's apidocs url.

Deployment Center - Microsoft / x House Price Prediction x Flaggger x +

housepriospred.azurewebsites.net/apidocs/

Swagger
powered by SMARTBEAR

/apispec_1.json Explore

A swagger API 0.0.1

/apispec_1.json

powered by Flaggger

[Terms of service](#)

default

POST /predict_fileinput Predict the Price for the House.

GET /predict_userinput Predict the Price for the House

[Powered by [Flaggger](#) 0.9.5]

Deployment Center - Microsoft / x House Price Prediction x Flaggger x +

housepriospred.azurewebsites.net/apidocs/#/default/post_predict_fileinput

Swagger
powered by SMARTBEAR

/apispec_1.json Explore

A swagger API 0.0.1

/apispec_1.json

powered by Flaggger

[Terms of service](#)

default

POST /predict_fileinput Predict the Price for the House.

Parameters Try it out

Name	Description
file required	
file	<input type="text" value="Choose File"/> No file chosen
(formData)	

Responses Response content type application/json