SDAIA
الهيئة السعودية للبيانات والذكاء الاصطناعي
Saudi Data & AI Authority

أكاديمية طويق
TUWAIQ ACADEMY

# Road Classificaton

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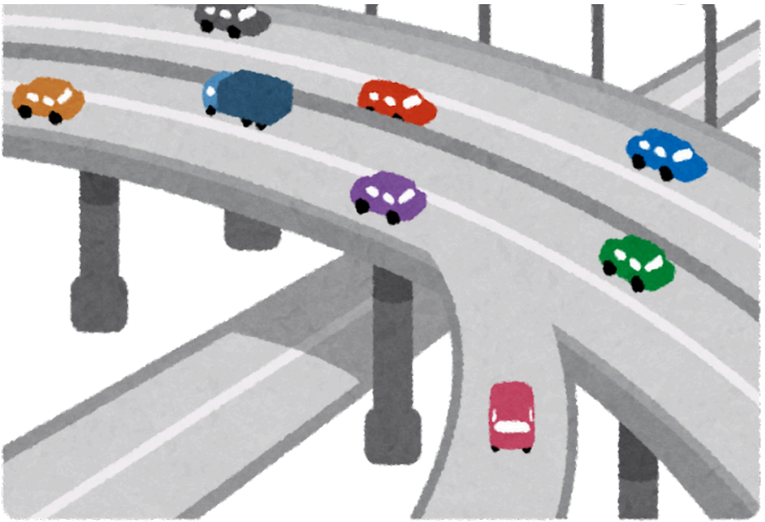
# Introduction

The dataset contains images of clean and dirty road,There are a total of 237 images

**Images:** Folder containing all the road images.

**metadata.csv:** A csv file mapping the image name with the class label.



| filename<br>Names of the image files. | label<br>Class label of the image. |
|---|---|
| 237<br>unique values | 0 1 |
| dirty_2.jpg | 1 |
| clean_36.jpg | 0 |
| clean_31.jpg | 0 |
| dirty_69.jpg | 1 |
| clean_113.jpg | 0 |
| clean_102.jpg | 0 |
| clean_43.jpg | 0 |
| dirty_27.jpg | 1 |
| dirty_53.jpg | 1 |
| clean_55.jpg | 0 |
| clean_28.jpg | 0 |
| dirty_55.jpg | 1 |
| clean_103.jpg | 0 |

# Clean

# dirty

# Agumentation

# Methods

- Add random brightness
- Resize and shift
- Blur using average

- Emboss effect
- Flip horizontally
- Gaussian blur

## Add random brightness

Effect: The resulting image can be either darker or lighter, which helps the model learn to recognize roads under diverse lighting environments.

## Resize and shift

Effect: The image is first resized, which alters its scale, and then shifted, which can simulate camera or object movement. This helps the model become invariant to scale and translation.

## Blur using average

Effect: This blur smooths out the image by averaging the pixels with their neighbors, reducing the image's detail level. This can help the model focus on more significant features rather than overfitting to noise.

## Emboss effect

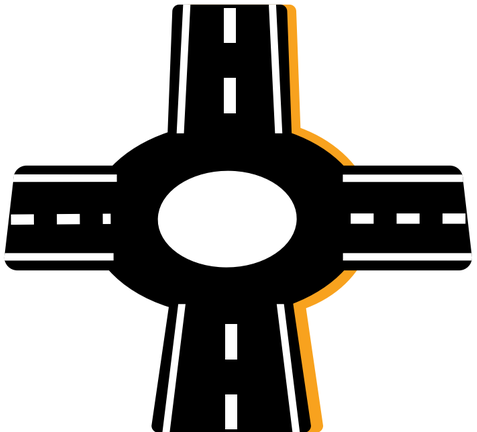
Effect: This filter uses a kernel to highlight edges and texture, creating a relief impression of the image. It's particularly useful for emphasizing subtle features in the road surface that indicate cleanliness or dirtiness.

## Flip horizontally

Effect: It creates a mirror image of the original, effectively doubling the dataset with new orientations, helping the model to generalize better across different directional views.

## Gaussian blur

Effect: Gaussian blur softens the image by weighting the average of the surrounding pixels with a Gaussian function, reducing detail and noise. This helps in reducing overfitting by making the model less sensitive to small, precise details in the input images.



