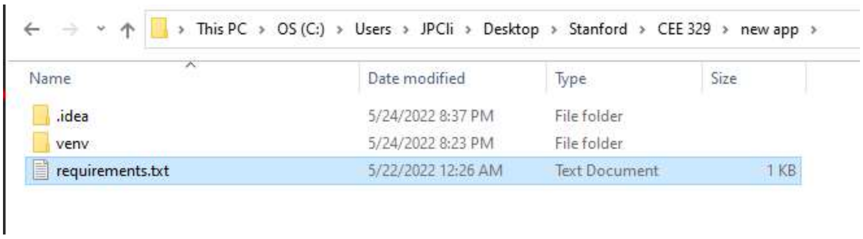
Crack Detection Test Page Instructions

1. Install required packages for the project

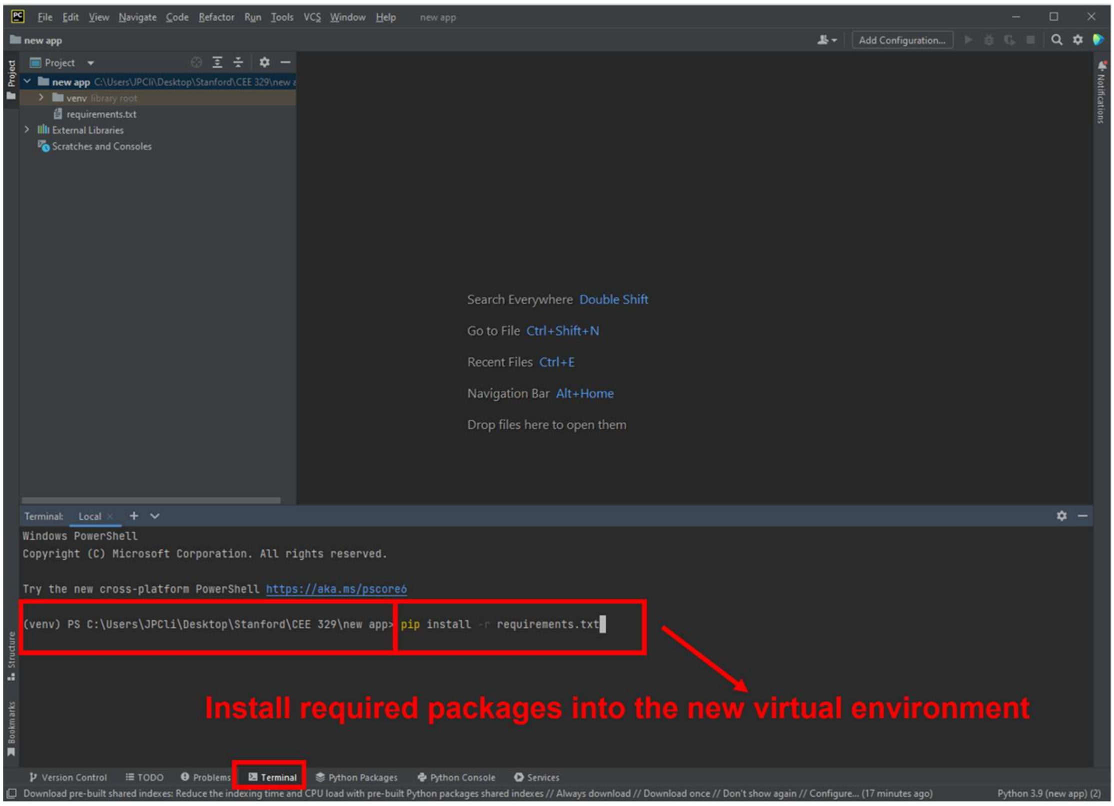
Copy the requirement.txt file into the new project folder. It will look like this:



This PC > OS (C:) > Users > JPCli > Desktop > Stanford > CEE 329 > new app >

Name	Date modified	Type	Size
.idea	5/24/2022 8:37 PM	File folder	
venv	5/24/2022 8:23 PM	File folder	
requirements.txt	5/22/2022 12:26 AM	Text Document	1 KB

In ***Terminal***, input `pip install -r requirements.txt` and press Enter to install required packages into the new virtual environment. It will take several minutes to run.

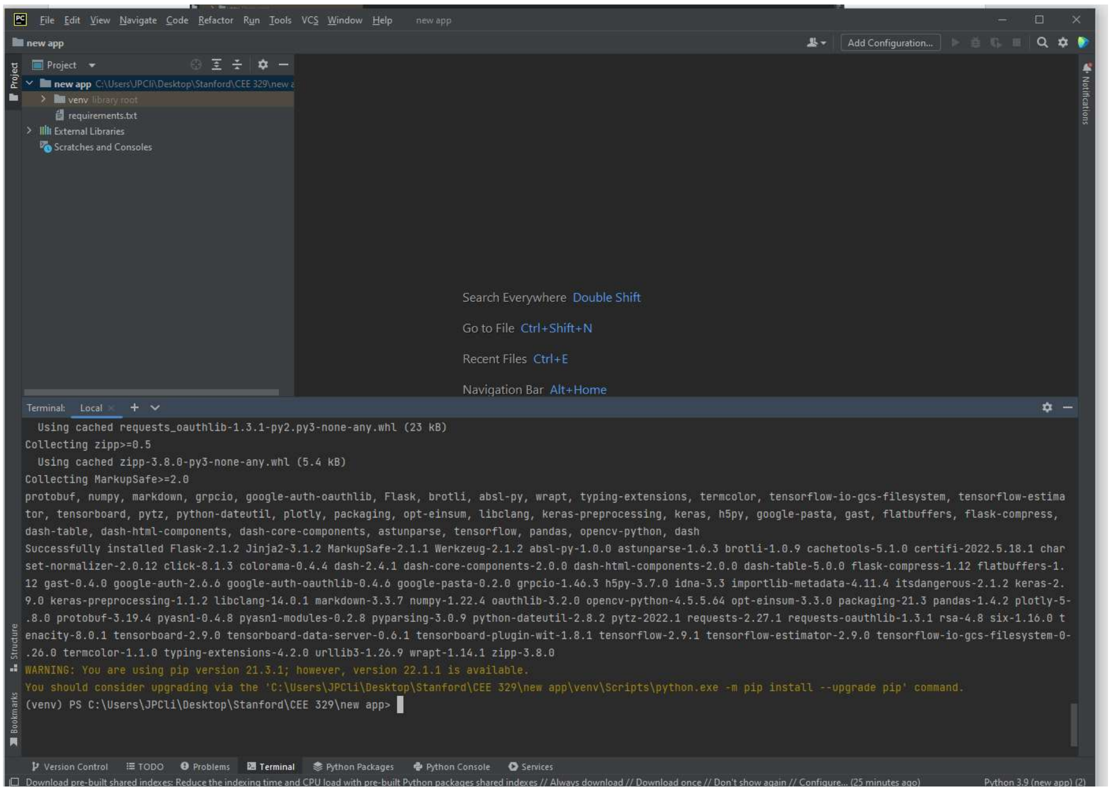


```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Try the new cross-platform PowerShell https://aka.ms/pscore6

(venv) PS C:\Users\JPCli\Desktop\Stanford\CEE 329\new app> pip install -r requirements.txt
```

Install required packages into the new virtual environment

Download pre-built shared indexes: Reduce the indexing time and CPU load with pre-built Python packages shared indexes // Always download // Download once // Don't show again // Configure... (17 minutes ago)

It will look like this when it is finished:

