Digital Talent Scholarship 2022

Convolution Neural Network Pt 1

Lead a sprint through the Associate Machine Learning Track

Agenda

- Computer Vision
- Convolution Neural Network
- Classifying Real-World Images
- Horse or Human
- Cats and Dogs

Are your students ML-ready?

Recap

Apa itu Computer Vision?

Coding Session

mnist / fashion_mnist dataset

mnist = tf.keras.datasets.fashion_mnist

Computer Vision

```
import tensorflow as tf

mnist = tf.keras.datasets.fashion_mnist

(training_images, training_labels) ,  (test_images, test_labels) =
mnist.load_data()

training_images = training_images/255.0

test_images = test_images/255.0

model = tf.keras.models.Sequential([tf.keras.layers.Flatten(),
                                    tf.keras.layers.Dense(512, activation=tf.nn.relu),
                                    tf.keras.layers.Dense(10, activation=tf.nn.softmax)])

model.compile(optimizer = 'adam', loss = 'sparse_categorical_crossentropy')

model.fit(training_images, training_labels, epochs=5)

model.evaluate(test_images, test_labels)

classifications = model.predict(test_images)

print(classifications[0])

print(test_labels[0])
```

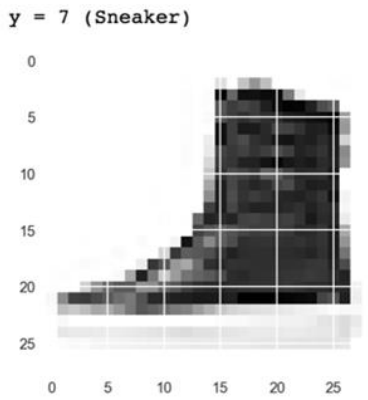
Additional Codes

```
import matplotlib.pyplot as plt

plt.imshow(training_images[0])

print(training_labels[0])

print(training_images[0])
```

Limitations of DNN

1. Not 28x28 greyscale
2. Not Left-facing boot
3. Must be centered, well defined, similar shapes

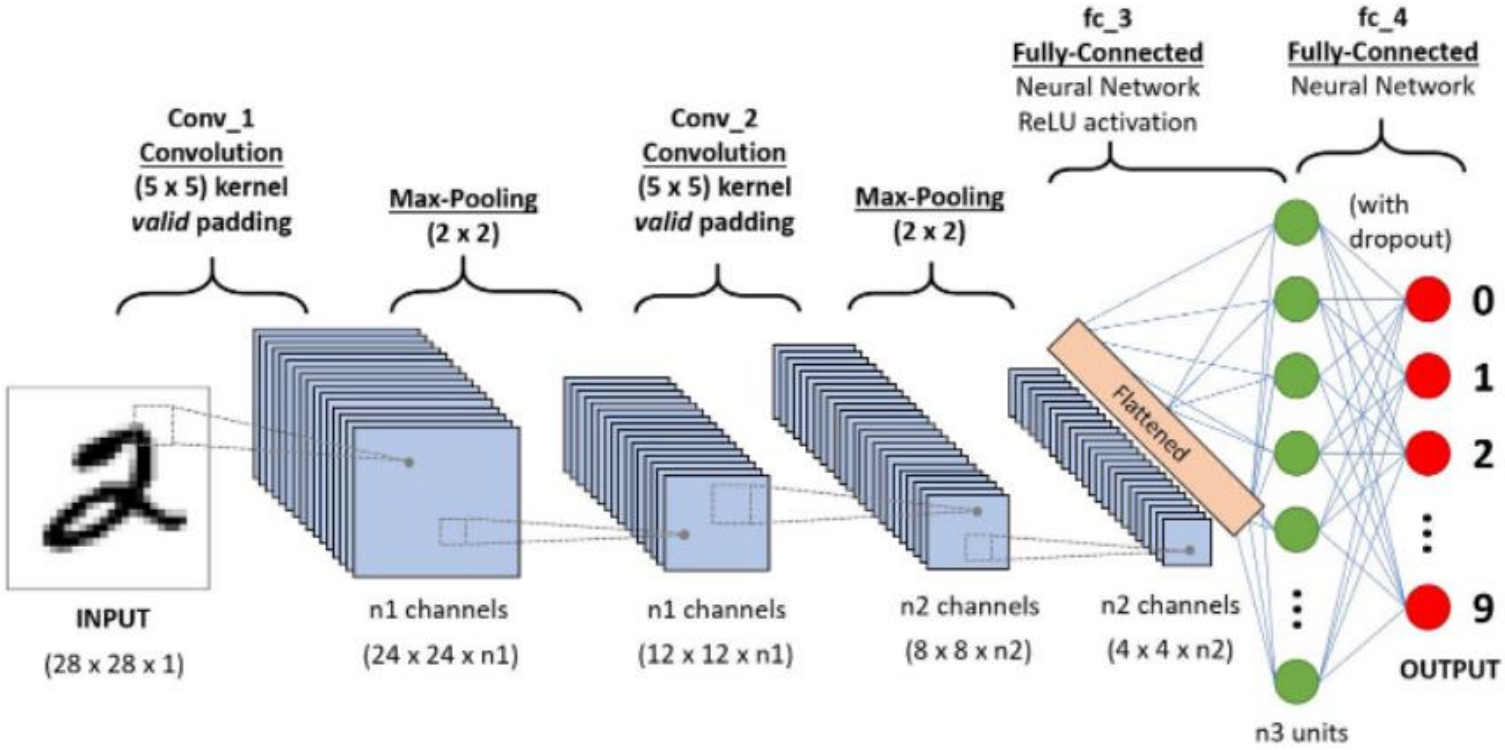
Solusinya? CNN!



