

# Pavement Distress Detection with CNNs using pavement images

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**GPT-4**

Large language model

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**ASCE  
TRANSPORTATION  
CONFERENCES 2023**

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*In partnership with Texas Department of Transportation*





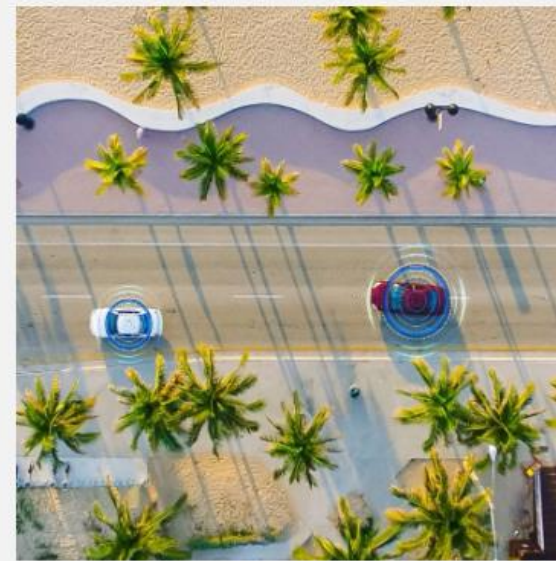
# Okte Research Group



Transportation Infrastructure  
Sustainability and Sustainable Pavements



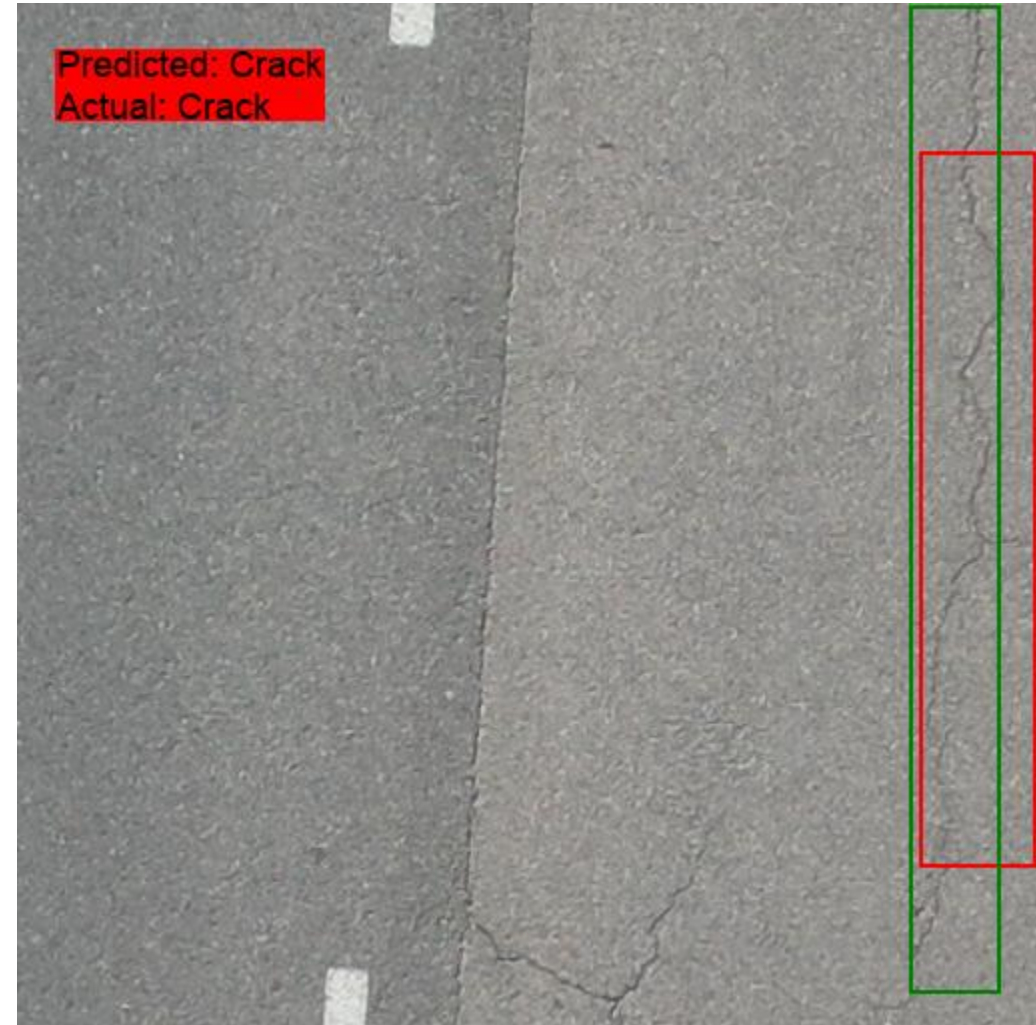
Artificial Intelligence and Machine Learning  
for Performance Prediction and Analysis