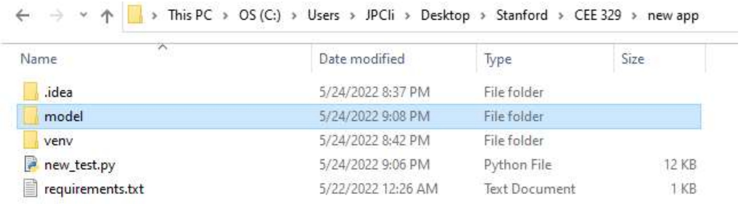


```
  Using cached requests_oauthlib-1.3.1-py2.py3-none-any.whl (23 kB)
Collecting zipp>=0.5
  Using cached zipp-3.8.0-py3-none-any.whl (5.4 kB)
Collecting MarkupSafe>=2.0
protobuf, numpy, markdown, grpcio, google-auth-oauthlib, Flask, brotli, absl-py, wrapt, typing-extensions, termcolor, tensorflow-io-gcs-filesystem, tensorflow-estima
tor, tensorboard, pytz, python-dateutil, plotly, packaging, opt-einsum, libclang, keras-preprocessing, keras, h5py, google-pasta, gast, flatbuffers, flask-compress,
dash-table, dash-html-components, dash-core-components, astunparse, tensorflow, pandas, opencv-python, dash
Successfully installed Flask-2.1.2 Jinja2-3.1.2 MarkupSafe-2.1.1 Werkzeug-2.1.2 absl-py-1.0.0 astunparse-1.6.3 brotli-1.0.9 cachetools-5.1.0 certifi-2022.5.18.1 char
set-normalizer-2.0.12 click-8.1.3 colorama-0.4.4 dash-2.4.1 dash-core-components-2.0.0 dash-html-components-2.0.0 dash-table-5.0.0 flask-compress-1.12 flatbuffers-1.
12 gast-0.4.0 google-auth-2.6.6 google-auth-oauthlib-0.4.6 google-pasta-0.2.0 grpcio-1.46.3 h5py-3.7.0 idna-3.3 importlib-metadata-4.11.4 itsdangerous-2.1.2 keras-2.
9.0 keras-preprocessing-1.1.2 libclang-14.0.1 markdown-3.3.7 numpy-1.22.4 oauthlib-3.2.0 opencv-python-4.5.5.64 opt-einsum-3.3.0 packaging-21.3 pandas-1.4.2 plotly-5-
.8.0 protobuf-3.19.4 pyasn1-0.4.8 pyasn1-modules-0.2.8 pyparsing-3.0.9 python-dateutil-2.8.2 pytz-2022.1 requests-2.27.1 requests-oauthlib-1.3.1 rsa-4.8 six-1.16.0 t
enacity-8.0.1 tensorboard-2.9.0 tensorboard-data-server-0.6.1 tensorboard-plugin-wit-1.8.1 tensorflow-2.9.1 tensorflow-estimator-2.9.0 tensorflow-io-gcs-filesystem-0-
.26.0 termcolor-1.1.0 typing-extensions-4.2.0 urllib3-1.26.9 wrapt-1.14.1 zipp-3.8.0
WARNING: You are using pip version 21.3.1; however, version 22.1.1 is available.
You should consider upgrading via the 'C:\Users\JPCli\Desktop\Stanford\CEE 329\new app\venv\Scripts\python.exe -m pip install --upgrade pip' command.
(venv) PS C:\Users\JPCli\Desktop\Stanford\CEE 329\new app>
```

Download pre-built shared indexes: Reduce the indexing time and CPU load with pre-built Python packages shared indexes // Always download // Download once // Don't show again // Configure... (25 minutes ago)

2. Run the script

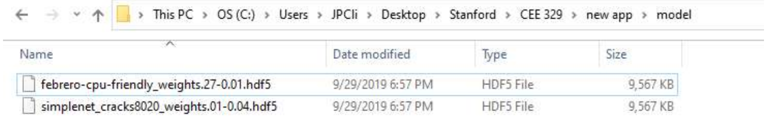
Copy ***model*** folder into the new project folder to provide the trained model for testing. It will look like this:



This PC › OS (C:) › Users › JPCli › Desktop › Stanford › CEE 329 › new app

Name	Date modified	Type	Size
.idea	5/24/2022 8:37 PM	File folder	
model	5/24/2022 9:08 PM	File folder	
venv	5/24/2022 8:42 PM	File folder	
new_test.py	5/24/2022 9:06 PM	Python File	12 KB
requirements.txt	5/22/2022 12:26 AM	Text Document	1 KB

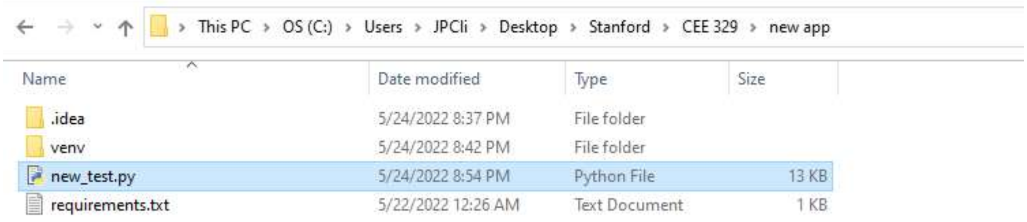
The ***model*** folder includes some models that have been well-trained (***copy from Train app/ model-checkpoints (after training)***).



This PC › OS (C:) › Users › JPCli › Desktop › Stanford › CEE 329 › new app › model

Name	Date modified	Type	Size
febrero-cpu-friendly_weights.27-0.01.hdf5	9/29/2019 6:57 PM	HDF5 File	9,567 KB
simplenet_cracks8020_weights.01-0.04.hdf5	9/29/2019 6:57 PM	HDF5 File	9,567 KB

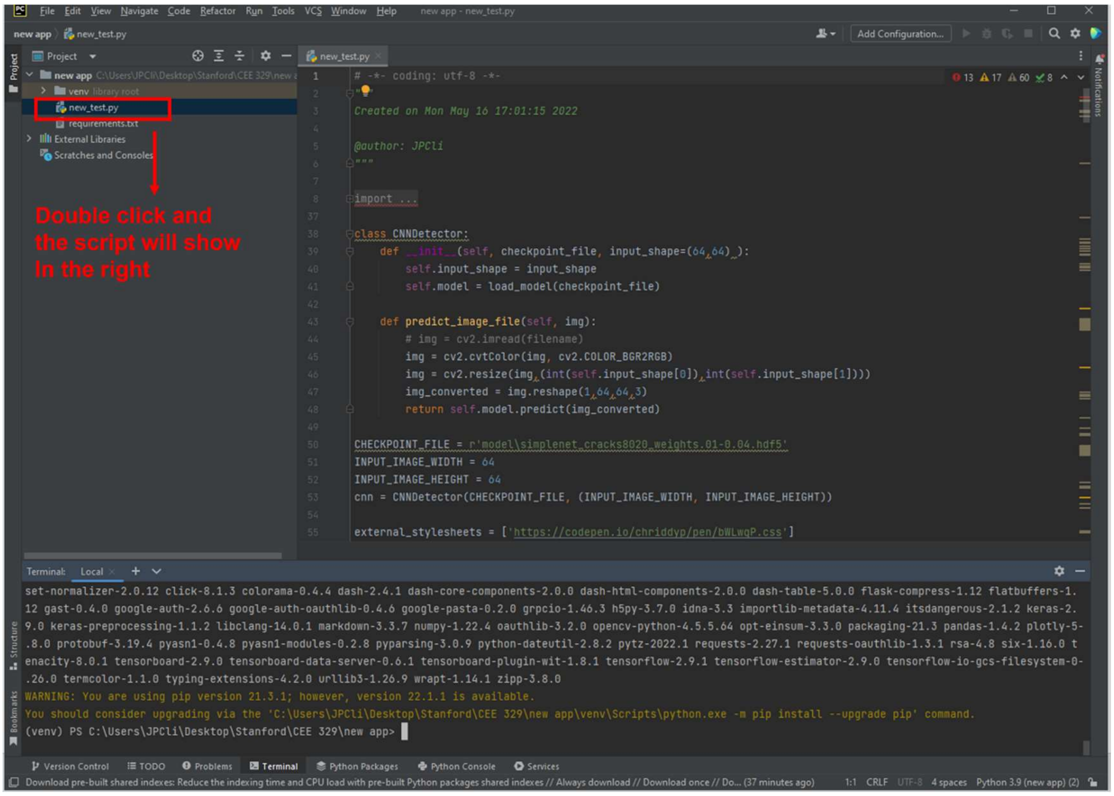
Copy ***new_test.py*** file into the new project folder. It will look like this:



