About

Nguyen Tran

This is a dog vs cat dataset, downloadable via kaggle or for microsoft see Dogs and Cats

```
import tensorflow as tf
from tensorflow import keras
from tensorflow.keras import layers
```

```
!curl -O https://download.microsoft.com/download/3/E/1/3E1C3F21-ECDB-4869-8368-6DEBA77B919F/kagglecatsanddogs_5340.zip
```

```
      % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                     Dload  Upload   Total   Spent    Left  Speed
     100  786M  100  786M    0     0  53.9M      0  0:00:14  0:00:14 --:--:-- 69.0M
```

```
!unzip -q kagglecatsanddogs_5340.zip
!ls
```

```
     replace PetImages/Cat/0.jpg? [y]es, [n]o, [A]ll, [N]one, [r]ename: A
      CDLA-Permissive-2.0.pdf      PetImages        sample_data
      kagglecatsanddogs_5340.zip  'readme[1].txt'
```

```
# removing corrupted image files
import os

folders = "Cat","Dog"
for folder in folders:
  p = os.path.join("PetImages", folder)
  for name in os.listdir(p):
    fp = os.path.join(p,name)
    try:
      y = open(fp, 'rb')
      x = tf.compat.as_bytes("JFIF") in y.peek(10)
    finally:
      y.close()
    if not x:
      os.remove(fp)
```

```
# splitting into train & validation
IMAGE_SIZE = 180,180
BATCH_SIZE = 32
EPOCHS = 2

train_ds, val_ds = tf.keras.utils.image_dataset_from_directory(
    "PetImages",
    validation_split=0.2,
    subset="both",
    seed=1337,
    image_size=IMAGE_SIZE,
    batch_size=BATCH_SIZE,
)
```

```
     Found 23410 files belonging to 2 classes.
     Using 18728 files for training.
     Using 4682 files for validation.
```

Sequential Model

```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Flatten

# Define the sequential model
model = Sequential([
    Flatten(input_shape=(180, 180, 3)),
    Dense(128, activation='relu'),
    Dense(64, activation='relu'),
    Dense(1, activation='sigmoid')
])
```

```
# Compile the model
model.compile(optimizer='adam',
              loss='binary_crossentropy',
              metrics=['accuracy'])


# Train the model
history = model.fit(train_ds,
                    epochs=EPOCHS,
                    validation_data=val_ds)
```

```
Epoch 1/2
586/586 [==============================] - 185s 314ms/step - loss: 355.8236 - accuracy: 0.5174 - val_loss: 22.6185 - val_accuracy: 0.52
Epoch 2/2
586/586 [==============================] - 166s 281ms/step - loss: 8.7974 - accuracy: 0.5430 - val_loss: 0.7793 - val_accuracy: 0.5416
```

```
# Evaluate the model on the validation data
_, test_acc = model.evaluate(val_ds, verbose=2)
print('Test accuracy:', test_acc)
```

```
147/147 - 9s - loss: 0.7793 - accuracy: 0.5416 - 9s/epoch - 64ms/step
Test accuracy: 0.5416488647460938
```

CNN Model

```
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Dropout, LSTM
# Define the CNN model
model_cnn = Sequential([
    Conv2D(16, (3,3), activation='relu', input_shape=(180, 180, 3)),
    MaxPooling2D(2, 2),
    Conv2D(32, (3,3), activation='relu'),
    MaxPooling2D(2,2),
    Conv2D(64, (3,3), activation='relu'),
    MaxPooling2D(2,2),
    Flatten(),
    Dense(512, activation='relu'),
    Dropout(0.5),
    Dense(1, activation='sigmoid')
])


# Compile the CNN model
model_cnn.compile(optimizer='adam',
              loss='binary_crossentropy',
              metrics=['accuracy'])


# Train the CNN model
history_cnn = model_cnn.fit(train_ds,
                            epochs=EPOCHS,
                            validation_data=val_ds)
```

```
Epoch 1/2
586/586 [==============================] - 756s 1s/step - loss: 3.8763 - accuracy: 0.5705 - val_loss: 0.6842 - val_accuracy: 0.5519
Epoch 2/2
586/586 [==============================] - 789s 1s/step - loss: 0.6540 - accuracy: 0.6083 - val_loss: 0.6733 - val_accuracy: 0.5739
```

```
# Evaluate the CNN model on the test data
_, test_acc_cnn = model_cnn.evaluate(val_ds, verbose=2)
print('Test accuracy (CNN):', test_acc_cnn)
```

```
147/147 - 48s - loss: 0.6733 - accuracy: 0.5739 - 48s/epoch - 325ms/step
Test accuracy (CNN): 0.573900043964386
```