Autonomous Vehicle and Pavement  
Interaction

# What are we doing?

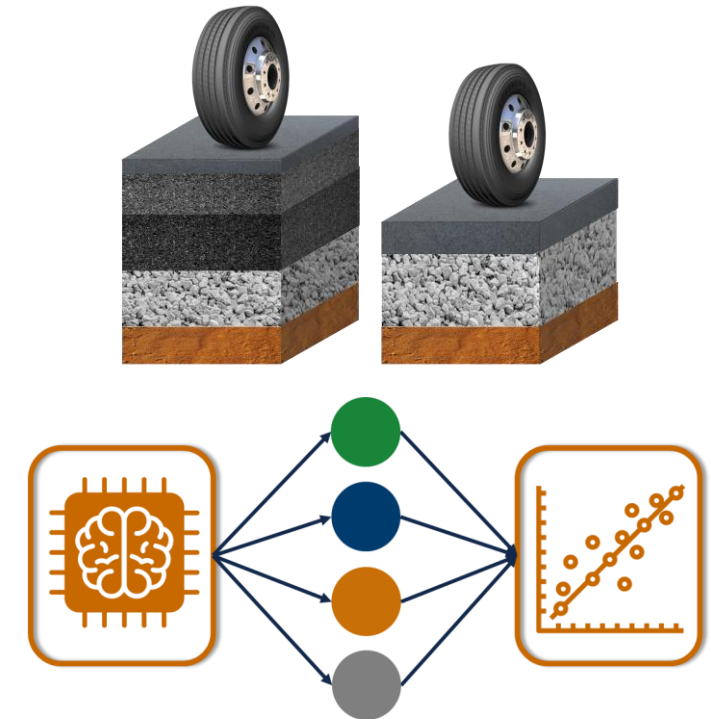
- ***A very quick* overview of machine learning and uses in pavement engineering**
- **Training a convolutional neural network to predict the location and type of distress using Google Colab and Keras**





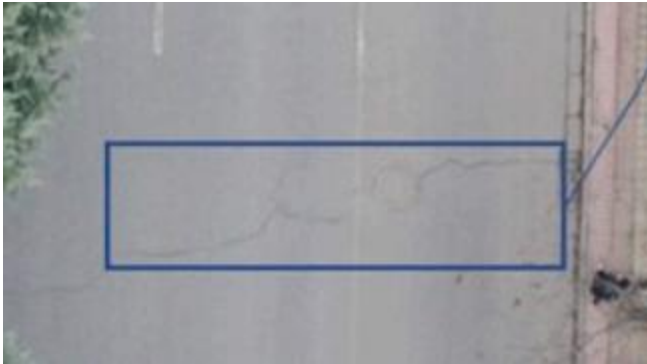
# Some applications of ML and AI in Pavement Engineering

- **Structural predictions**
  - Back-calculation of moduli from FWD
- **Performance Prediction**
  - Prediction of distresses in service
- **Design Optimization**
  - Optimization of mix-design and/or maintenance planning
- **Distress Prediction**
  - Prediction of location/type/extent of pavement distresses