This PC › OS (C:) › Users › JPCli › Desktop › Stanford › CEE 329 › new app

Name	Date modified	Type	Size
.idea	5/24/2022 8:37 PM	File folder	
venv	5/24/2022 8:42 PM	File folder	
new_test.py	5/24/2022 8:54 PM	Python File	13 KB
requirements.txt	5/22/2022 12:26 AM	Text Document	1 KB

In your PyCharm, it will look like this:

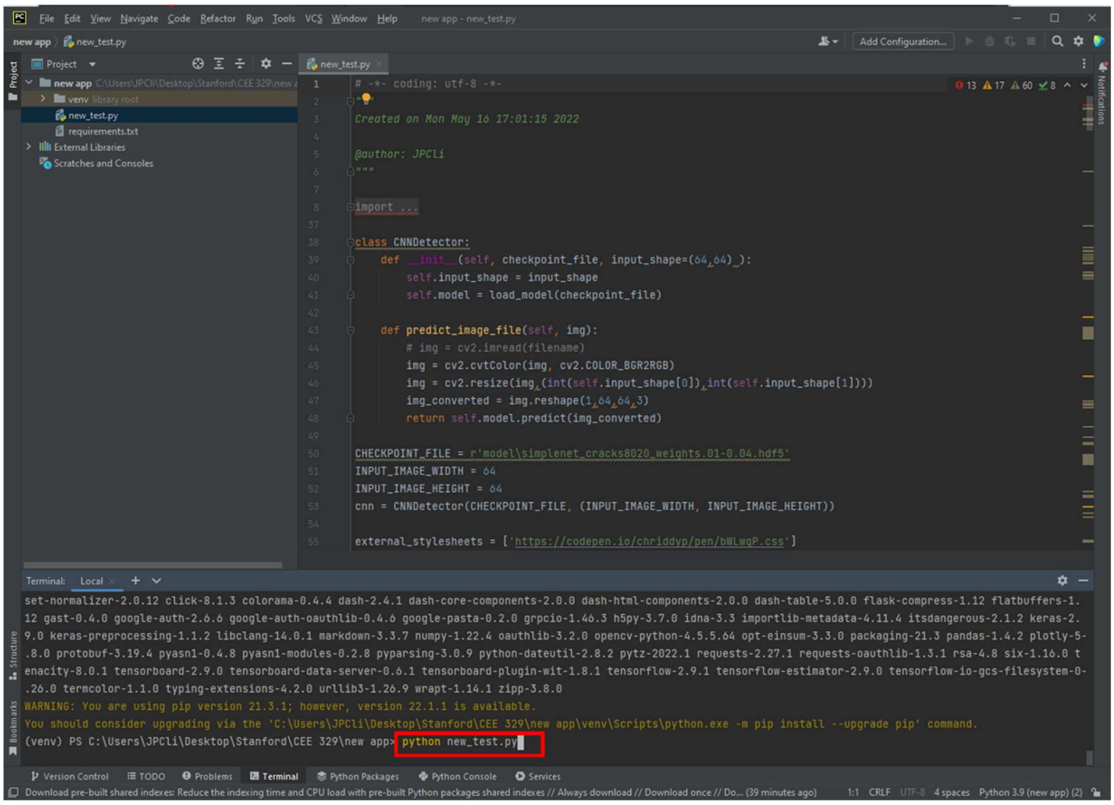


File Edit View Navigate Code Refactor Run Tools VCS Window Help new app - new_test.py
new app new_test.py
Add Configuration...
Project
new app C:\Users\JPCli\Desktop\Stanford\CEE 329\new a
venv library root
new_test.py
requirements.txt
External Libraries
Scratches and Consoles
Double click and the script will show in the right
Terminal: Local
Version Control TODO Problems Terminal Python Packages Python Console Services
Download pre-built shared indexes: Reduce the indexing time and CPU load with pre-built Python packages shared indexes // Always download // Download once // Do... (37 minutes ago) 1:1 CRLF UTF-8 4 spaces Python 3.9 (new app) (2)

```python
# -*- coding: utf-8 -*-
"""
Created on Mon May 16 17:01:15 2022

@author: JPCli
"""

import ...

class CNNDetector:
    def __init__(self, checkpoint_file, input_shape=(64,64) ):
        self.input_shape = input_shape
        self.model = load_model(checkpoint_file)

    def predict_image_file(self, img):
        # img = cv2.imread(filename)
        img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
        img = cv2.resize(img,(int(self.input_shape[0]),int(self.input_shape[1])))
        img_converted = img.reshape(1,64,64,3)
        return self.model.predict(img_converted)

CHECKPOINT_FILE = r'model\simplenet_cracks8020_weights.01-0.04.hdf5'
INPUT_IMAGE_WIDTH = 64
INPUT_IMAGE_HEIGHT = 64
cnn = CNNDetector(CHECKPOINT_FILE, (INPUT_IMAGE_WIDTH, INPUT_IMAGE_HEIGHT))

external_stylesheets = ['https://codepen.io/chriddyp/pen/bWLwgP.css']
```

```
set-normalizer-2.0.12 click-8.1.3 colorama-0.4.4 dash-2.4.1 dash-core-components-2.0.0 dash-html-components-2.0.0 dash-table-5.0.0 flask-compress-1.12 flatbuffers-1.
12 gast-0.4.0 google-auth-2.6.6 google-auth-oauthlib-0.4.6 google-pasta-0.2.0 grpcio-1.46.3 h5py-3.7.0 idna-3.3 importlib-metadata-4.11.4 itsdangerous-2.1.2 keras-2.
9.0 keras-preprocessing-1.1.2 libclang-14.0.1 markdown-3.3.7 numpy-1.22.4 oauthlib-3.2.0 opencv-python-4.5.5.64 opt-einsum-3.3.0 packaging-21.3 pandas-1.4.2 plotly-5-
.8.0 protobuf-3.19.4 pyasn1-0.4.8 pyasn1-modules-0.2.8 pyparsing-3.0.9 python-dateutil-2.8.2 pytz-2022.1 requests-2.27.1 requests-oauthlib-1.3.1 rsa-4.8 six-1.16.0 t
enacity-8.0.1 tensorboard-2.9.0 tensorboard-data-server-0.6.1 tensorboard-plugin-wit-1.8.1 tensorflow-2.9.1 tensorflow-estimator-2.9.0 tensorflow-io-gcs-filesystem-0-
.26.0 termcolor-1.1.0 typing-extensions-4.2.0 urllib3-1.26.9 wrapt-1.14.1 zipp-3.8.0
WARNING: You are using pip version 21.3.1; however, version 22.1.1 is available.
You should consider upgrading via the 'C:\Users\JPCli\Desktop\Stanford\CEE 329\new app\venv\Scripts\python.exe -m pip install --upgrade pip' command.
(venv) PS C:\Users\JPCli\Desktop\Stanford\CEE 329\new app>
```

Enter python ***new_test.py*** to run the script in the ***Terminal***.