Apa itu CNN

CNN atau bisa disebut sebagai **Convolution Neural Network** merupakan bagian dari AI

CNN merupakan bagian dari **Deep Learning**

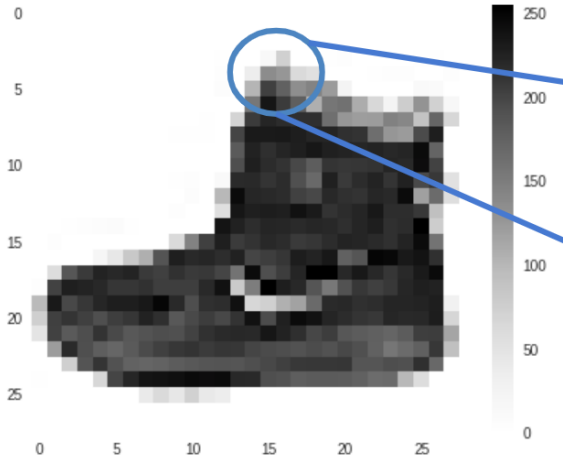

fc_3
Fully-Connected
Neural Network
ReLU activation
fc_4
Fully-Connected
Neural Network
Conv_1
Convolution
(5 x 5) kernel
valid padding
Max-Pooling
(2 x 2)
Conv_2
Convolution
(5 x 5) kernel
valid padding
Max-Pooling
(2 x 2)
(with
dropout)
Flattened
0
1
2
9
INPUT
(28 x 28 x 1)
n1 channels
(24 x 24 x n1)
n1 channels
(12 x 12 x n1)
n2 channels
(8 x 8 x n2)
n2 channels
(4 x 4 x n2)
n3 units
OUTPUT

Convolution NN

1. Mengekstrak fitur dalam sebuah gambar
2. Mencocokkan fitur yang tepat dengan set

Bagian manakah dari proses ini yang merupakan Machine Learning?

Convolution NN



0	64	128
48	192	144
142	226	168

Current Pixel Value is 192

Consider neighbor Values

-1	0	-2
.5	4.5	-1.5
1.5	2	-3

Filter Definition

```
CURRENT_PIXEL_VALUE = 192
NEW_PIXEL_VALUE = (-1 * 0) + (0 * 64) + (-2 * 128) +
                  (.5 * 48) + (4.5 * 192) + (-1.5 * 144) +
                  (1.5 * 42) + (2 * 226) + (-3 * 168)
```

tf.keras.layers.Conv2D(64, (3,3), activation='relu')

Convolutions is about Filter !

