Cat vs Dog CNN Classifier

Problem Statement :-

- In this Section we are implementing Convolution Neural Network(CNN) Classifier for Classifying dog and cat images. The Total number of images available for training is 20,000 and final testing is done on seperate 5000 images.

Note :- This problem statement and dataset is taken from this **Kaggle** competition.

> Add blockquote

Loading the dataset From Kaggle

```
!mkdir -p ~/.kaggle
!cp kaggle.json ~/.kaggle/
```

```
cp: cannot stat 'kaggle.json': No such file or directory
```

```
!kaggle datasets download -d salader/dogs-vs-cats
```

```
Dataset URL: https://www.kaggle.com/datasets/salader/dogs-vs-cats
License(s): unknown
Downloading dogs-vs-cats.zip to /content
100% 1.06G/1.06G [00:07<00:00, 183MB/s]
100% 1.06G/1.06G [00:07<00:00, 159MB/s]
```

```
import zipfile
zip_ref = zipfile.ZipFile('/content/dogs-vs-cats.zip', 'r')
zip_ref.extractall('/content')
zip_ref.close()
```

Import required libraries

```
import numpy as np
import matplotlib.pyplot as plt
import tensorflow as tf
from tensorflow import keras
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten,
Dense
from tensorflow.keras.layers import BatchNormalization, Dropout
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.preprocessing import image
```

Generator

```
train_dataset = keras.utils.image_dataset_from_directory(
    directory='/content/train',
    labels='inferred',
    label_mode='int',
    batch_size=32,
    image_size=(256, 256)
)

validation_dataset = keras.utils.image_dataset_from_directory(
    directory='/content/test',
    labels='inferred',
    label_mode='int',
    batch_size=32,
    image_size=(256, 256)
)
```

```
Found 20000 files belonging to 2 classes.
Found 5000 files belonging to 2 classes.
```

Doing Normalize

```
def process(image,label):
  image = tf.cast(image/255. ,tf.float32)
  return image,label

train_dataset = train_dataset.map(process)
validation_dataset = validation_dataset.map(process)
```