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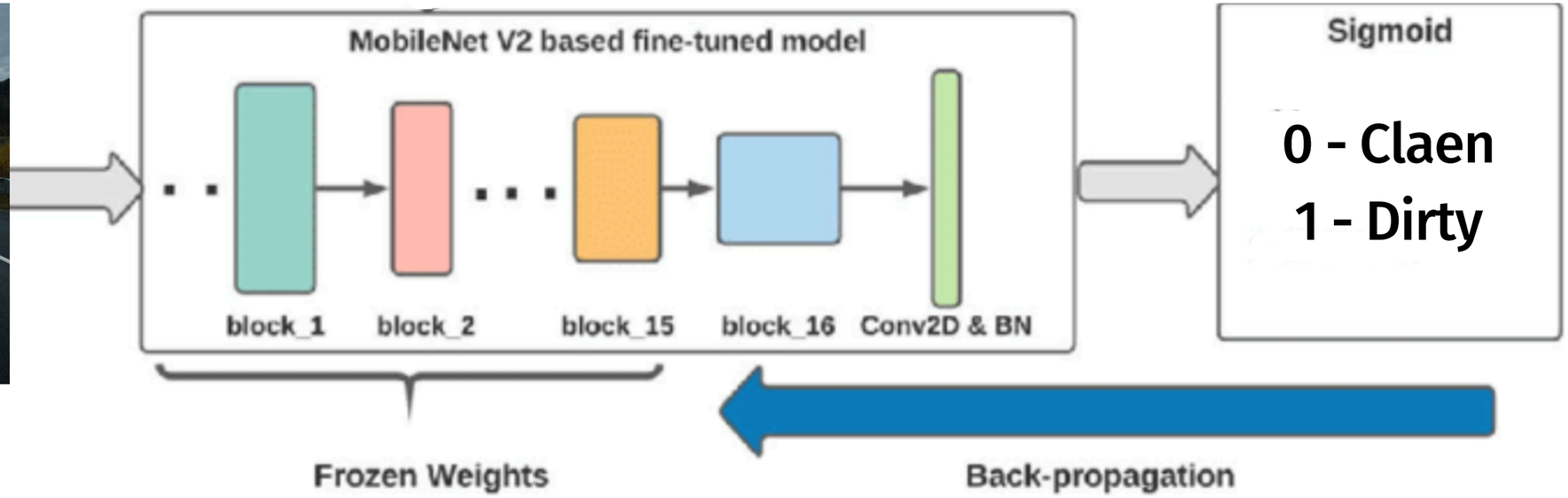
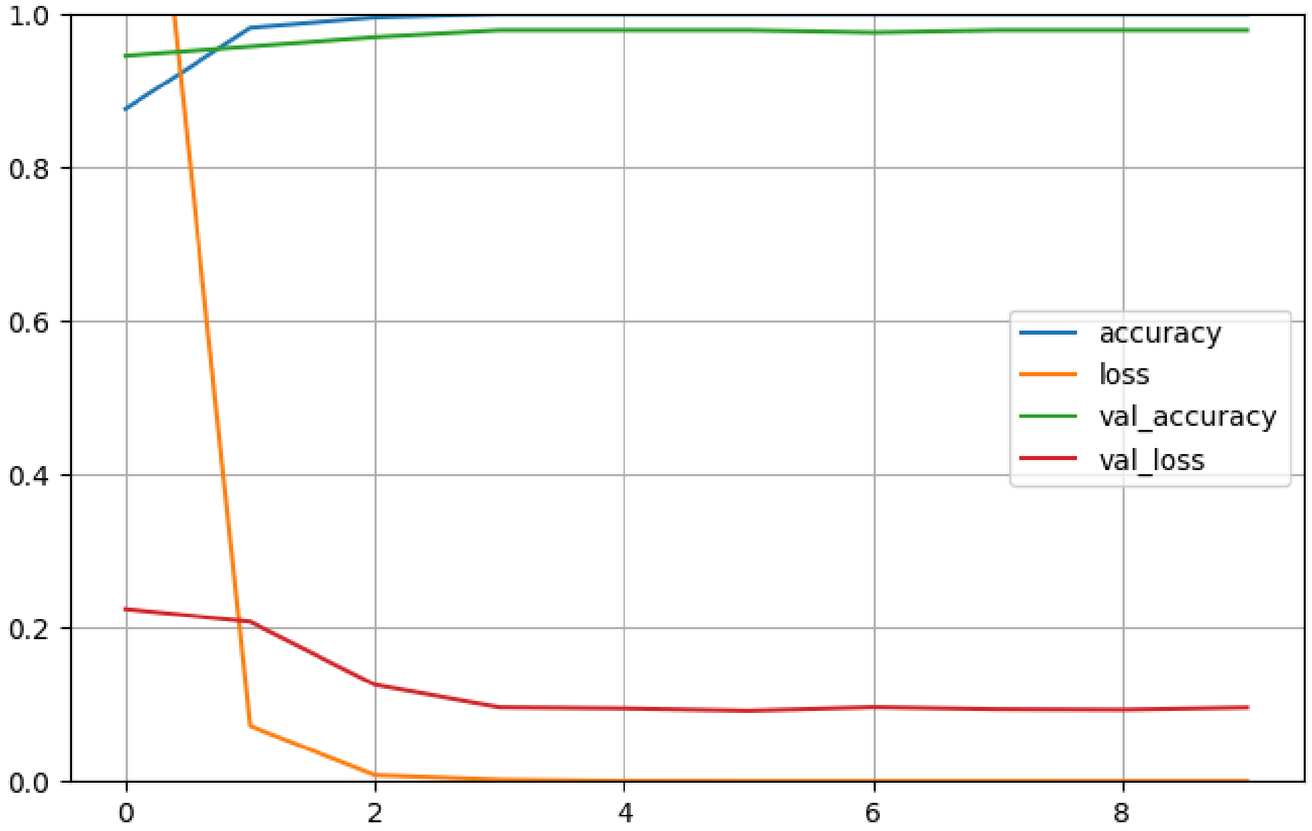
# Transfer Learning Implementation and Scratch Model