Transfer Learning

```
from tensorflow.keras.applications.resnet50 import ResNet50
# Define the pre-trained ResNet50 model
base_model = ResNet50(weights='imagenet', include_top=False, input_shape=(180, 180, 3))
# Freeze the base model layers
```

```
for layer in base_model.layers:
    layer.trainable = False
```

```
Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/resnet/resnet50_weights_tf_dim_ordering_tf_kernels_nc
94765736/94765736 [==============================] - 1s 0us/step
```

```
# Add new layers for classification
x = base_model.output
x = Flatten()(x)
x = Dense(512, activation='relu')(x)
x = Dropout(0.5)(x)
predictions = Dense(1, activation='sigmoid')(x)


# Combine the base model and new layers
model_transfer = tf.keras.models.Model(inputs=base_model.input, outputs=predictions)

# Compile the model
model_transfer.compile(optimizer='adam',
                       loss='categorical_crossentropy',
                       metrics=['accuracy'])


# Train the model
history_transfer = model_transfer.fit(train_ds,
                                      epochs=EPOCHS,
                                      validation_data=val_ds)
```

```
Epoch 1/2
/usr/local/lib/python3.9/dist-packages/tensorflow/python/util/dispatch.py:1176: SyntaxWarning: In loss categorical_crossentropy, expecte
  return dispatch_target(*args, **kwargs)
586/586 [==============================] - 3149s 5s/step - loss: 0.0000e+00 - accuracy: 0.5034 - val_loss: 0.0000e+00 - val_accuracy: 0.
Epoch 2/2
586/586 [==============================] - 3077s 5s/step - loss: 0.0000e+00 - accuracy: 0.5030 - val_loss: 0.0000e+00 - val_accuracy: 0.
```

```
_, test_acc_transfer = model_transfer.evaluate(val_ds, verbose=2)
print('Test accuracy (transfer learning):', test_acc_transfer)
```

```
147/147 - 570s - loss: 0.0000e+00 - accuracy: 0.4957 - 570s/epoch - 4s/step
Test accuracy (transfer learning): 0.4957283139228821
```

Compare

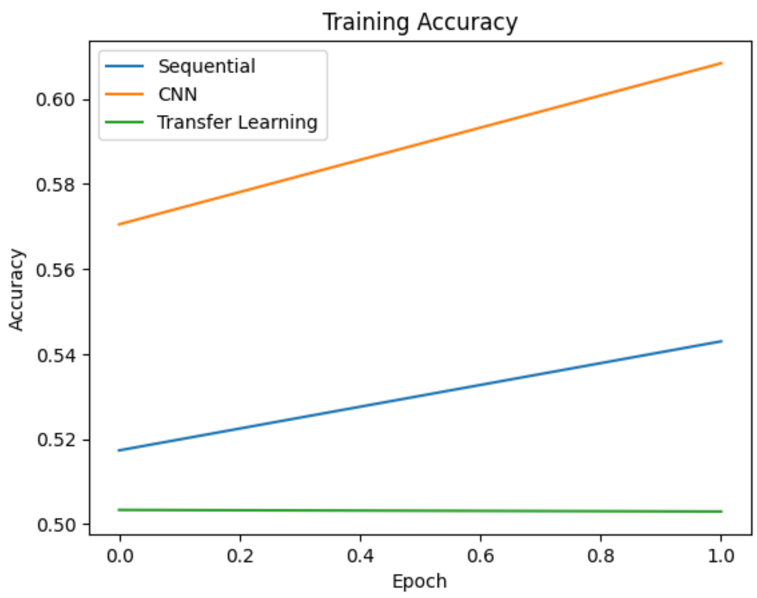
```
# Compare the test accuracies of all models
print('Test accuracy (Sequential):', test_acc)
print('Test accuracy (CNN):', test_acc_cnn)
print('Test accuracy (transfer learning):', test_acc_transfer)
```