File Edit View Navigate Code Refactor Run Tools VCS Window Help new app - new_test.py
new app new_test.py
Add Configuration...
Project
new app C:\Users\JPCli\Desktop\Stanford\CEE 329\new a
venv library root
new_test.py
requirements.txt
External Libraries
Scratches and Consoles
Terminal: Local
Version Control TODO Problems Terminal Python Packages Python Console Services
Download pre-built shared indexes: Reduce the indexing time and CPU load with pre-built Python packages shared indexes // Always download // Download once // Do... (39 minutes ago) 1:1 CRLF UTF-8 4 spaces Python 3.9 (new app) (2)

```python
# -*- coding: utf-8 -*-
"""
Created on Mon May 16 17:01:15 2022

@author: JPCli
"""

import ...

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        self.model = load_model(checkpoint_file)

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        # img = cv2.imread(filename)
        img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
        img = cv2.resize(img,(int(self.input_shape[0]),int(self.input_shape[1])))
        img_converted = img.reshape(1,64,64,3)
        return self.model.predict(img_converted)

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INPUT_IMAGE_WIDTH = 64
INPUT_IMAGE_HEIGHT = 64
cnn = CNNDetector(CHECKPOINT_FILE, (INPUT_IMAGE_WIDTH, INPUT_IMAGE_HEIGHT))

external_stylesheets = ['https://codepen.io/chriddyp/pen/bWLwgP.css']
```
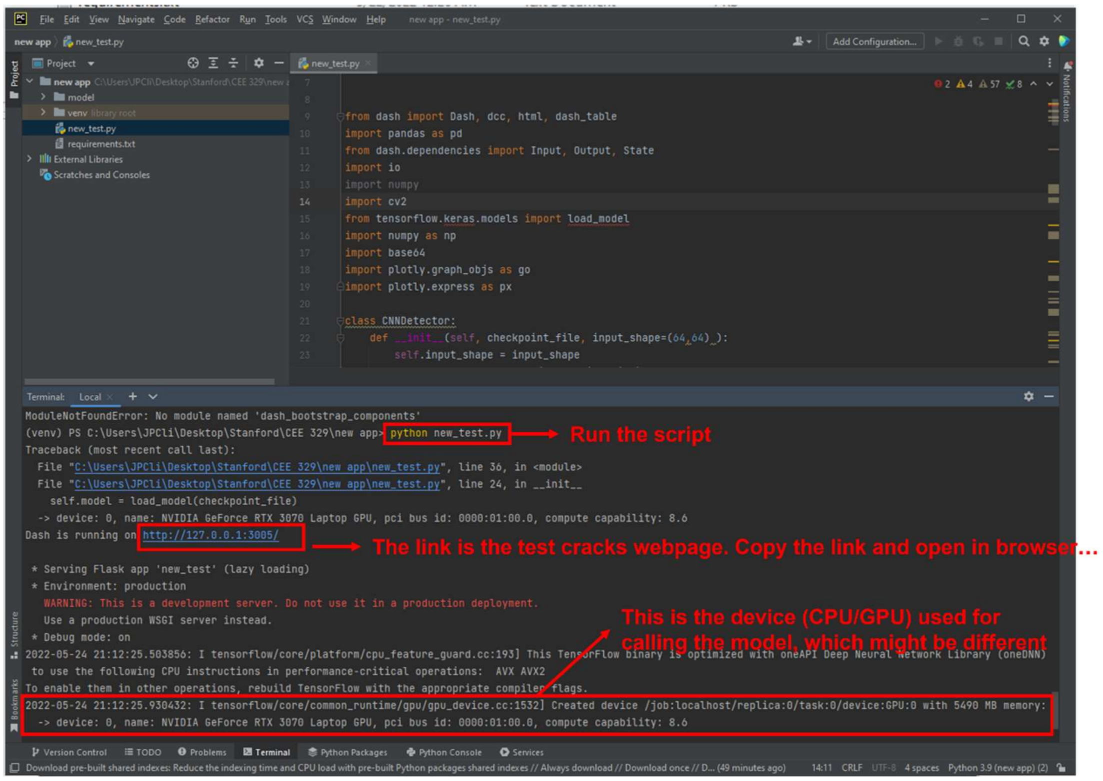

```
set-normalizer-2.0.12 click-8.1.3 colorama-0.4.4 dash-2.4.1 dash-core-components-2.0.0 dash-html-components-2.0.0 dash-table-5.0.0 flask-compress-1.12 flatbuffers-1.
12 gast-0.4.0 google-auth-2.6.6 google-auth-oauthlib-0.4.6 google-pasta-0.2.0 grpcio-1.46.3 h5py-3.7.0 idna-3.3 importlib-metadata-4.11.4 itsdangerous-2.1.2 keras-2.
9.0 keras-preprocessing-1.1.2 libclang-14.0.1 markdown-3.3.7 numpy-1.22.4 oauthlib-3.2.0 opencv-python-4.5.5.64 opt-einsum-3.3.0 packaging-21.3 pandas-1.4.2 plotly-5-
.8.0 protobuf-3.19.4 pyasn1-0.4.8 pyasn1-modules-0.2.8 pyparsing-3.0.9 python-dateutil-2.8.2 pytz-2022.1 requests-2.27.1 requests-oauthlib-1.3.1 rsa-4.8 six-1.16.0 t
enacity-8.0.1 tensorboard-2.9.0 tensorboard-data-server-0.6.1 tensorboard-plugin-wit-1.8.1 tensorflow-2.9.1 tensorflow-estimator-2.9.0 tensorflow-io-gcs-filesystem-0-
.26.0 termcolor-1.1.0 typing-extensions-4.2.0 urllib3-1.26.9 wrapt-1.14.1 zipp-3.8.0
WARNING: You are using pip version 21.3.1; however, version 22.1.1 is available.
You should consider upgrading via the 'C:\Users\JPCli\Desktop\Stanford\CEE 329\new app\venv\Scripts\python.exe -m pip install --upgrade pip' command.
(venv) PS C:\Users\JPCli\Desktop\Stanford\CEE 329\new app> python new_test.py
```

Then script is running:


File Edit View Navigate Code Refactor Run Tools VCS Window Help
new app - new_test.py
new app
new_test.py
Add Configuration...
Project
new app C:\Users\JPCli\Desktop\Stanford\CEE 329\new a
model
venv library root
new_test.py
requirements.txt
External Libraries
Scratches and Consoles
Terminal: Local
Version Control
TODO
Problems
Terminal
Python Packages
Python Console
Services
Download pre-built shared indexes: Reduce the indexing time and CPU load with pre-built Python packages shared indexes // Always download // Download once // D... (49 minutes ago)
14:11 CRLF UTF-8 4 spaces Python 3.9 (new app) (2)

```
from dash import Dash, dcc, html, dash_table
import pandas as pd
from dash.dependencies import Input, Output, State
import io
import numpy
import cv2
from tensorflow.keras.models import load_model
import numpy as np
import base64
import plotly.graph_objs as go
import plotly.express as px

class CNNDetector:
    def __init__(self, checkpoint_file, input_shape=(64,64) ):
        self.input_shape = input_shape
```

```
ModuleNotFoundError: No module named 'dash_bootstrap_components'
(venv) PS C:\Users\JPCli\Desktop\Stanford\CEE 329\new app> python new_test.py
Traceback (most recent call last):
  File "C:\Users\JPCli\Desktop\Stanford\CEE 329\new app\new_test.py", line 36, in <module>
  File "C:\Users\JPCli\Desktop\Stanford\CEE 329\new app\new_test.py", line 24, in __init__
    self.model = load_model(checkpoint_file)
  -> device: 0, name: NVIDIA GeForce RTX 3070 Laptop GPU, pci bus id: 0000:01:00.0, compute capability: 8.6
Dash is running on http://127.0.0.1:3005/

 * Serving Flask app 'new_test' (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: on
2022-05-24 21:12:25.503856: I tensorflow/core/platform/cpu_feature_guard.cc:193] This TensorFlow binary is optimized with oneAPI Deep Neural Network Library (oneDNN)
 to use the following CPU instructions in performance-critical operations:  AVX AVX2
To enable them in other operations, rebuild TensorFlow with the appropriate compiler flags.
2022-05-24 21:12:25.930432: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1532] Created device /job:localhost/replica:0/task:0/device:GPU:0 with 5490 MB memory:
 -> device: 0, name: NVIDIA GeForce RTX 3070 Laptop GPU, pci bus id: 0000:01:00.0, compute capability: 8.6
```