# MobileNetV2 architecture

Clean



# Transferred Model Performance




Confusion Matrix:

```
[[156   5]
 [  2 169]]
```

Classification Report:

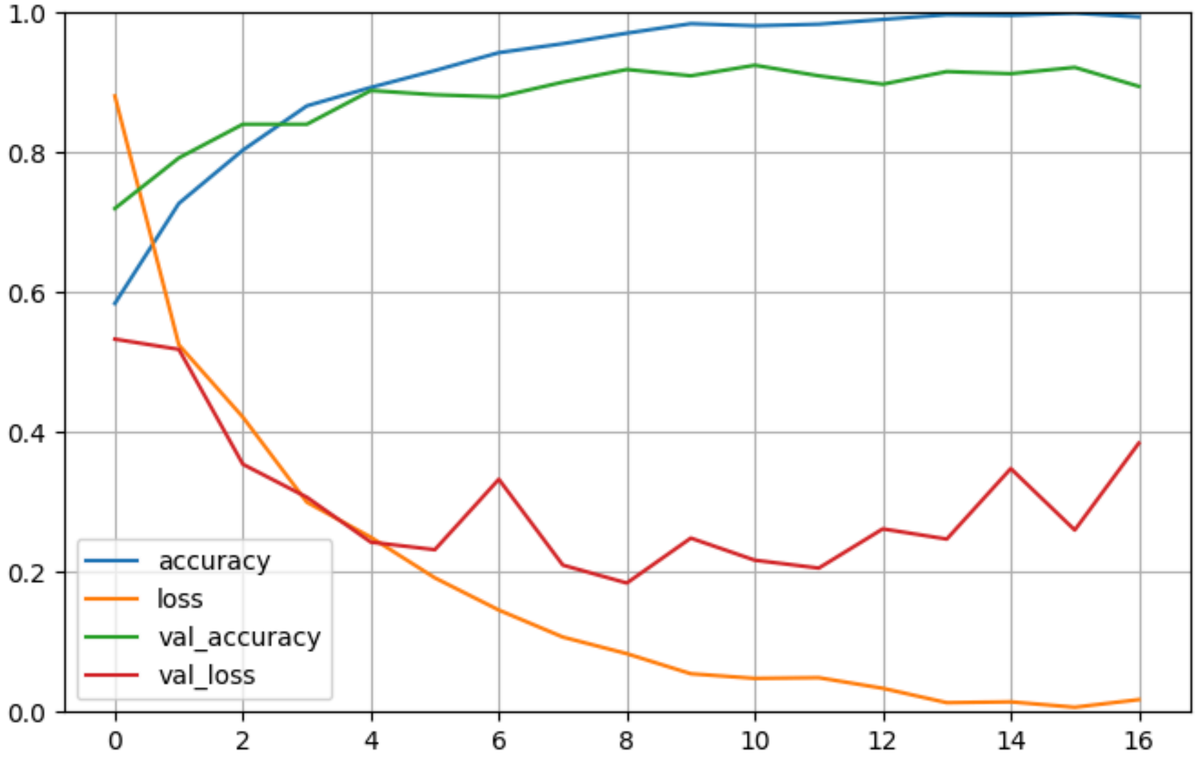
| | precision | recall | f1-score | support |
|---|---|---|---|---|
| Clean | 0.99 | 0.97 | 0.98 | 161 |
| Dirty | 0.97 | 0.99 | 0.98 | 171 |
| accuracy | | | 0.98 | 332 |
| macro avg | 0.98 | 0.98 | 0.98 | 332 |
| weighted avg | 0.98 | 0.98 | 0.98 | 332 |