Create CNN Model

```
model = Sequential()

model.add(Conv2D(32, kernel_size=(3, 3),padding = 'valid',
activation='relu', input_shape = (256, 256, 3)))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2, 2),strides=2,padding = 'valid'))

model.add(Conv2D(32, kernel_size=(3, 3),padding = 'valid', activation
='relu'))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2, 2),strides=2,padding = 'valid'))

model.add(Conv2D(32, kernel_size=(3, 3),padding = 'valid',
activation='relu'))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2, 2),strides=2,padding = 'valid'))

model.add(Flatten())

model.add(Dense(128, activation='relu'))
model.add(Dropout(0.1))
model.add(Dense(64, activation='relu'))
model.add(Dropout(0.1))
model.add(Dense(1, activation='sigmoid'))
```

```
/usr/local/lib/python3.11/dist-packages/keras/src/layers/
convolutional/base_conv.py:107: UserWarning: Do not pass an
`input_shape`/`input_dim` argument to a layer. When using Sequential
models, prefer using an `Input(shape)` object as the first layer in
the model instead.
  super().__init__(activity_regularizer=activity_regularizer,
**kwargs)
```

```
model.summary()
```

```
Model: "sequential_1"

┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━
━━━━━━━━━━━━━━━━┓
┃ Layer (type)                         ┃ Output Shape                ┃
Param # ┃
┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━
━━━━━━━━━━━━━━━━┩
│ conv2d_3 (Conv2D)                    │ (None, 254, 254, 32)        │
896 │
├──────────────────────────────────────┼─────────────────────────────┼─
────────────────┤
│ batch_normalization                  │ (None, 254, 254, 32)        │
128 │
│ (BatchNormalization)                 │                             │
│
├──────────────────────────────────────┼─────────────────────────────┼─
────────────────┤
│ max_pooling2d_3 (MaxPooling2D)       │ (None, 127, 127, 32)        │
0 │
├──────────────────────────────────────┼─────────────────────────────┼─
────────────────┤
│ conv2d_4 (Conv2D)                    │ (None, 125, 125, 32)        │
9,248 │
├──────────────────────────────────────┼─────────────────────────────┼─
────────────────┤
│ batch_normalization_1                │ (None, 125, 125, 32)        │
128 │
│ (BatchNormalization)                 │                             │
│
├──────────────────────────────────────┼─────────────────────────────┼─
────────────────┤
│ max_pooling2d_4 (MaxPooling2D)       │ (None, 62, 62, 32)          │
```

```
0 │
├──────────────────────────────────────┼─────────────────────────────┼
─────────────────┤
│ conv2d_5 (Conv2D)                    │ (None, 60, 60, 32)          │
9,248 │
├──────────────────────────────────────┼─────────────────────────────┼
─────────────────┤
│ batch_normalization_2                │ (None, 60, 60, 32)          │
128 │
│ (BatchNormalization)                 │                             │
│
├──────────────────────────────────────┼─────────────────────────────┼
─────────────────┤
│ max_pooling2d_5 (MaxPooling2D)       │ (None, 30, 30, 32)          │
0 │
├──────────────────────────────────────┼─────────────────────────────┼
─────────────────┤
│ flatten_1 (Flatten)                  │ (None, 28800)               │
0 │
├──────────────────────────────────────┼─────────────────────────────┼
─────────────────┤
│ dense_3 (Dense)                      │ (None, 128)                 │
3,686,528 │
├──────────────────────────────────────┼─────────────────────────────┼
─────────────────┤
│ dropout (Dropout)                    │ (None, 128)                 │
0 │
├──────────────────────────────────────┼─────────────────────────────┼
─────────────────┤
│ dense_4 (Dense)                      │ (None, 64)                  │
8,256 │
├──────────────────────────────────────┼─────────────────────────────┼
─────────────────┤
│ dropout_1 (Dropout)                  │ (None, 64)                  │
0 │
├──────────────────────────────────────┼─────────────────────────────┼
─────────────────┤
│ dense_5 (Dense)                      │ (None, 1)                   │
65 │
└──────────────────────────────────────┴─────────────────────────────┴
─────────────────┘

 Total params: 3,714,625 (14.17 MB)

 Trainable params: 3,714,433 (14.17 MB)

 Non-trainable params: 192 (768.00 B)

model.compile(optimizer='adam',loss='binary_crossentropy',metrics=['ac
curacy'])
```

```
history = model.fit(train_dataset,epochs = 10,validation_data =
validation_dataset)
history
```