Input image

1	1	1	0	0
0	1	1	1	0
0	0	1	1	1
0	0	1	1	0
0	1	1	0	0

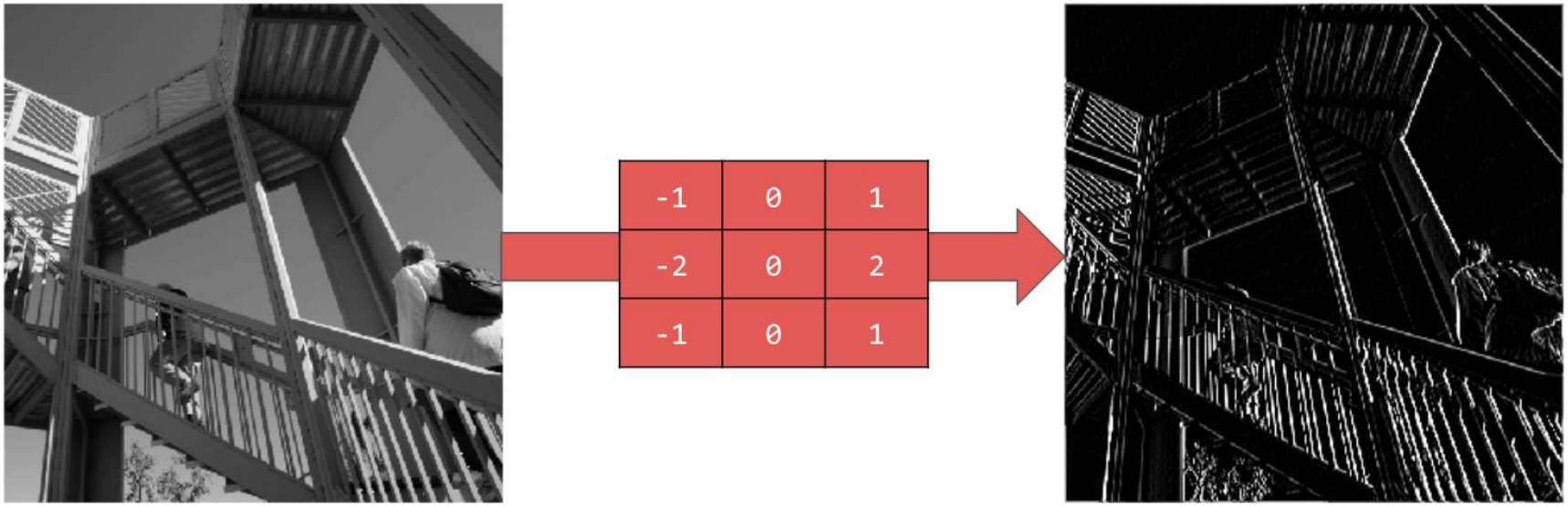
Filter

1	0	1
0	1	0
1	0	1

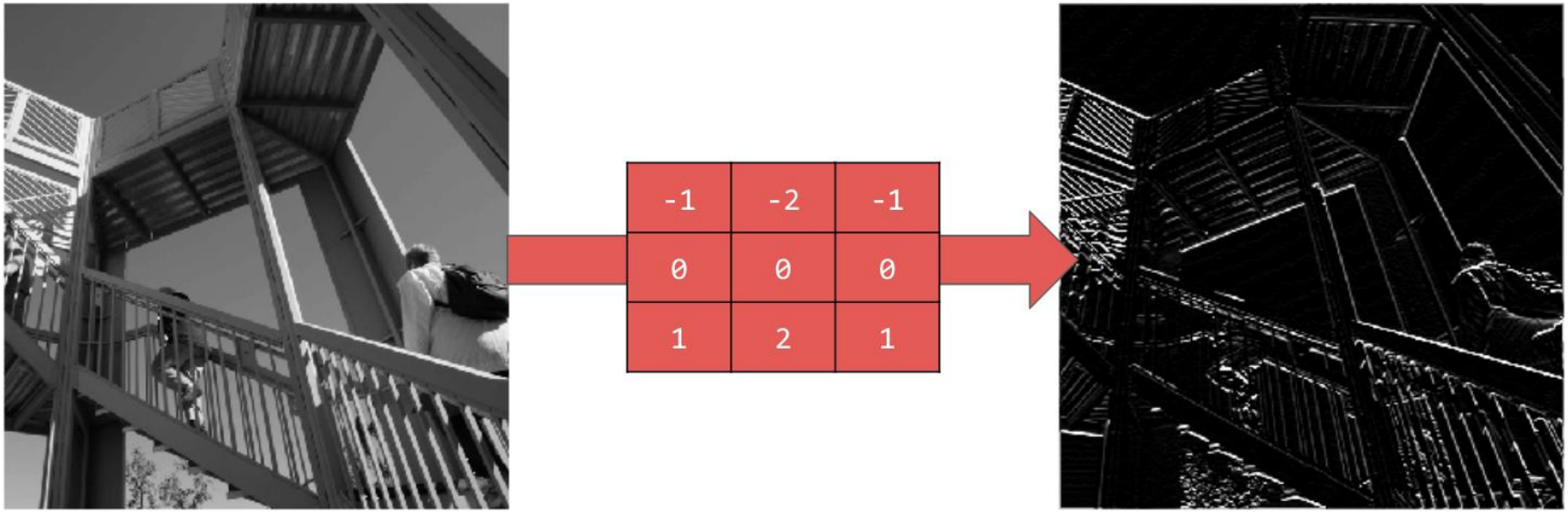
1x1	1x0	1x1	0	0
0x0	1x1	1x0	1	0
0x1	0x0	1x1	1	1
0	0	1	1	0
0	1	1	0	0

4		

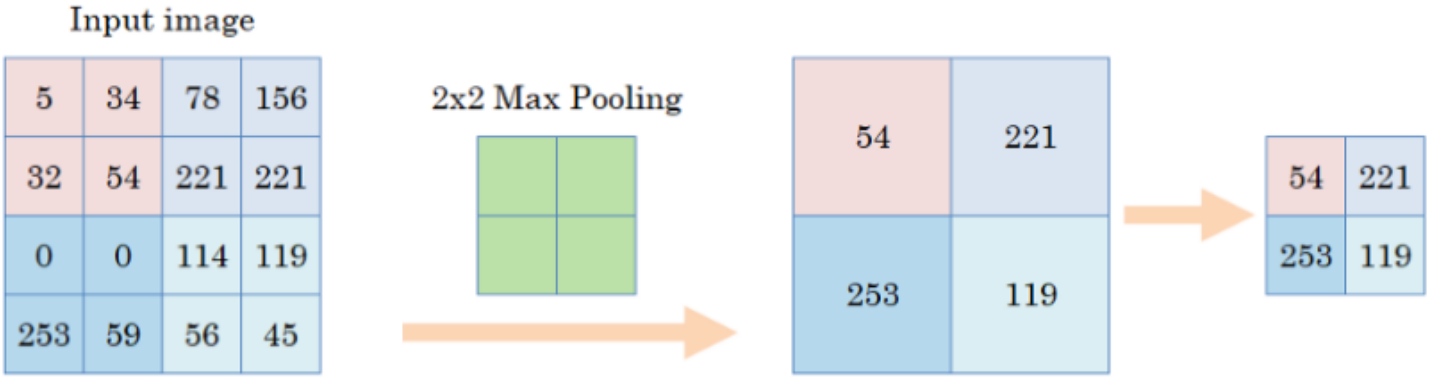
Convolution NN



Convolution NN

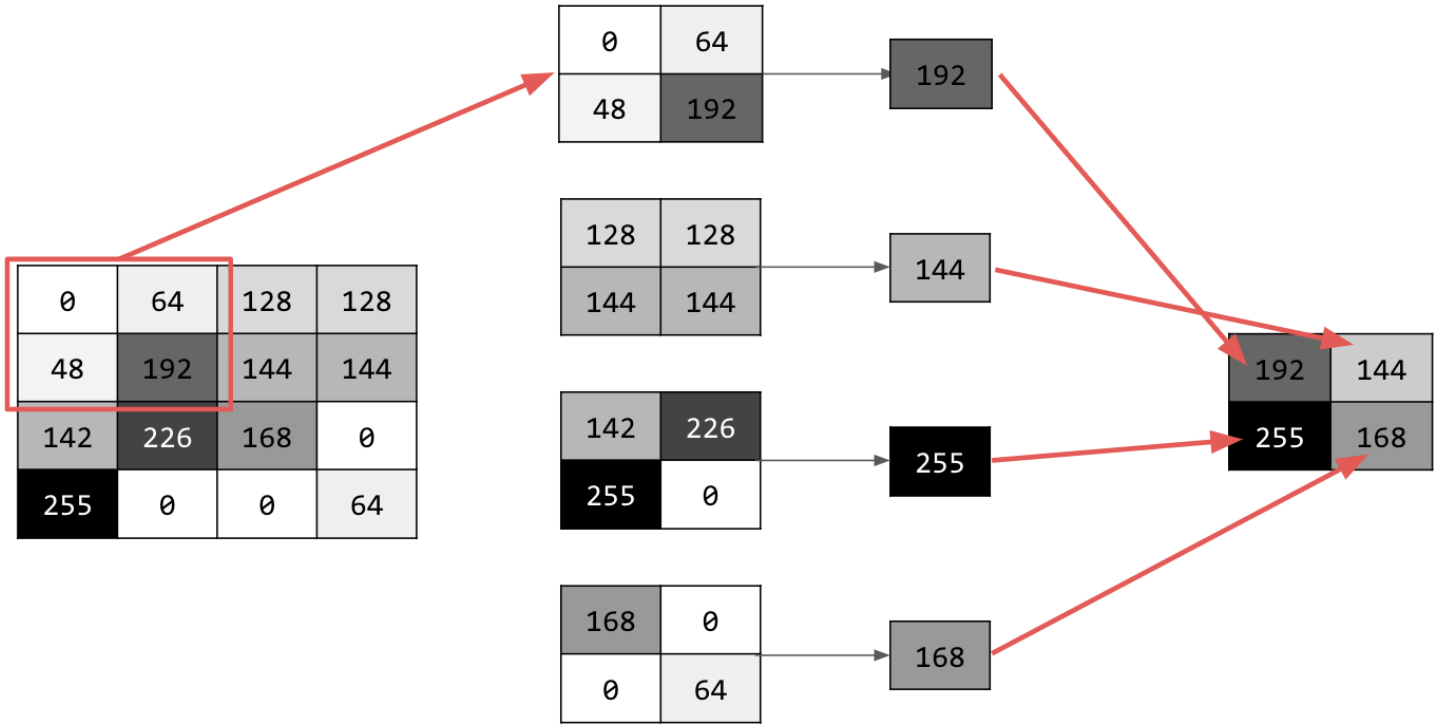


Lalu Apa itu Pooling ?