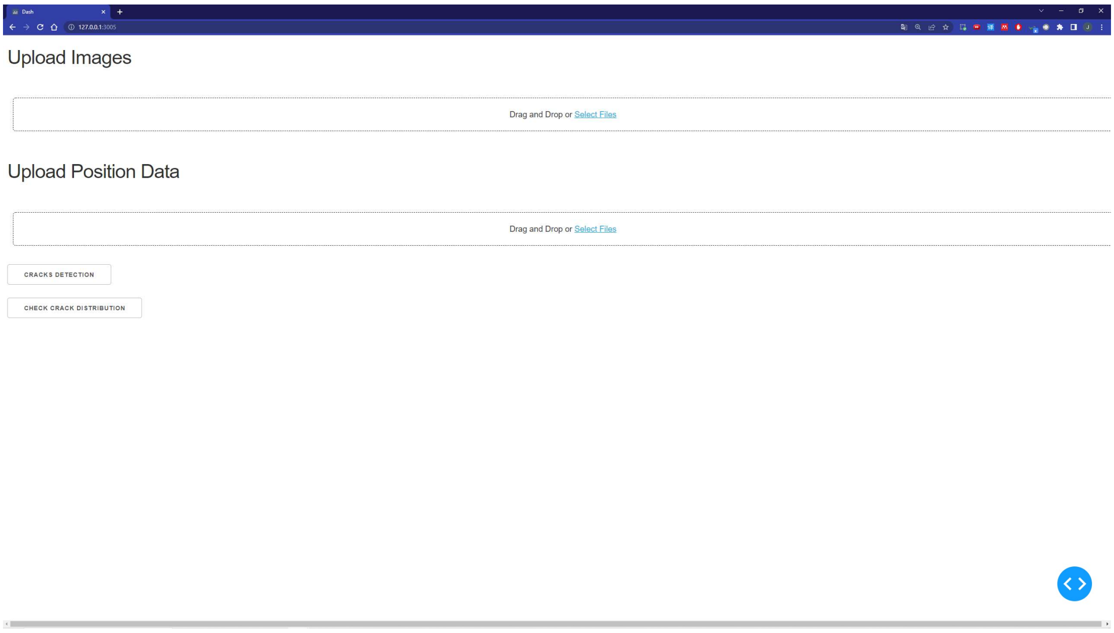
Run the script

The link is the test cracks webpage. Copy the link and open in browser…

This is the device (CPU/GPU) used for calling the model, which might be different

3. Go to the crack’s detection webpage

Open the link http://127.0.0.1:3005/ in your browser:

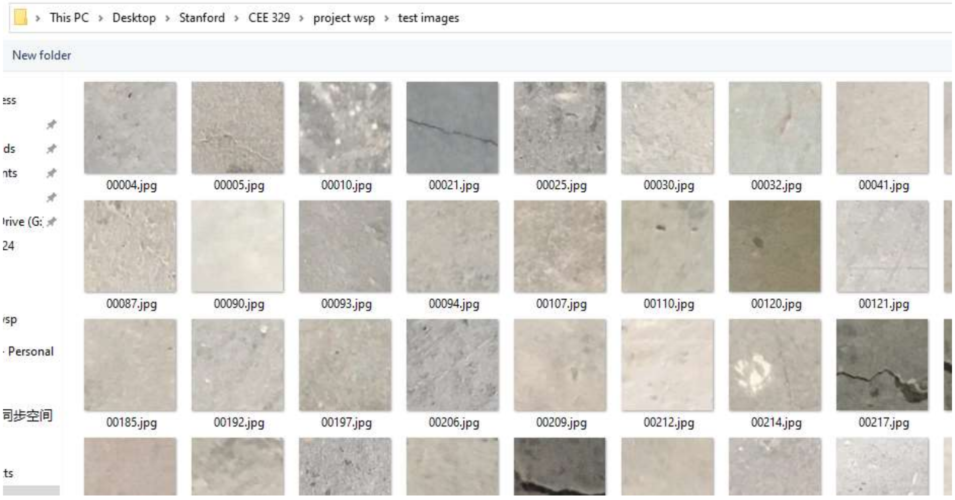


Refresh it before use.

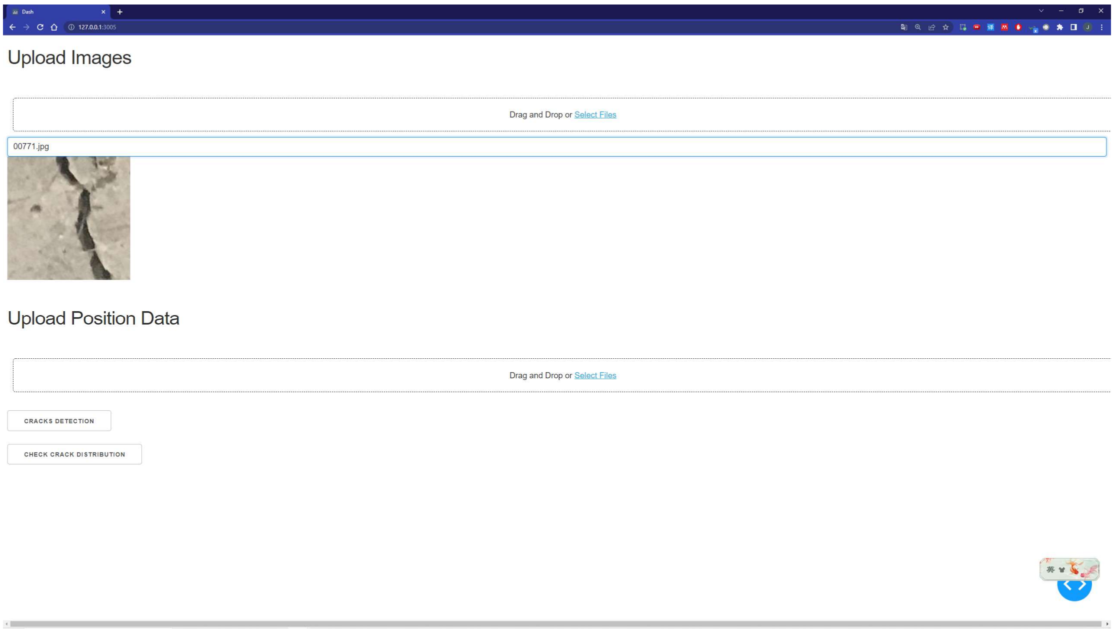
4. Use the Crack detection UI

a) Upload Images

Upload the images from the ***test image*** folder (the folder can be put anywhere as long as you can find it).



After uploading the images, it will look like this:

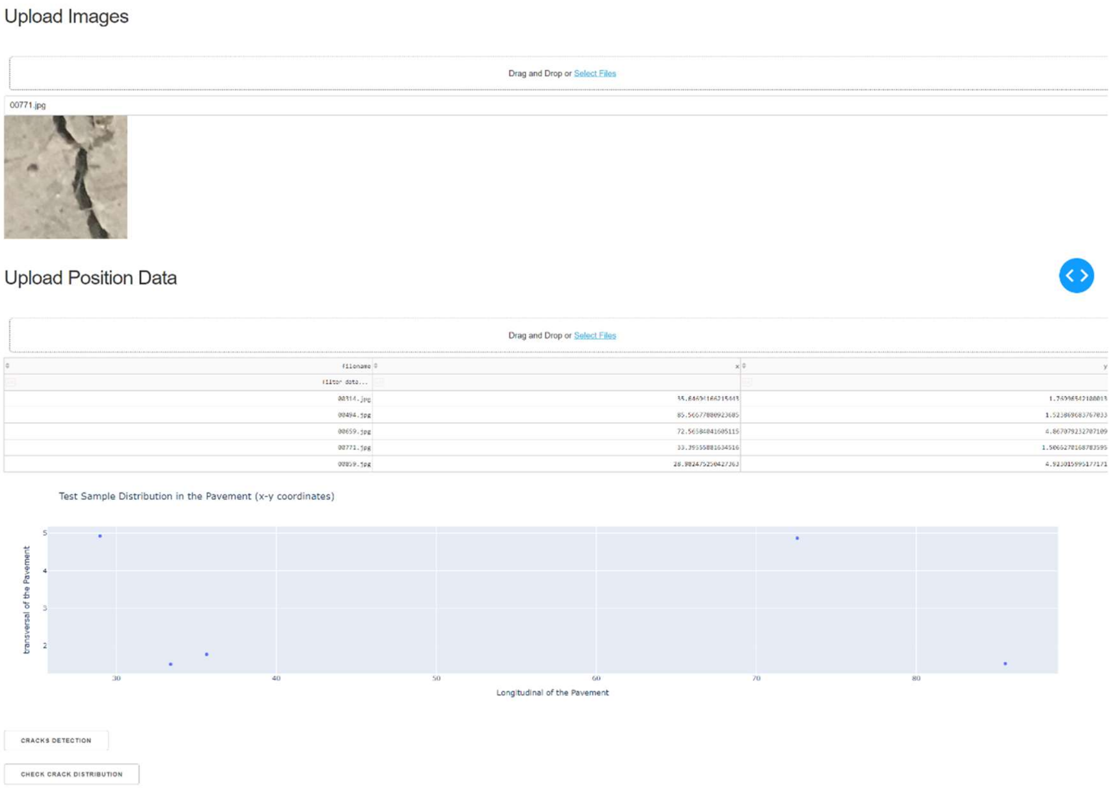


b) Upload Position Data

Upload the ***position_file.csv*** (Similarly, the file can be put anywhere as long as you can find it). Note: the ***Position_file*** corresponds to the ***test image*** folder. If one wants to add new image into the ***test image*** folder, a new row that includes the name, x, y coordinates of the image should also been added in the ***Position_file.csv*** to make sure the position of the image can be retrieved.

Position_file.csv 5/17/2022 8:36 AM Microsoft Excel C... 51 KB

After uploading the Position_file.csv, it will look like this:



Upload Images

Drag and Drop or Select Files

00771.jpg

Upload Position Data

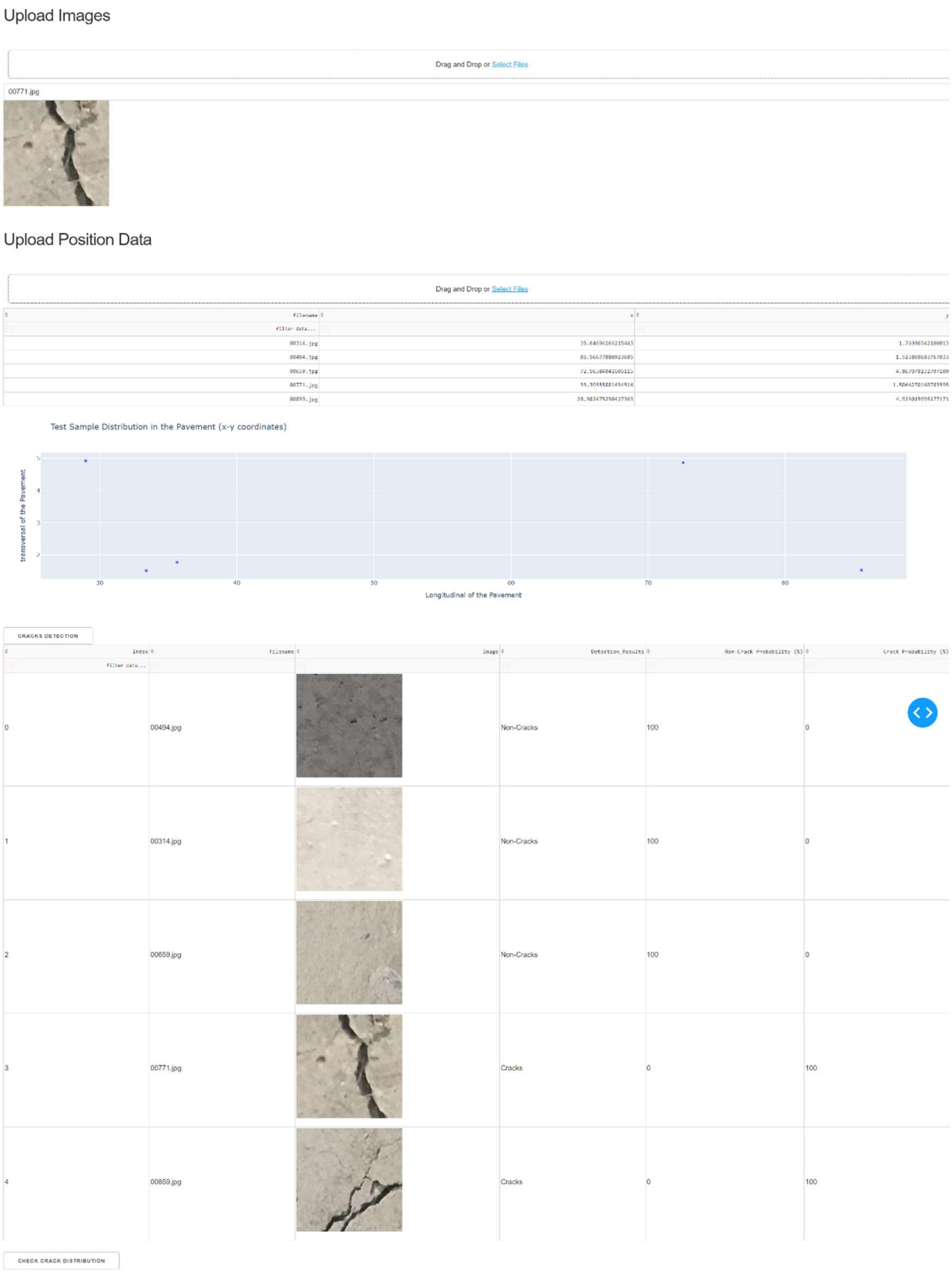
Drag and Drop or Select Files

filename	x	y
filter data...		
00314.jpg	35.64694166215443	1.76996542180013
00494.jpg	85.56677080923685	1.523869683767033
00659.jpg	72.56584041605115	4.867079232707109
00771.jpg	33.39555881634516	1.5066270168783595
00859.jpg	28.982475250427363	4.923015995177171

Test Sample Distribution in the Pavement (x-y coordinates)
transversal of the Pavement
Longitudinal of the Pavement
5
4
3
2
30
40
50
60
70
80
CRACKS DETECTION
CHECK CRACK DISTRIBUTION

c) Cracks Detection

Click the CRACKS DETECTION BUTTON. It will look like this:

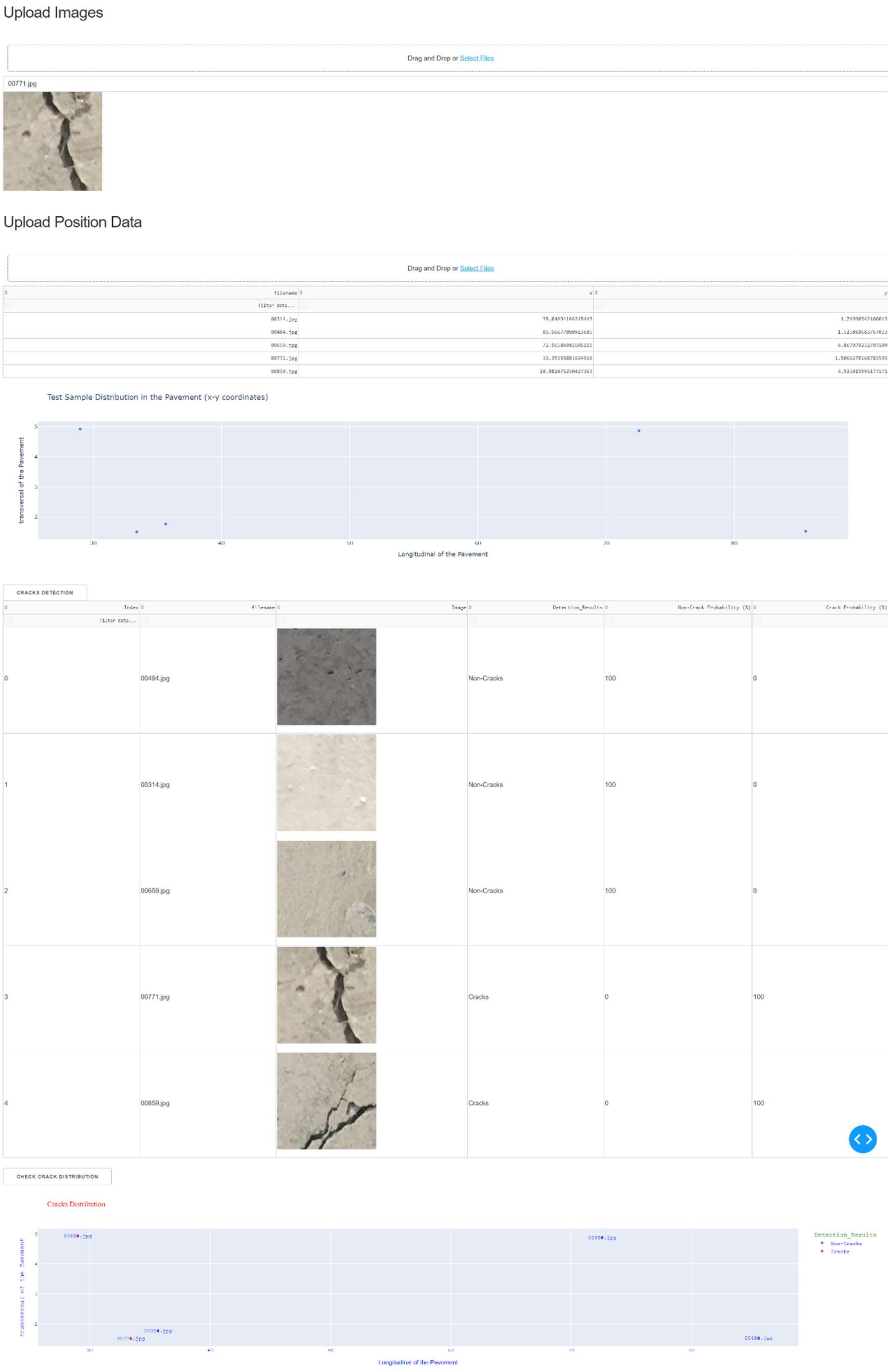

Upload Images
Drag and Drop or Select Files
00771.jpg
Upload Position Data
Drag and Drop or Select Files
Test Sample Distribution in the Pavement (x-y coordinates)
transversal of the Pavement
2
3
4
5
30
40
50
60
70
80
Longitudinal of the Pavement
CRACKS DETECTION
filter data...
CHECK CRACK DISTRIBUTION

filename	x	y
00314.jpg	35.64694166215443	1.76996542100013
00494.jpg	85.56677880923685	1.523869683767033
00659.jpg	72.56584841605115	4.867079232707109
00771.jpg	33.39555881634516	1.5066270168783595
00859.jpg	28.983475250427363	4.923015995177171

Index	filename	Image	Detection_Results	Non Crack Probability (%)	Crack Probability (%)
0	00494.jpg		Non-Cracks	100	0
1	00314.jpg		Non-Cracks	100	0
2	00659.jpg		Non-Cracks	100	0
3	00771.jpg		Cracks	0	100
4	00859.jpg		Cracks	0	100

d) Cracks Distribution

Click the CHECK CRACKS DISTRIBUTION button. It will look like this:



Upload Images

Drag and Drop or Select Files

00771.jpg

Upload Position Data

Drag and Drop or Select Files

filename	x	y
filter data...		
00314.jpg	35.64694166215443	1.7629654210001 3
00494.jpg	85.56677000923605	1.5230696837670 33
00659.jpg	72.56584041605115	4.867079232707109
00771.jpg	33.39555881634516	1.5066270168783595
00859.jpg	28.982475250427363	4.923015995177171

Test Sample Distribution in the Pavement (x-y coordinates)

CRACKS DETECTION

Index	filename	Image	Detection_Results	Non-Crack Probability (%)	Crack Probability (%)
filter data...					
0	00494.jpg		Non-Cracks	100	0
1	00314.jpg		Non-Cracks	100	0
2	00659.jpg		Non-Cracks	100	0
3	00771.jpg		Cracks	0	100
4	00859.jpg		Cracks	0	100

CHECK CRACK DISTRIBUTION

Cracks Distribution

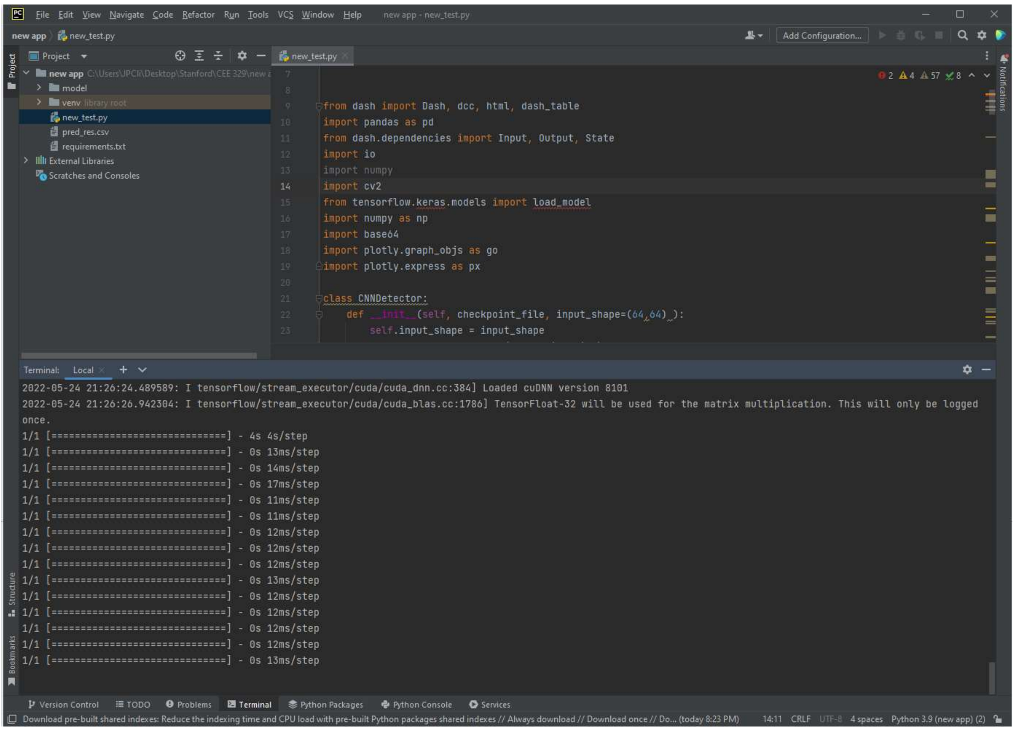
e) Start a new test

Refresh the page and start a new test.

End the test

Close the webpage. Press Ctrl+C in the Terminal to stop the program.

Before stopping:

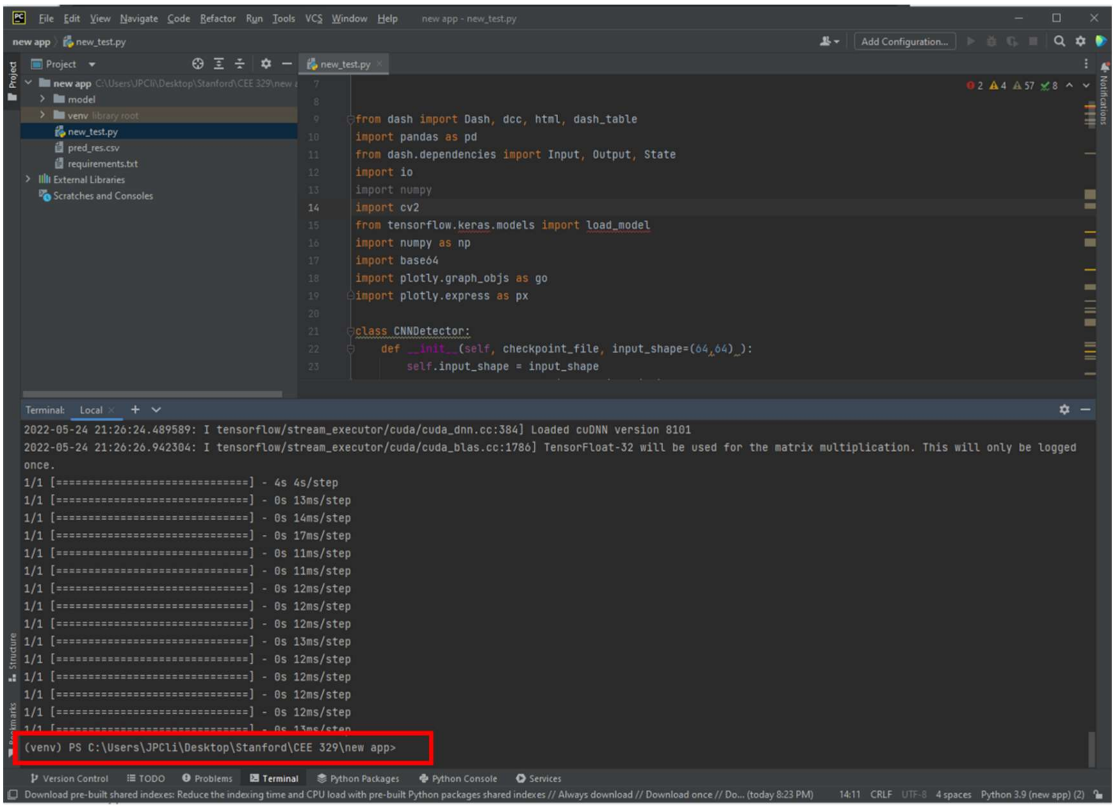


```python
from dash import Dash, dcc, html, dash_table
import pandas as pd
from dash.dependencies import Input, Output, State
import io
import numpy
import cv2
from tensorflow.keras.models import load_model
import numpy as np
import base64
import plotly.graph_objs as go
import plotly.express as px

class CNNDetector:
    def __init__(self, checkpoint_file, input_shape=(64,64) ):
        self.input_shape = input_shape
```

```
2022-05-24 21:26:24.489589: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384] Loaded cuDNN version 8101
2022-05-24 21:26:26.942304: I tensorflow/stream_executor/cuda/cuda_blas.cc:1786] TensorFloat-32 will be used for the matrix multiplication. This will only be logged
once.
1/1 [==============================] - 4s 4s/step
1/1 [==============================] - 0s 13ms/step
1/1 [==============================] - 0s 14ms/step
1/1 [==============================] - 0s 17ms/step
1/1 [==============================] - 0s 11ms/step
1/1 [==============================] - 0s 11ms/step
1/1 [==============================] - 0s 12ms/step
1/1 [==============================] - 0s 12ms/step
1/1 [==============================] - 0s 12ms/step
1/1 [==============================] - 0s 13ms/step
1/1 [==============================] - 0s 12ms/step
1/1 [==============================] - 0s 12ms/step
1/1 [==============================] - 0s 12ms/step
1/1 [==============================] - 0s 12ms/step
1/1 [==============================] - 0s 13ms/step
```

File Edit View Navigate Code Refactor Run Tools VCS Window Help
new app - new_test.py
new app
new_test.py
Add Configuration...
Project
new app C:\Users\JPCli\Desktop\Stanford\CEE 329\new a
model
venv library root
new_test.py
pred_res.csv
requirements.txt
External Libraries
Scratches and Consoles
Terminal: Local
Version Control
TODO
Problems
Terminal
Python Packages
Python Console
Services
Download pre-built shared indexes: Reduce the indexing time and CPU load with pre-built Python packages shared indexes // Always download // Download once // Do... (today 8:23 PM)
14:11 CRLF UTF-8 4 spaces Python 3.9 (new app) (2)

After stopping:



```python
from dash import Dash, dcc, html, dash_table
import pandas as pd
from dash.dependencies import Input, Output, State
import io
import numpy
import cv2
from tensorflow.keras.models import load_model
import numpy as np
import base64
import plotly.graph_objs as go
import plotly.express as px

class CNNDetector:
    def __init__(self, checkpoint_file, input_shape=(64,64) ):
        self.input_shape = input_shape
```

```
2022-05-24 21:26:24.489589: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384] Loaded cuDNN version 8101
2022-05-24 21:26:26.942304: I tensorflow/stream_executor/cuda/cuda_blas.cc:1786] TensorFloat-32 will be used for the matrix multiplication. This will only be logged
once.
1/1 [==============================] - 4s 4s/step
1/1 [==============================] - 0s 13ms/step
1/1 [==============================] - 0s 14ms/step
1/1 [==============================] - 0s 17ms/step
1/1 [==============================] - 0s 11ms/step
1/1 [==============================] - 0s 11ms/step
1/1 [==============================] - 0s 12ms/step
1/1 [==============================] - 0s 12ms/step
1/1 [==============================] - 0s 12ms/step
1/1 [==============================] - 0s 13ms/step
1/1 [==============================] - 0s 12ms/step
1/1 [==============================] - 0s 12ms/step
1/1 [==============================] - 0s 12ms/step
1/1 [==============================] - 0s 12ms/step
1/1 [==============================] - 0s 13ms/step
(venv) PS C:\Users\JPCli\Desktop\Stanford\CEE 329\new app>
```

File Edit View Navigate Code Refactor Run Tools VCS Window Help
new app - new_test.py
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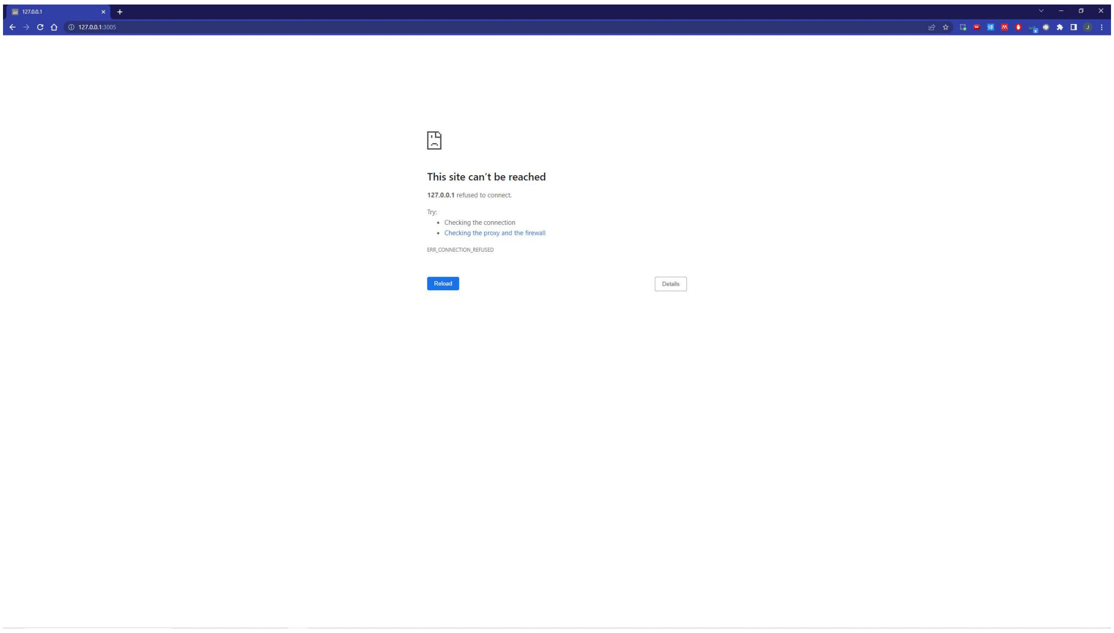
14:11 CRLF UTF-8 4 spaces Python 3.9 (new app) (2)

If you open the test webpage (http://127.0.0.1:3005/) again at this time, it will look like this:



This site can’t be reached

127.0.0.1 refused to connect.

Try:

- Checking the connection
- Checking the proxy and the firewall

ERR_CONNECTION_REFUSED

If you want to reactive the page, just enter **python new_test.py** in **Terminal** again as before. Then refresh the webpage.
If you want to end everything, just exit the PyCharm.