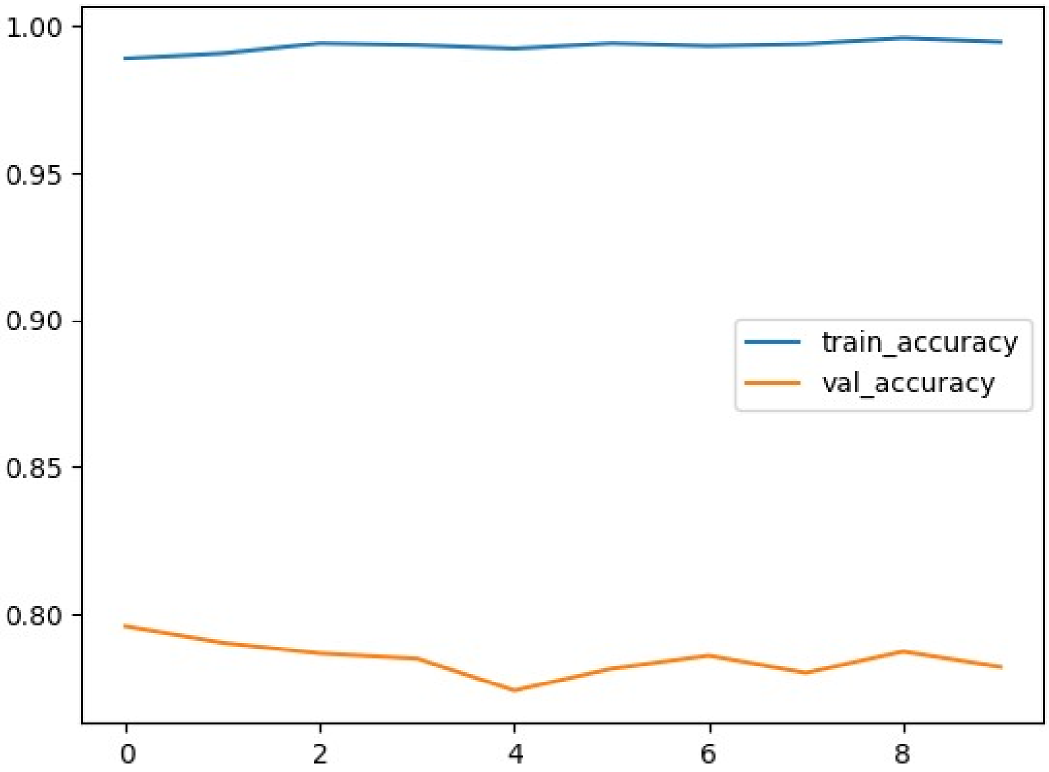
```
Epoch 1/10
625/625 ━━━━━━━━━━━━━━━━━━━━ 48s 67ms/step - accuracy: 0.5891 - loss:
1.0111 - val_accuracy: 0.7044 - val_loss: 0.5732
Epoch 2/10
625/625 ━━━━━━━━━━━━━━━━━━━━ 45s 72ms/step - accuracy: 0.7154 - loss:
0.5562 - val_accuracy: 0.7238 - val_loss: 0.5467
Epoch 3/10
625/625 ━━━━━━━━━━━━━━━━━━━━ 87s 81ms/step - accuracy: 0.7836 - loss:
0.4614 - val_accuracy: 0.7632 - val_loss: 0.5120
Epoch 4/10
625/625 ━━━━━━━━━━━━━━━━━━━━ 73s 66ms/step - accuracy: 0.8220 - loss:
0.3928 - val_accuracy: 0.7602 - val_loss: 0.5153
Epoch 5/10
625/625 ━━━━━━━━━━━━━━━━━━━━ 86s 73ms/step - accuracy: 0.8577 - loss:
0.3254 - val_accuracy: 0.7884 - val_loss: 0.5345
Epoch 6/10
625/625 ━━━━━━━━━━━━━━━━━━━━ 77s 66ms/step - accuracy: 0.9036 - loss:
0.2349 - val_accuracy: 0.7450 - val_loss: 1.0913
Epoch 7/10
625/625 ━━━━━━━━━━━━━━━━━━━━ 41s 65ms/step - accuracy: 0.9400 - loss:
0.1553 - val_accuracy: 0.7466 - val_loss: 1.1706
Epoch 8/10
625/625 ━━━━━━━━━━━━━━━━━━━━ 41s 66ms/step - accuracy: 0.9609 - loss:
0.1043 - val_accuracy: 0.8042 - val_loss: 0.7513
Epoch 9/10
625/625 ━━━━━━━━━━━━━━━━━━━━ 82s 66ms/step - accuracy: 0.9713 - loss:
0.0769 - val_accuracy: 0.7934 - val_loss: 1.1695
Epoch 10/10
625/625 ━━━━━━━━━━━━━━━━━━━━ 86s 73ms/step - accuracy: 0.9800 - loss:
0.0565 - val_accuracy: 0.7908 - val_loss: 1.0850

<keras.src.callbacks.history.History at 0x79a9a1fbc750>
```