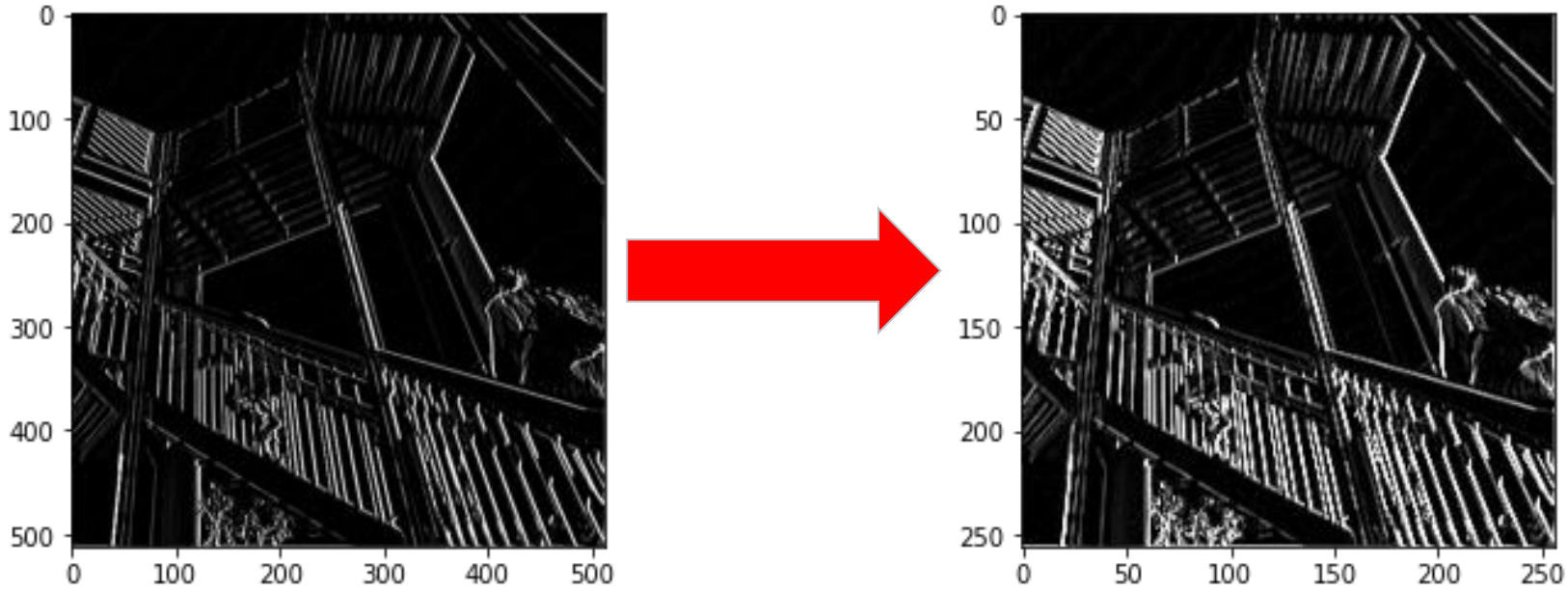


tf.keras.layers.MaxPooling2D(2, 2)

Pooling


0 64 128 128
48 192 144 144
142 226 168 0
255 0 0 64
0 64
48 192
192
128 128
144 144
144
142 226
255 0
255
168 0
0 64
168
192 144
255 168