# Distress Detection

**Where is the distress?**



**Object detection**

- **YOLO, SSD**

*Can technically also classify\**

**What is the distress?**



**Classification**

- **VGG16, ResNET**

**What is the extent/severity?**

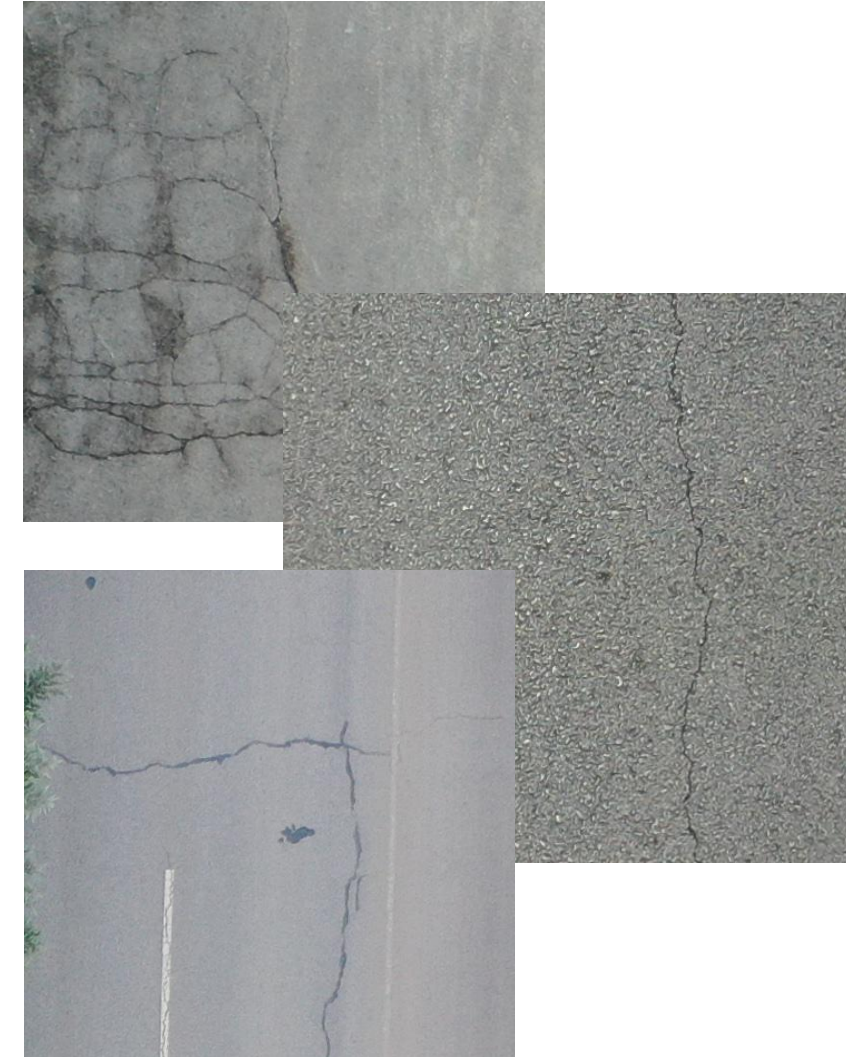


**Segmentation**

- **Mask R-CNN, DeepLabv3**

# What are we doing?

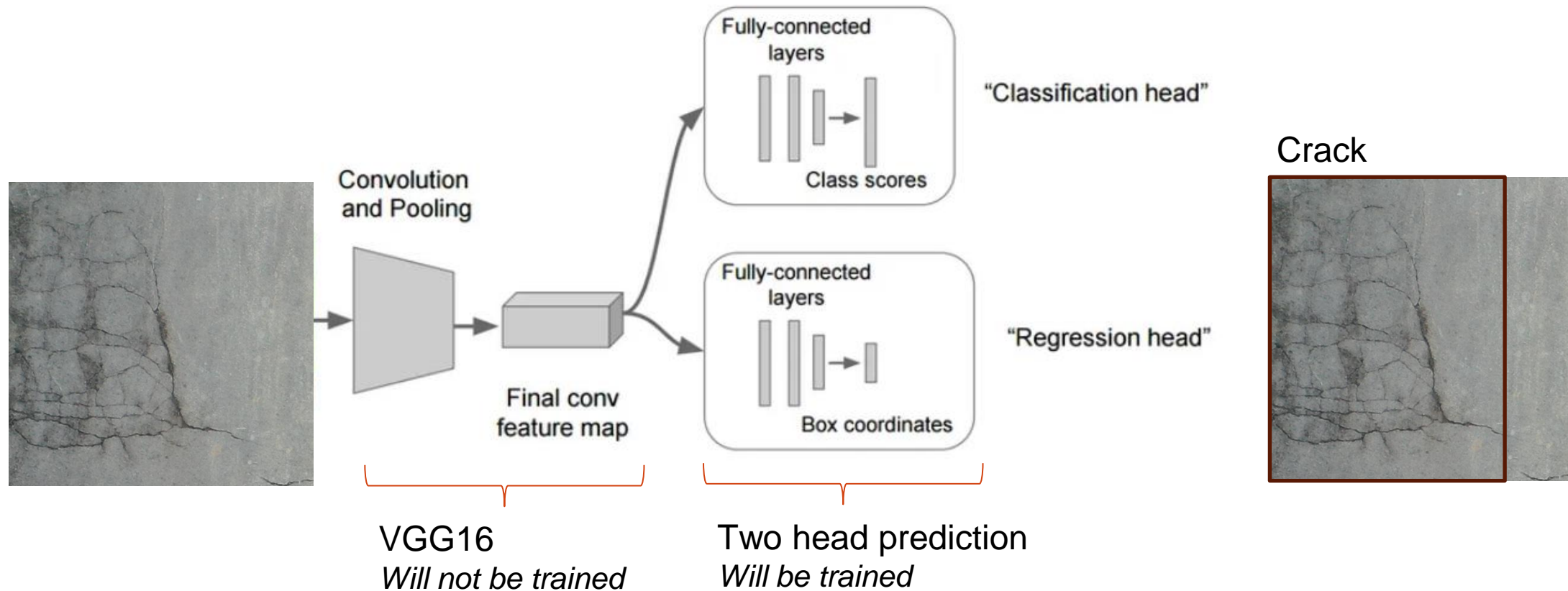
- Using the UAV Asphalt Pavement Distress Dataset to predict the location and type of distresses! 3000 images 512x512
  - Pavement distresses have been divided into six types: We make it three
    - Transverse crack;
    - Longitudinal crack;
    - Oblique crack;
    - Alligator crack;
    - Repair;
    - Pothole.
- Crack
- Repair
- Pothole