Here model is giving best **Accuracy with 99.46%**

Plot the model with training Vs validation Accuracy

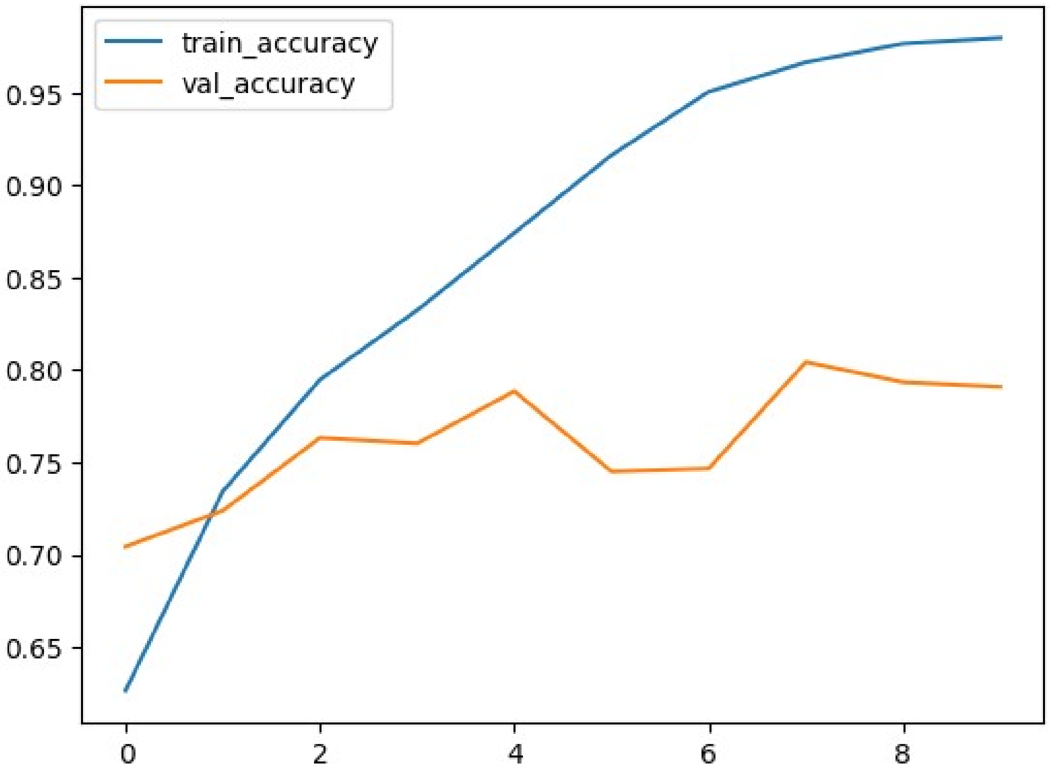
```
plt.plot(history.history['accuracy'], label='train_accuracy')
plt.plot(history.history['val_accuracy'], label='val_accuracy')
plt.legend()
plt.show()
```



I thing we are getting overfitting , so I have to try for reduce overfitting

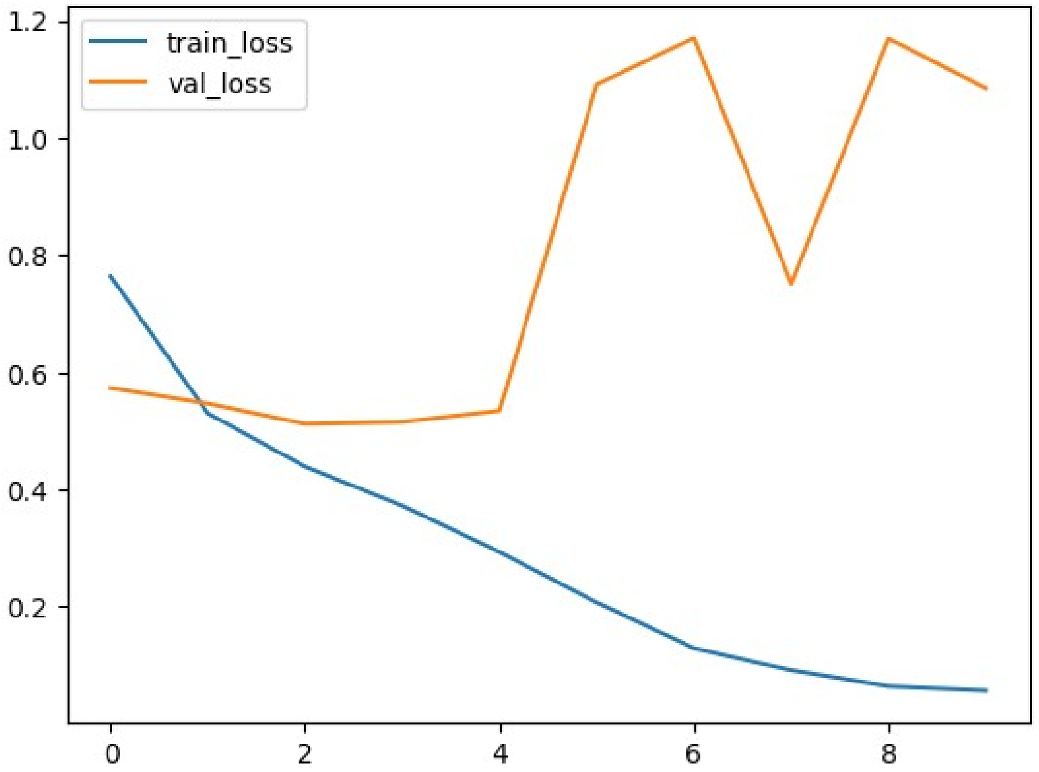
- use batch_normalization & dropout

```
plt.plot(history.history['accuracy'], label='train_accuracy')
plt.plot(history.history['val_accuracy'], label='val_accuracy')
plt.legend()
plt.show()
```