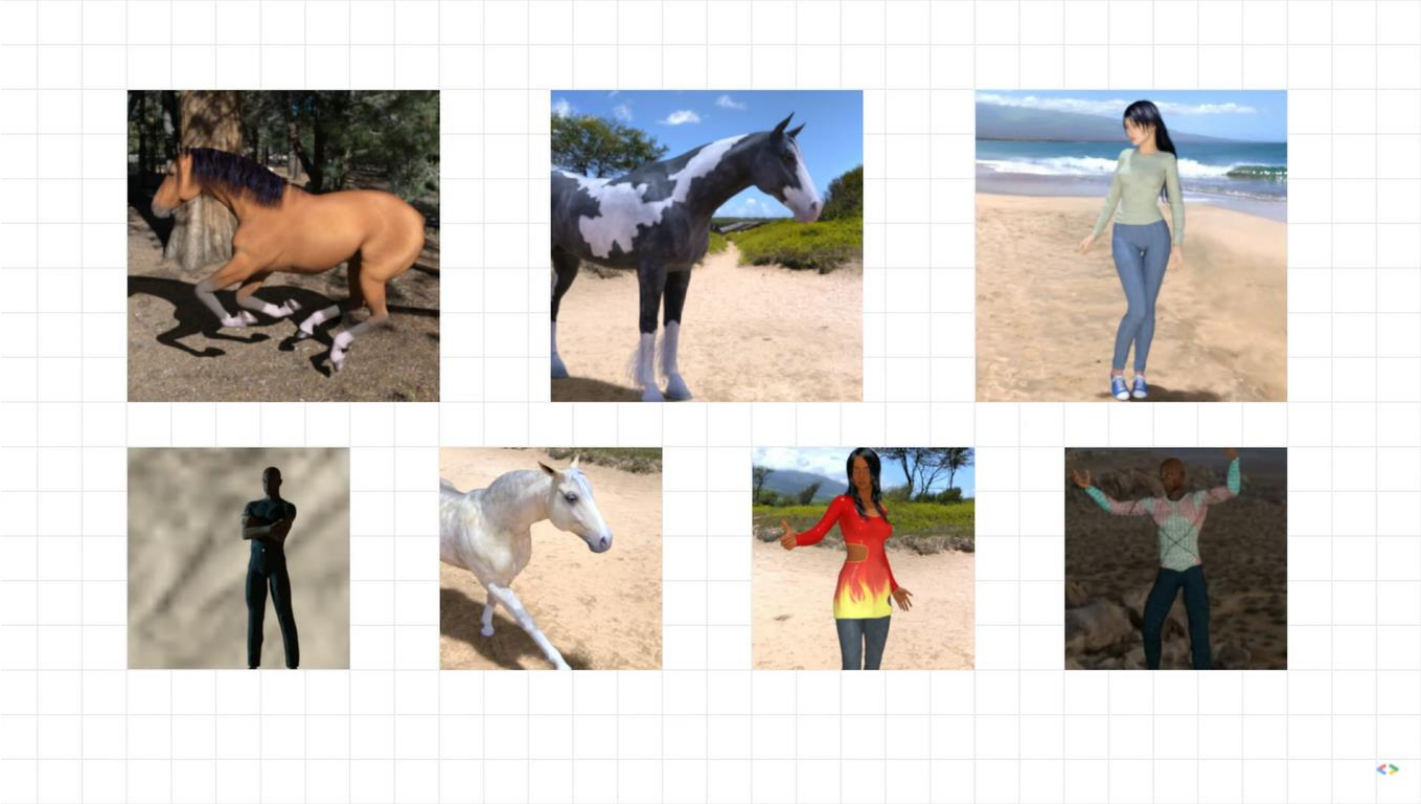
Pooling


0
100
200
300
400
500
0
100
200
300
400
500
0
50
100
150
200
250
0
50
100
150
200
250