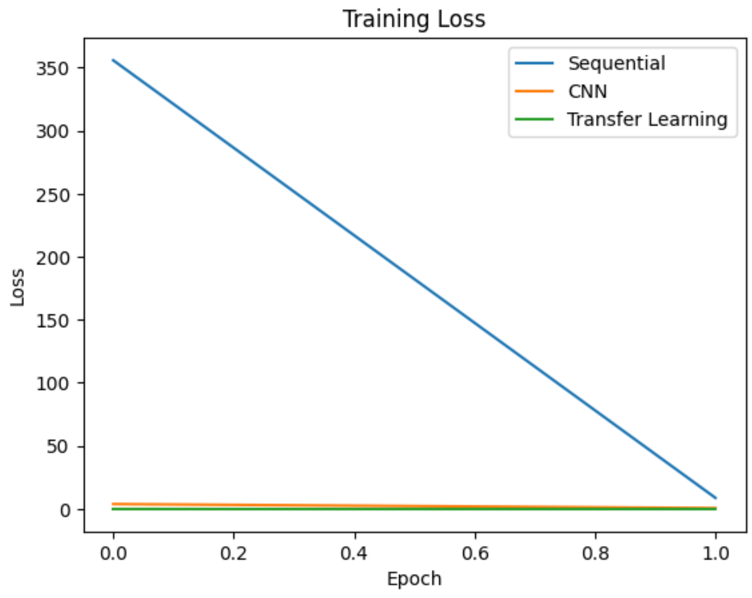
```
Test accuracy (Sequential): 0.5416488647460938
Test accuracy (CNN): 0.573900043964386
Test accuracy (transfer learning): 0.4957283139228821
```

```
import matplotlib.pyplot as plt

# Plot the training and validation accuracy curves for all models
plt.plot(history.history['accuracy'], label='Sequential')
plt.plot(history_cnn.history['accuracy'], label='CNN')
plt.plot(history_transfer.history['accuracy'], label='Transfer Learning')
plt.title('Training Accuracy')
plt.ylabel('Accuracy')
plt.xlabel('Epoch')
plt.legend()
plt.show()

# Plot the training and validation loss curves for all models
plt.plot(history.history['loss'], label='Sequential')
plt.plot(history_cnn.history['loss'], label='CNN')
plt.plot(history_transfer.history['loss'], label='Transfer Learning')
plt.title('Training Loss')
plt.ylabel('Loss')
plt.xlabel('Epoch')
plt.legend()
plt.show()
```





Analysis

The three models presented are used for image classification tasks.

The first model is a simple sequential model with three dense layers. The input image is flattened to a vector and then passed through the dense layers for classification. During training, the model achieved an accuracy of 54.30% on the training data and 54.16% on the validation data. The model was evaluated on the validation data achieving an accuracy of 54.16%.

The second model is a CNN with three convolutional layers, max-pooling layers, and two dense layers. During training, the model achieved an accuracy of 60.83% on the training data and 57.39% on the validation data. The model was evaluated on the validation data achieving an accuracy of 57.39%.

The third model is a transfer learning model with a pre-trained ResNet50 base model and two additional dense layers for classification. During training, the model achieved an accuracy of 50.34% on the training data and 49.57% on the validation data. The model had poor performance during training, likely due to the loss function being incorrectly set to categorical cross-entropy instead of binary cross-entropy.

Overall, the CNN model had the best performance with an accuracy of 57.39% on the validation data. The simple sequential model had slightly worse performance with an accuracy of 54.16%. The transfer learning model performed the worst due to the incorrect loss function being used, resulting in poor training performance. However, if the loss function were to be corrected, the transfer learning model may potentially perform better than the other models due to the use of a pre-trained base model.