plot the loss between train & validation

```
plt.plot(history.history['loss'], label='train_loss')
plt.plot(history.history['val_loss'], label='val_loss')
plt.legend()
plt.show()
```



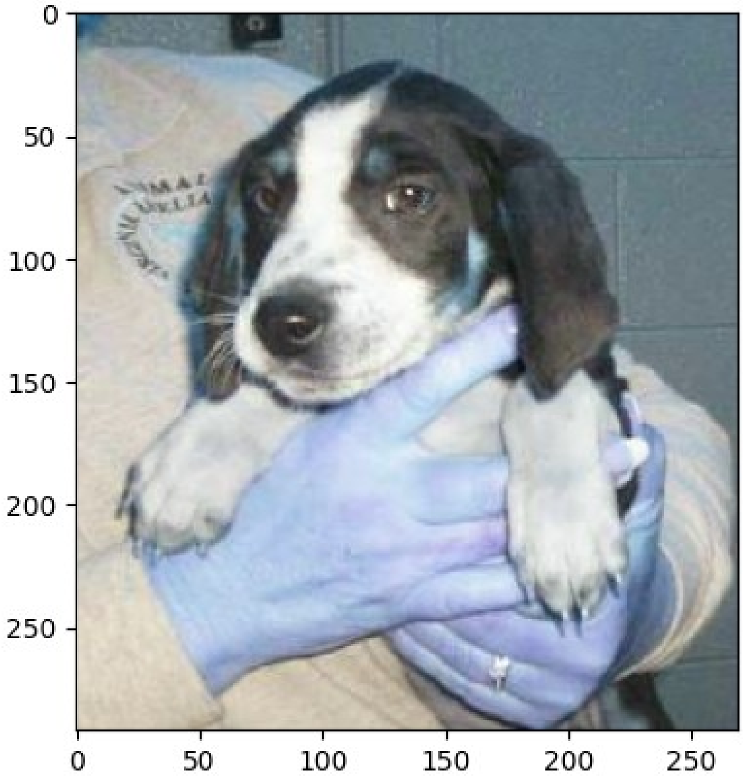
##Predict the model & Visualize

```
import cv2

test_img = cv2.imread('/content/train/dogs/dog.10.jpg')

plt.imshow(test_img)
```

```
<matplotlib.image.AxesImage at 0x79a9a02abb90>
```



```
test_img.shape
```

```
(292, 269, 3)
```

Check the image that is it dog or cat

- 0 means = cat
- 1 means = dog

```
test_img = cv2.resize(test_img,(256,256))

test_input = test_img.reshape((1,256,256,3))

model.predict(test_input)
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 16ms/step
```