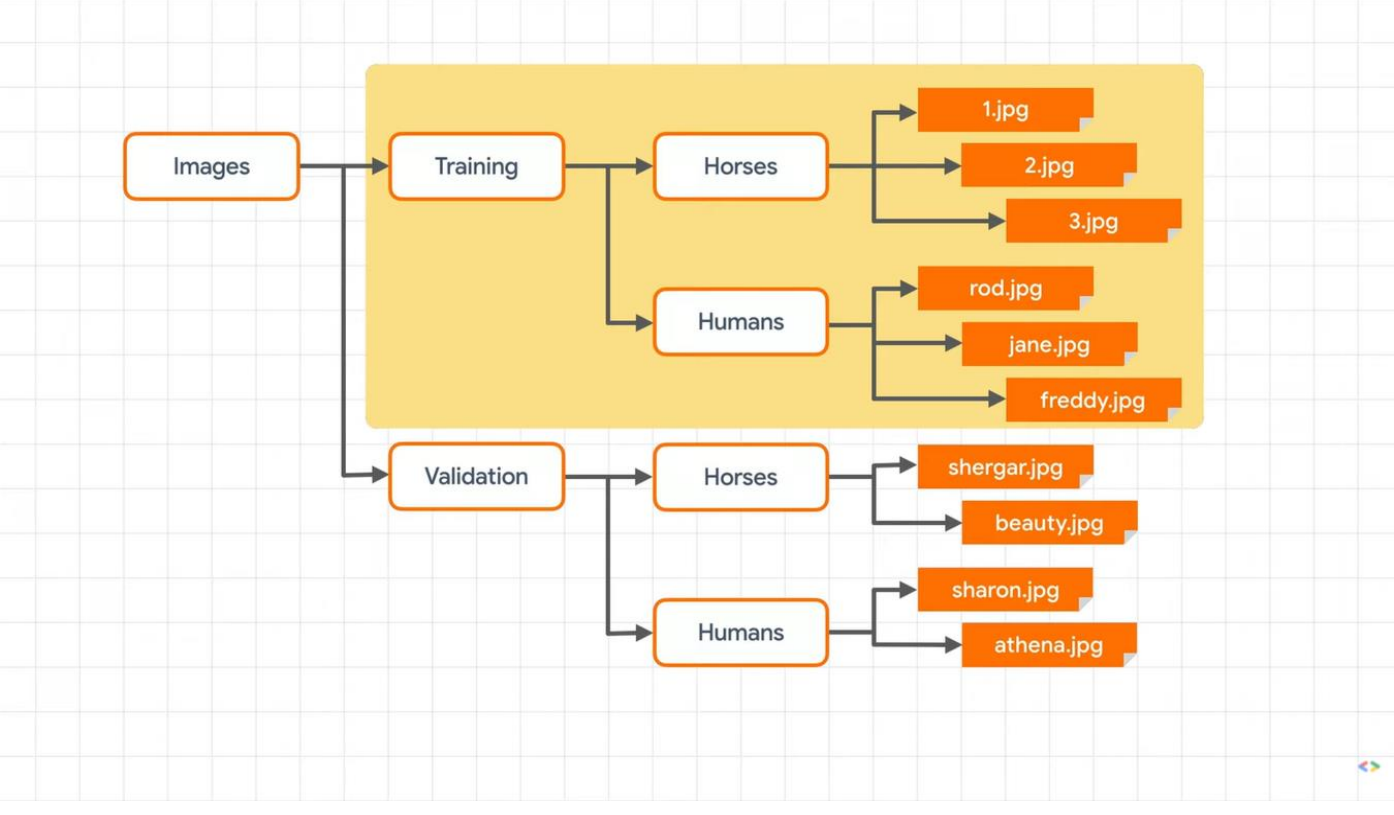
Contoh Filter dan Pooling

https://colab.research.google.com/drive/1CTxGUcjxQzvTWVFfF5j2LcopK82jN8E0

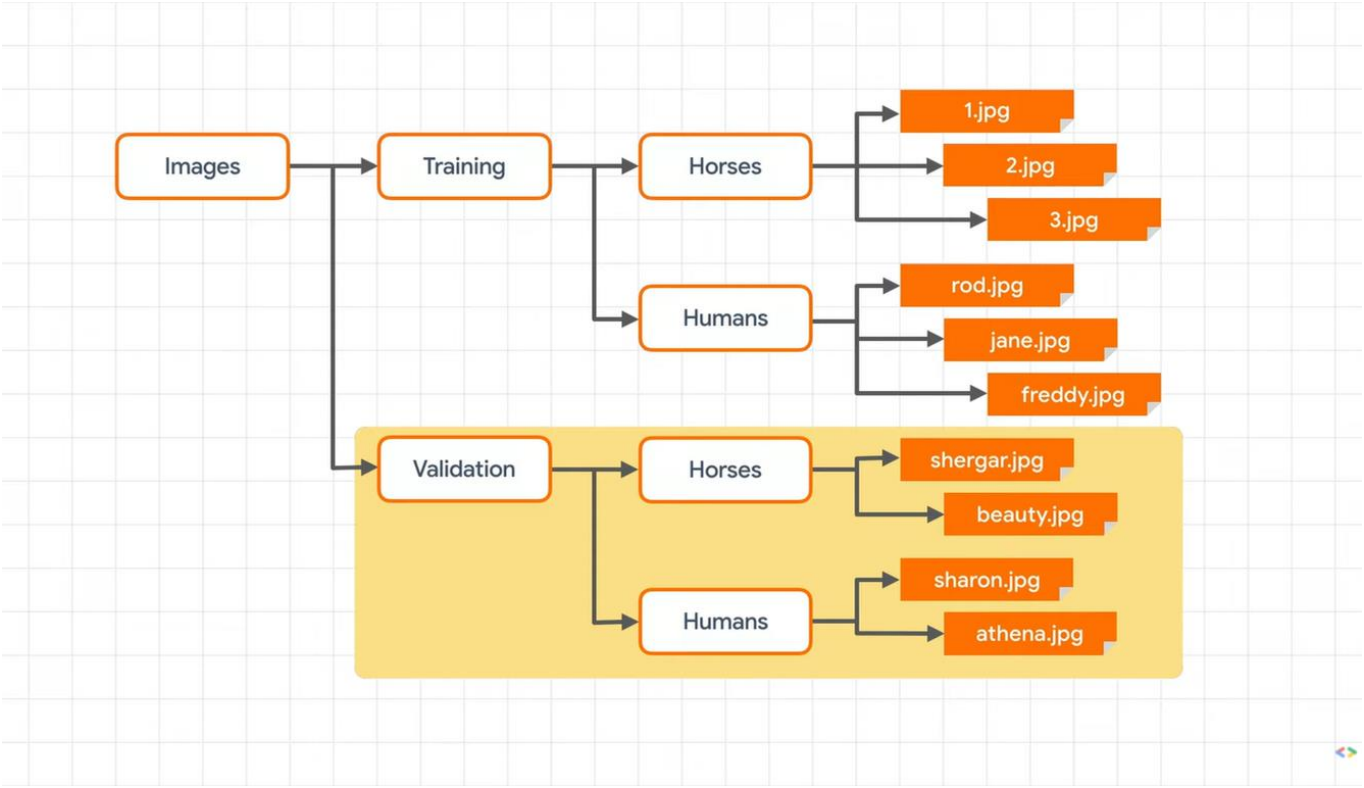
Classifying Real-World Images



Classifying Real-World Images



Classifying Real-World Images



Data Generator

- You can then use this to do some transformers in the image so just normalizing them
- in this case, this will be the training directory that contains the horses and humans sub directories.
- You only have two classes like we do here keep this is binary, if you have more classes it should be categorical feel validation datasets.
- These two generators now provide the images that your model can use for training and validation.

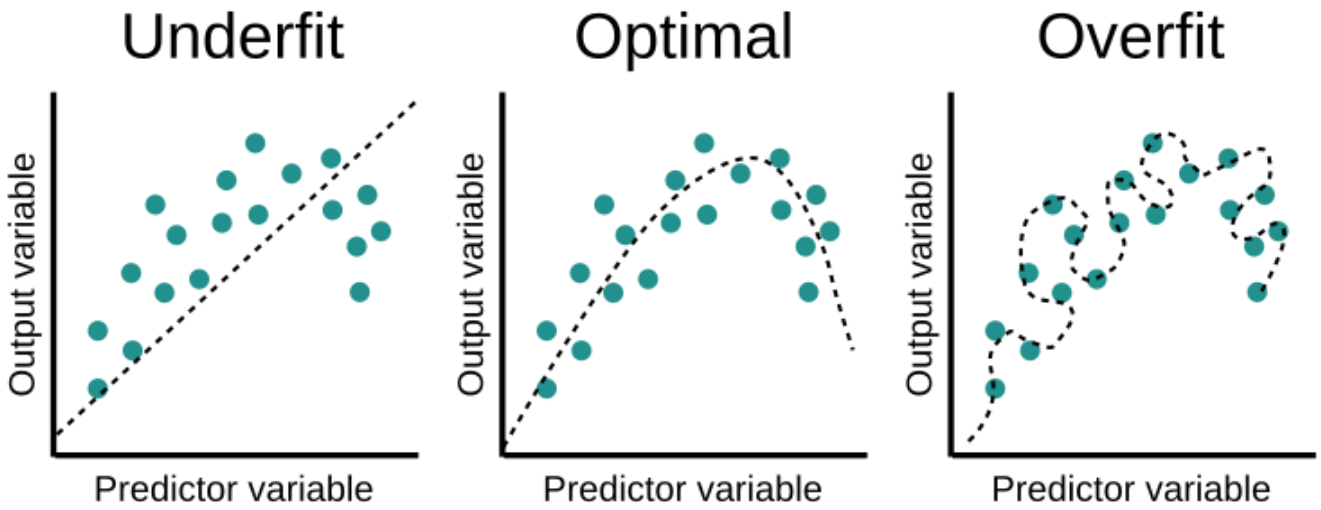
Data Generator

```
test_datagen = ImageDataGenerator(rescale=1./255)

validation_generator = test_datagen.flow_from_directory(
        validation_dir,
        target_size=(300, 300),
        batch_size=32,
        class_mode='binary')
```

Image Augmentation and Overfitting

Apa itu overfitting

Bagaimana cara menangani overfitting?