# Transferred model Predection


```
Predictions: [[7.664878e-06]]
Predicted class: [[0]]
```

**0 - Clean**

# Scratch Model Performance




Confusion Matrix:

```
[[144  17]
 [ 10 161]]
```

Classification Report:

| | precision | recall | f1-score | support |
|---|---|---|---|---|
| Clean | 0.94 | 0.89 | 0.91 | 161 |
| Dirty | 0.90 | 0.94 | 0.92 | 171 |
| accuracy | | | 0.92 | 332 |
| macro avg | 0.92 | 0.92 | 0.92 | 332 |
| weighted avg | 0.92 | 0.92 | 0.92 | 332 |

# Scratch model Predection

```
Predictions: [[0.00453938]]
Predicted class: [[0]]
```

**0 - Clean**

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# Hyperparameter Tuning

filters range: (16-64)
kernel_size:(5,5)
pool size=(2,2)
Flatten layer()

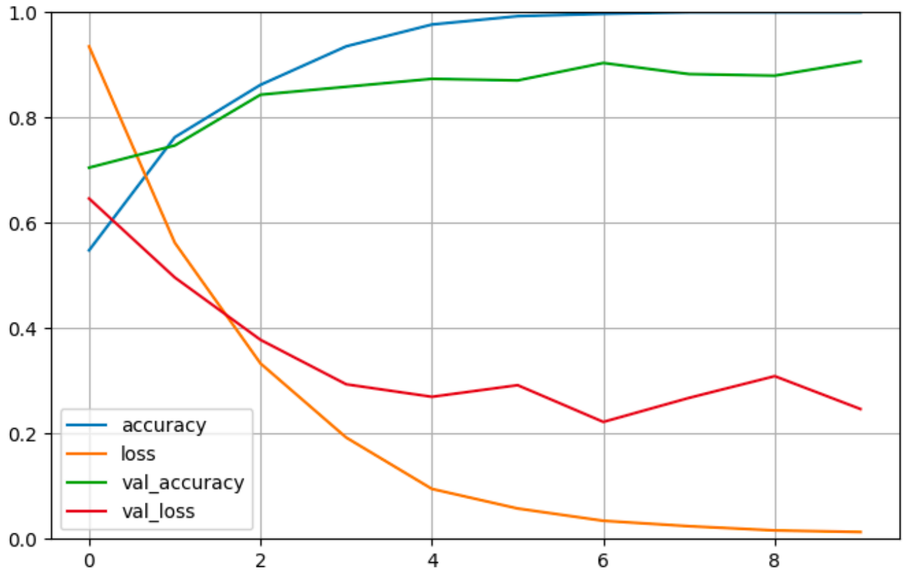
numbers of hidden layers:(0-3)
numbers of neurons:(16-128)
learning rate range:(1e-4 - 1e-2)

```
Trial 5 Complete [00h 05m 58s]
val_accuracy: 0.9066265225410461

Best val_accuracy So Far: 0.9126505851745605
Total elapsed time: 00h 20m 06s
```

```
Trial 3 summary
Hyperparameters:
filters: 18
kernel_size: 5
n_hidden: 0
n_neurons: 50
learning_rate: 0.0009749332269823054
Score: 0.9126505851745605
```