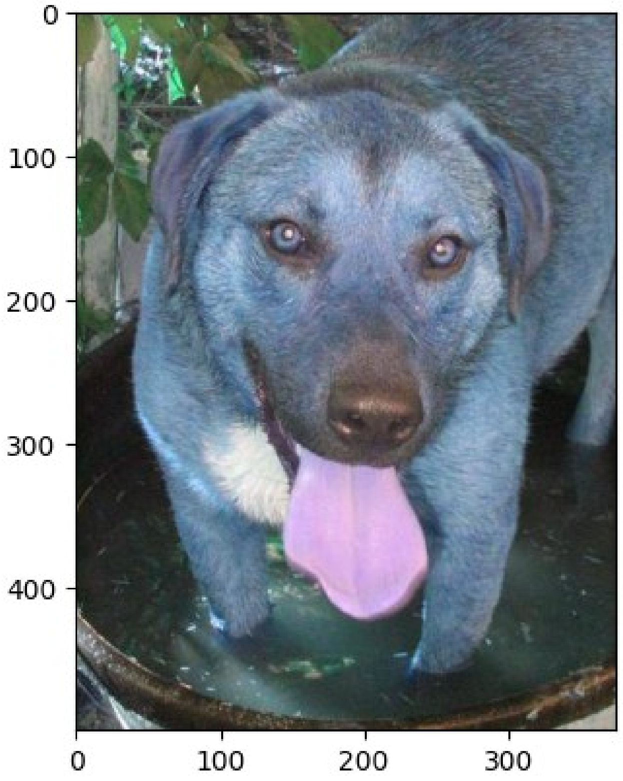
```
array([[1.]], dtype=float32)
```

model is working well on train data which is giving best prediction

```
# lets check on test dataset

test_image = cv2.imread('/content/test/dogs/dog.10075.jpg')
plt.imshow(test_image)
```

```
<matplotlib.image.AxesImage at 0x79a989bb1590>
```



```
test_image = cv2.resize(test_image,(256,256))
test_input = test_image.reshape((1,256,256,3))
model.predict(test_input)
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 16ms/step
```

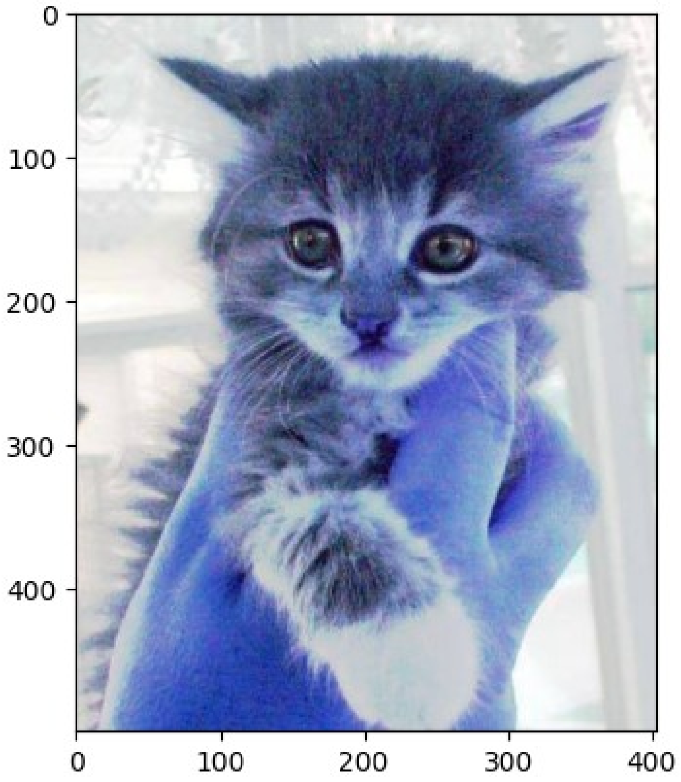
```
array([[1.]], dtype=float32)
```

model is also working best on test data which is giving best prediction

```
# Again lets check on train dataset

test_img = cv2.imread('/content/dogs_vs_cats/train/cats/cat.100.jpg')
plt.imshow(test_img)
```

```
<matplotlib.image.AxesImage at 0x79a9a008f5d0>
```



```
test_image = cv2.resize(test_img,(256,256))
test_input = test_image.reshape((1,256,256,3))
model.predict(test_input)

1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 16ms/step

array([[0.]], dtype=float32)
```