Augmenting Images

```
# Updated to do image augmentation
train_datagen = ImageDataGenerator(
      rescale=1./255,
      rotation_range=40,
      width_shift_range=0.2,
      height_shift_range=0.2,
      shear_range=0.2,
      zoom_range=0.2,
      horizontal_flip=True,
      fill_mode='nearest')
```

Dataset of Cats

Dataset of Cats

Augmenting Images

```
# Updated to do image augmentation
train_datagen = ImageDataGenerator(
      rescale=1./255,
      rotation_range=40,
      width_shift_range=0.2,
      height_shift_range=0.2,
      shear_range=0.2,
      zoom_range=0.2,
      horizontal_flip=True,
      fill_mode='nearest')
```

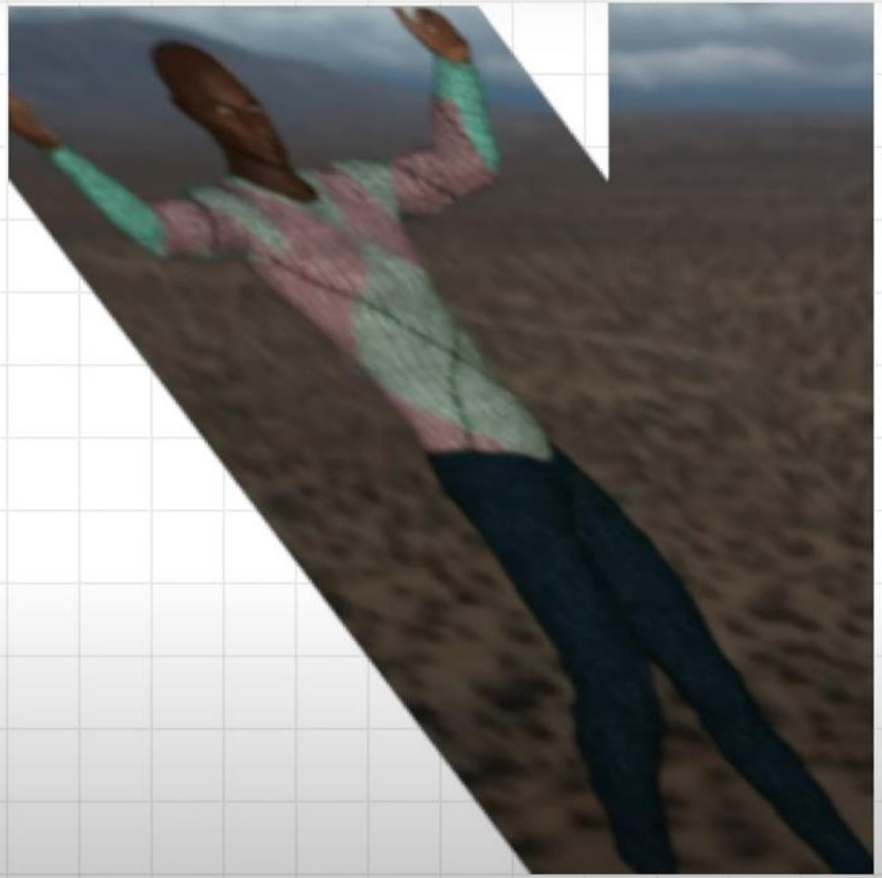
Dataset of Humans

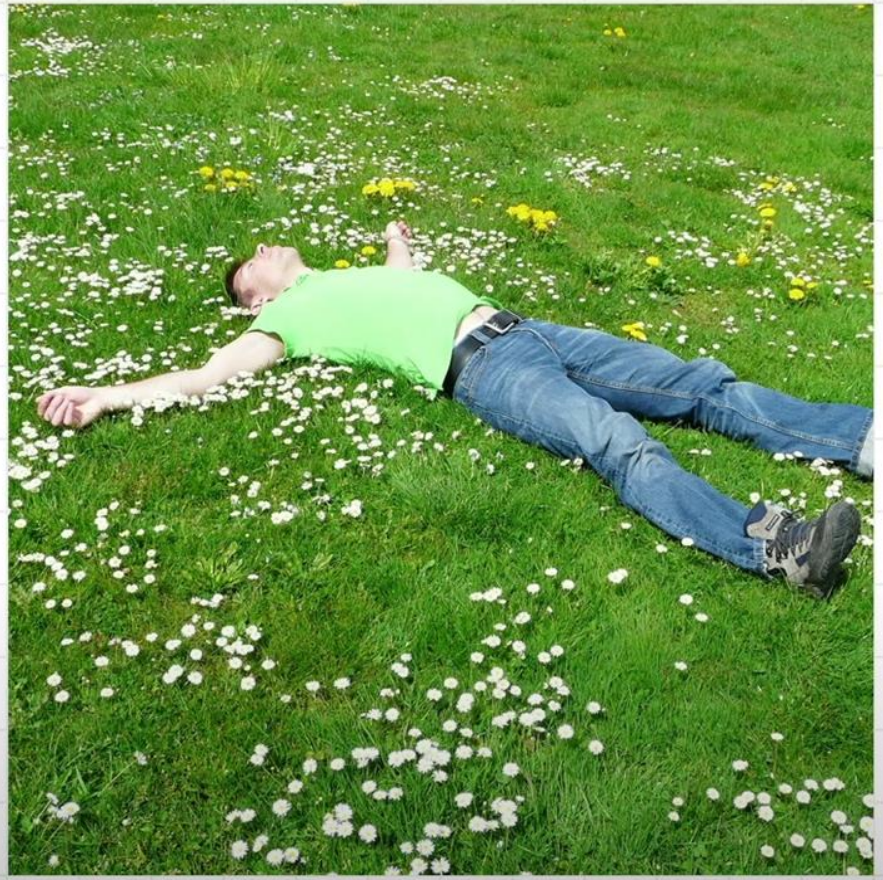
Machine Learning Foundations: Ep #7 - Image augmentation and overfitting

Augmenting Images

```
# Updated to do image augmentation
train_datagen = ImageDataGenerator(
      rescale=1./255,
      rotation_range=40,
      width_shift_range=0.2,
      height_shift_range=0.2,
      shear_range=0.2,
      zoom_range=0.2,
      horizontal_flip=True,
      fill_mode='nearest')
```