<https://github.com/tantantetetao/UAPD-Pavement-Distress-Dataset>

# How are we doing it?

- VGG16 backbone and two different heads



# We will be using Keras and Colab

If you would like to follow along

1. Open the following drive link on your Google Drive



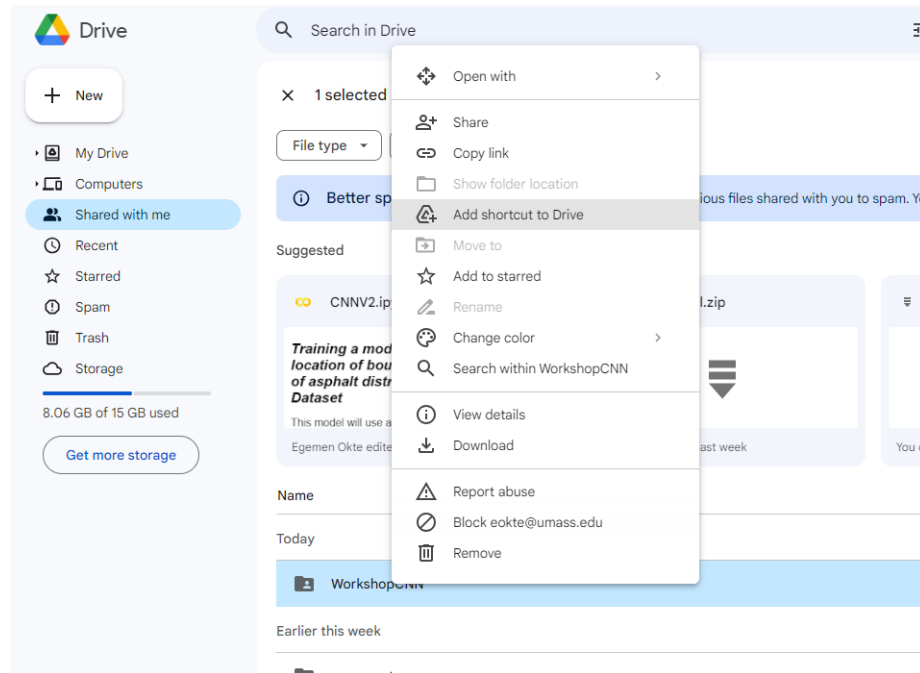
<https://rb.gy/632px>



# We will be using Keras and Colab

If you would like to follow along

**2.** Click on shared with me, right click on WorkshopCNN, click add shortcut to Drive

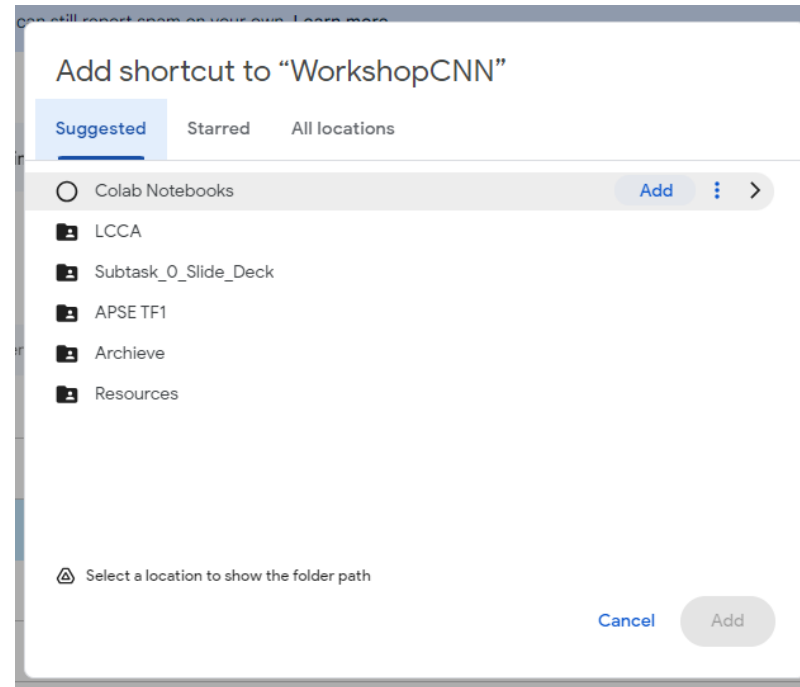


<https://rb.gy/632px>

# We will be using Keras and Colab

If you would like to follow along

**3.** Hover over an existing folder, and click on add

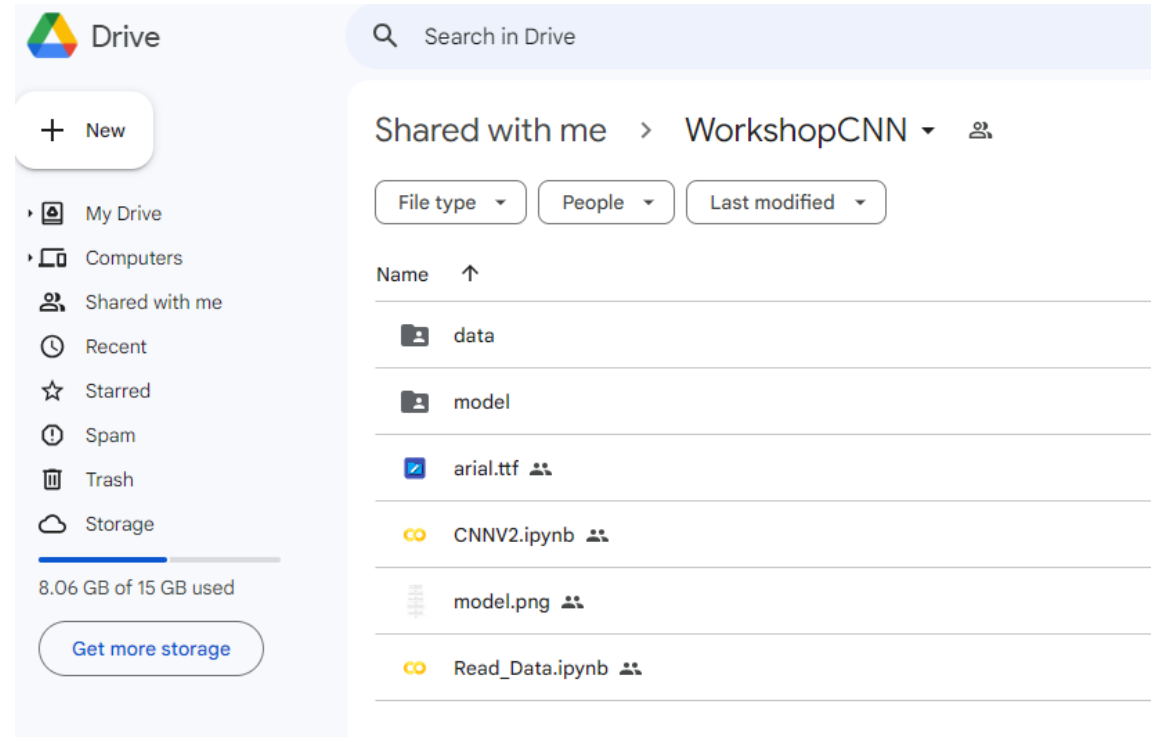


<https://rb.gy/632px>

# We will be using Keras and Colab

If you would like to follow along

**4.** Find the folder in My Drive. Click and open Read\_Data.ipynb



<https://rb.gy/632px>



# We will be using Keras and Colab

If you would like to follow along

## 5. Change the CurrentDir to your file path!

- You can make a copy for yourself later by downloading the file as a zip file as you do not have writing permissions for this shared folder



<https://rb.gy/632px>

```
Mount to Google Drive
```

```
[2] from google.colab import drive
import os
drive.mount('/content/drive')
CurrentDir='/content/drive/My Drive/Colab Notebooks/WorkshopCNN' #Change with your own path to the project!
os.chdir(CurrentDir)
```

Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force\_remount=True).