# Hyperparameter Tuning Performance

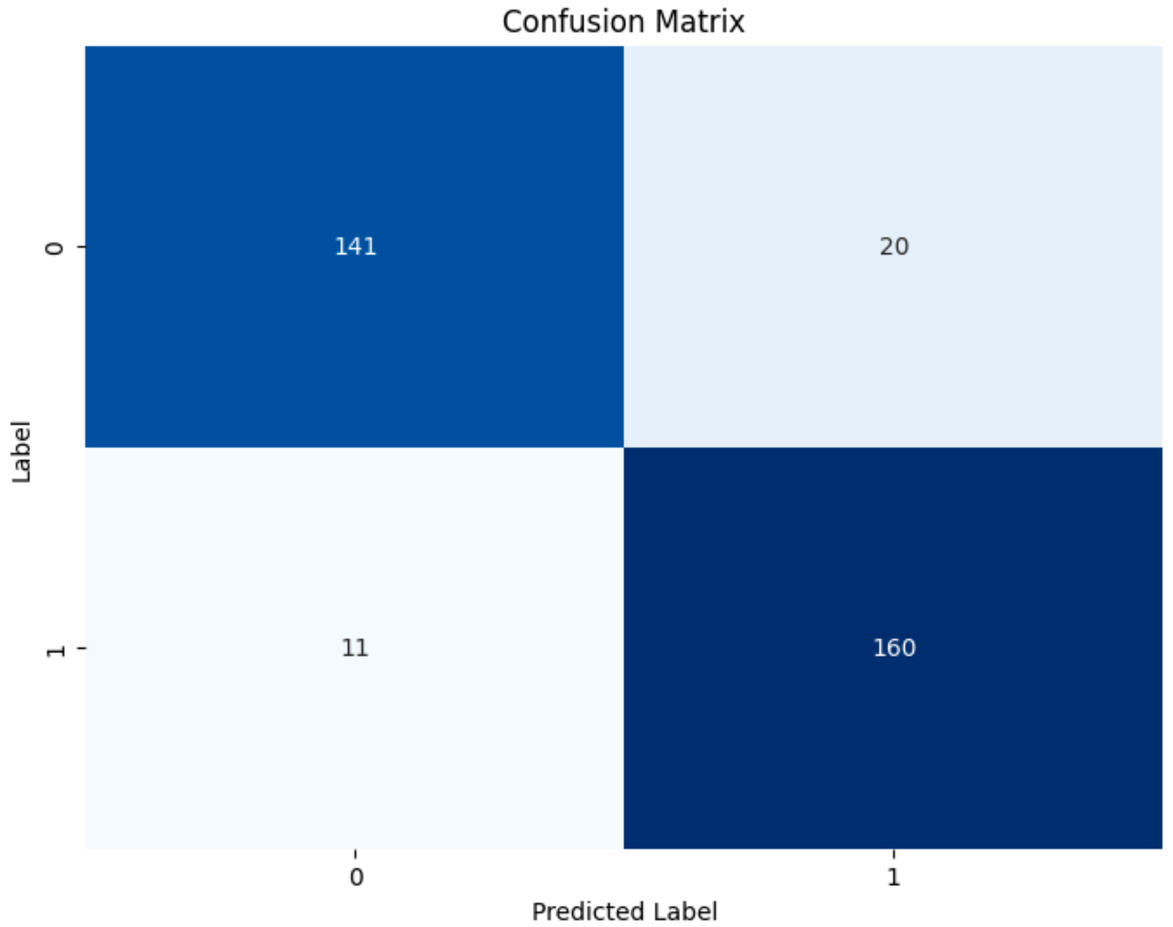



```
Classification Report:
              precision    recall  f1-score   support

       Clean       0.93      0.88      0.90       161
       Dirty       0.89      0.94      0.91       171

    accuracy                           0.91       332
   macro avg       0.91      0.91      0.91       332
weighted avg       0.91      0.91      0.91       332
```

# Hyperparameter Tuning confusion matrix



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# THANK YOU