Dataset of Humans

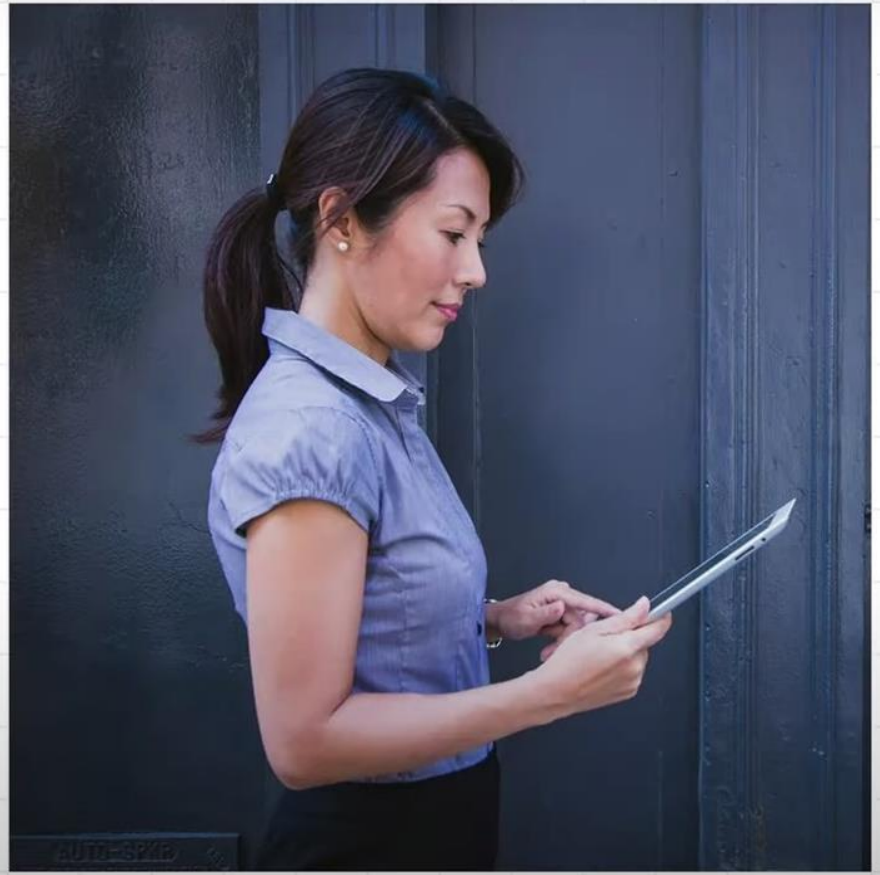




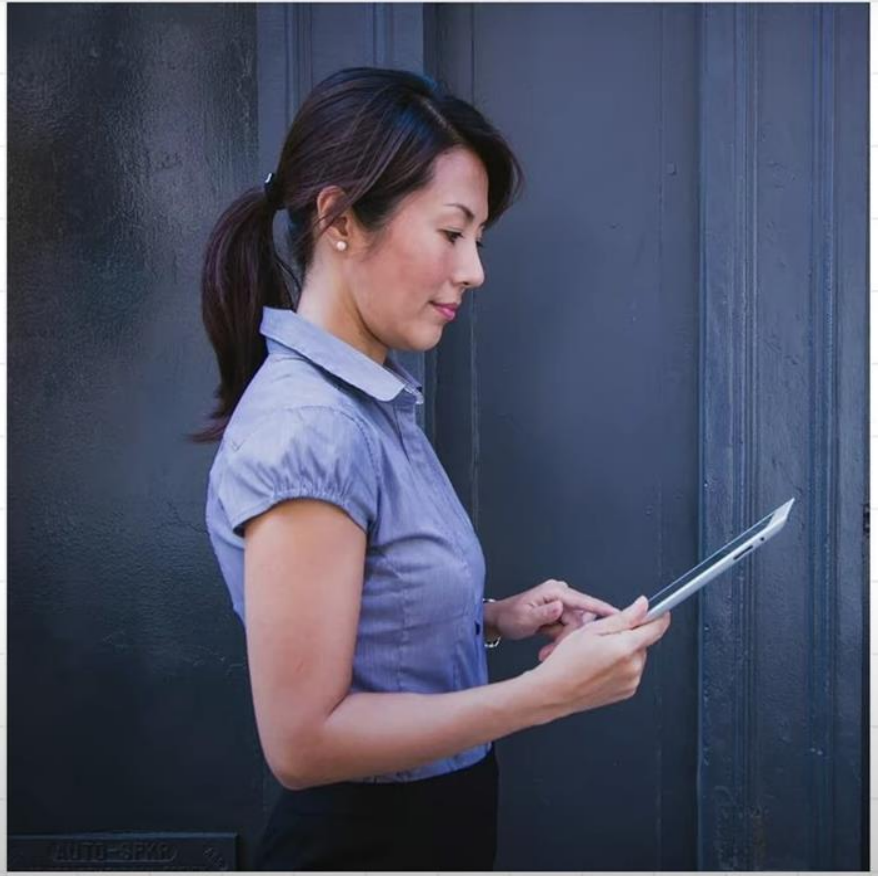
Dataset of Humans

Augmenting Images

```
# Updated to do image augmentation
train_datagen = ImageDataGenerator(
      rescale=1./255,
      rotation_range=40,
      width_shift_range=0.2,
      height_shift_range=0.2,
      shear_range=0.2,
      zoom_range=0.2,
      horizontal_flip=True,
      fill_mode='nearest')
```



Dataset of Humans



Dataset of Humans

Augmenting Images

```
# Updated to do image augmentation
train_datagen = ImageDataGenerator(
      rescale=1./255,
      rotation_range=40,
      width_shift_range=0.2,
      height_shift_range=0.2,
      shear_range=0.2,
      zoom_range=0.2,
      horizontal_flip=True,
      fill_mode='nearest')
```

Dataset of Humans

Augmenting Images

```
# Updated to do image augmentation
train_datagen = ImageDataGenerator(
      rescale=1./255,
      rotation_range=40,
      width_shift_range=0.2,
      height_shift_range=0.2,
      shear_range=0.2,
      zoom_range=0.2,
      horizontal_flip=True,
      fill_mode='nearest')
```

Apa itu Dropout

Dropout merupakan proses mencegah terjadinya overfitting dan juga mempercepat proses learning. Dropout mengacu kepada menghilangkan neuron yang berupa hidden maupun layer yang visible di dalam jaringan. Dengan menghilangkan suatu neuron, berarti menghilangkannya sementara dari jaringan yang ada.

Mengapa ini bisa membantu mengurangi overfitting?

tf.keras.layers.Dropout(0.5)

Effect on Augmentation

Cats and Dogs Dataset

https://goo.gle/2AKkIzX

QnA

Thank you