# We will be using Keras and Colab

If you would like to follow along

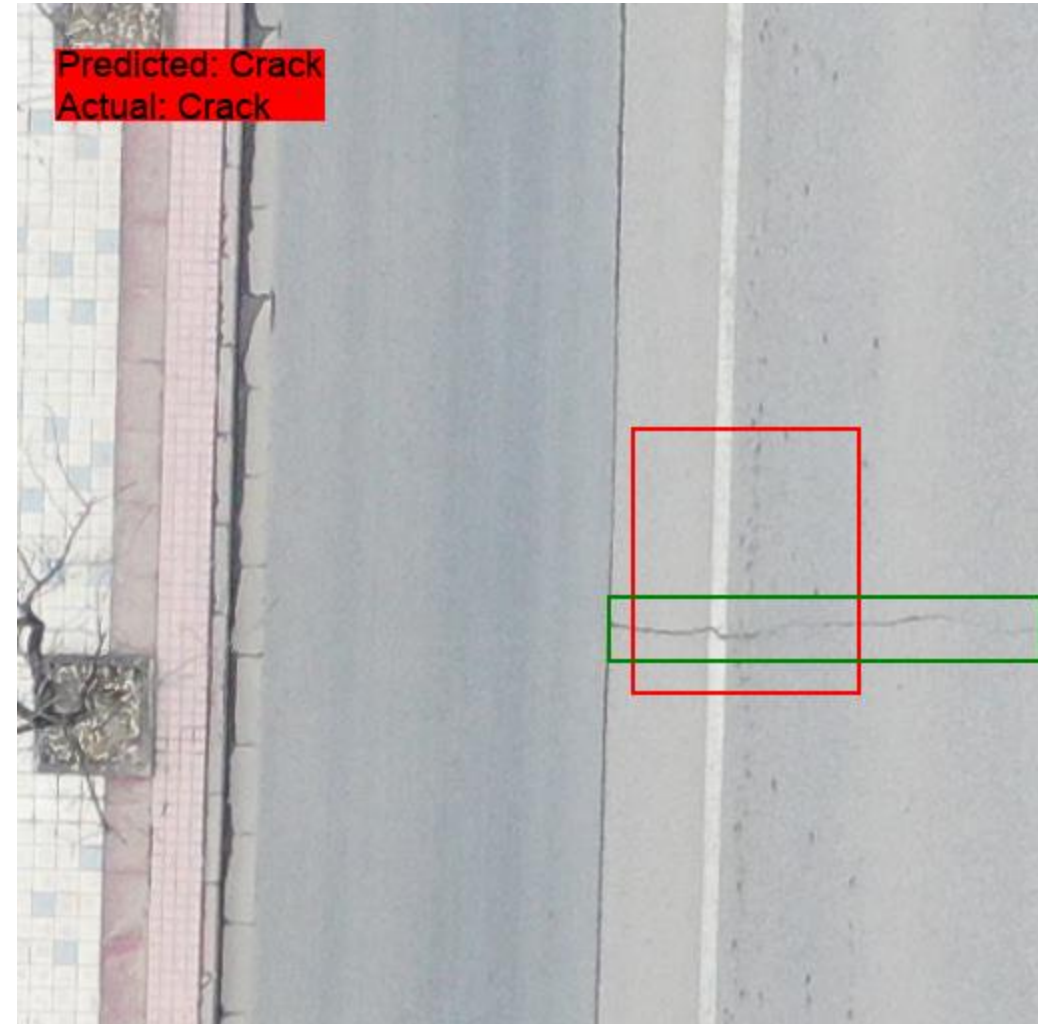
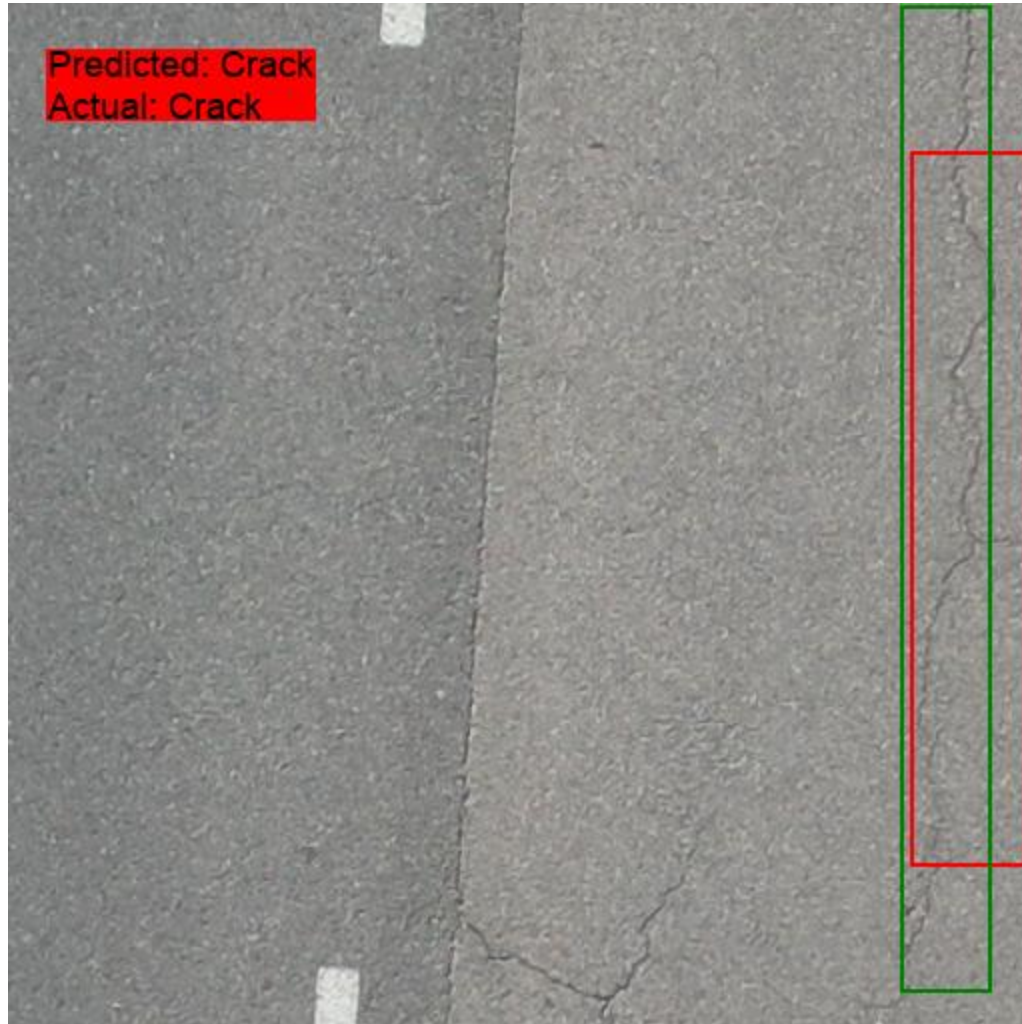
- 1.** We will first read and display the bounding box and type of distresses for some images using `Read_Data.ipnyb`
- 2.** We will train the network and predict locations and type of distresses using `CNNV2.ipnyb`



<https://rb.gy/632px>









Thank you! Questions?

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