Ejemplo 1

Otros Ejemplos: https://machinelearningmastery.com/how-to-develop-a-convolutional-neural-network-to-classify-photos-of-dogs-and-cats/

https://blog.keras.io/building-powerful-image-classification-models-using-very-little-data.html

https://es.bccrwp.org/compare/hello-world-program-in-keras-with-cnn-dog-vs-cat-classification-f5f294/

```
#from __future__ import absolute_import, division, print_function, unicode_litera l
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Conv2D, Flatten, Dropout, MaxPooling2D
from tensorflow.keras.preprocessing.image import ImageDataGenerator
import os
import numpy as np
import matplotlib.pyplot as plt
```

```
#Actualizacion Tensorflow
import tensorflow.compat.v1 as tf
tf.disable_v2_behavior()
```

```
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/tensorflow/pyth
Instructions for updating:
non-resource variables are not supported in the long term
```

```
#Cargar datos
_URL = 'https://storage.googleapis.com/mledu-datasets/cats_and_dogs_filtered.zip'
path_to_zip = tf.keras.utils.get_file('cats_and_dogs.zip', origin=_URL, extract= Tr
PATH = os.path.join(os.path.dirname(path_to_zip), 'cats_and_dogs_filtered')
```

```
Downloading data from https://storage.googleapis.com/mledu-datasets/cats_and_d
68608000/68606236 [==============================] - 1s 0us/step
```

```
train_dir = os.path.join(PATH, 'train')
validation_dir = os.path.join(PATH, 'validation')
train_cats_dir = os.path.join(train_dir, 'cats')  # directory with our training cat
train_dogs_dir = os.path.join(train_dir, 'dogs') # directory with our training dog
validation_cats_dir = os.path.join(validation_dir, 'cats') # directory with our val
validation_dogs_dir = os.path.join(validation_dir, 'dogs') # directory with our val
```

```
num_cats_tr = len(os.listdir(train_cats_dir))
num_dogs_tr = len(os.listdir(train_dogs_dir))
num_cats_val = len(os.listdir(validation_cats_dir))
num_dogs_val = len(os.listdir(validation_dogs_dir))
total_train = num_cats_tr + num_dogs_tr
```

```
total_val = num_cats_val + num_dogs_val
#Impresion
print('total training cat images:', num_cats_tr)
print('total training dog images:', num_dogs_tr)
print('total validation cat images:', num_cats_val)
print('total validation dog images:', num_dogs_val)
print("--")
print("Total training images:", total_train)
print("Total validation images:", total_val)
```

```
total training cat images: 1000
total training dog images: 1000
total validation cat images: 500
total validation dog images: 500
--
Total training images: 2000
Total validation images: 1000
```

```
#Variables
batch_size = 128
epochs = 15
IMG_HEIGHT = 150
IMG_WIDTH = 150
```

```
#Preparacion de datos
#Leer imágenes del disco.
#Decodifica el contenido de estas imágenes y las convierte al formato adecuado segú
#Conviérte las imagenes en tensores de coma flotante.
#Cambia la escala de los tensores de valores entre 0 y 255 a valores entre 0 y
# 1, ya que las redes neuronales prefieren tratar con valores de entrada pequeños.
train_image_generator = ImageDataGenerator(rescale=1./255) # Generator for our t ra
validation_image_generator = ImageDataGenerator(rescale=1./255) # Generator for our
train_data_gen = train_image_generator.flow_from_directory(batch_size=batch_size,
                                                           directory=train_dir, shu
                                                           target_size=(IMG_HEIGHT,
```

```
Found 2000 images belonging to 2 classes.
```

```
print(train_data_gen)
```

```
<tensorflow.python.keras.preprocessing.image.DirectoryIterator object at 0x7fe
```

```
val_data_gen = validation_image_generator.flow_from_directory(batch_size=batch_size
                                                              directory=validation_
                                                              class_mode='binary')
```

```
Found 1000 images belonging to 2 classes.
```

```
#Visualizacion fotos
sample_training_images, _ = next(train_data_gen)
print(sample_training_images[0])
# This function will plot images in the form of a grid with 1 row and 5 columns whe
```

```
def plotImages(images_arr):
  fig, axes = plt.subplots(1, 5, figsize=(20,20))
  axes = axes.flatten()
  for img, ax in zip( images_arr, axes):
          ax.imshow(img)
          ax.axis('off')
  plt.tight_layout()
  plt.show()
plotImages(sample_training_images[:5])
```

```
[[[0.63529414 0.57254905 0.5137255 ]
  [0.63529414 0.57254905 0.5137255 ]
  [0.63529414 0.57254905 0.5137255 ]
  ...
  [0.22352943 0.21960786 0.20000002]
  [0.21960786 0.21568629 0.19607845]
  [0.21568629 0.21176472 0.19215688]]

 [[0.63529414 0.57254905 0.5137255 ]
  [0.63529414 0.57254905 0.5137255 ]
  [0.63529414 0.57254905 0.5137255 ]
  ...
  [0.19607845 0.20000002 0.1764706 ]
```

```
sample_training_images, _ = next(train_data_gen)
print(len(sample_training_images))
```

```
128
  [0.63529414 0.57254905 0.5137255 ]
```

```
#Crear modelo
#El modelo consta de tres bloques de convolución con una capa de agrupación máxi ma
#Hay una capa completamente conectada con 512 unidades con funcion de activacion RE
#El modelo genera probabilidades de clase basadas en la clasificación binaria po r
model = Sequential([
    Conv2D(16, 3, padding='same', activation='relu', input_shape=(IMG_HEIGHT,
                                                                  IMG_WIDTH ,3)),
    MaxPooling2D(),
    Conv2D(32, 3, padding='same', activation='relu'),
    MaxPooling2D(),
    Conv2D(64, 3, padding='same', activation='relu'),
    MaxPooling2D(),
    Flatten(),
    Dense(512, activation='relu'),
    Dense(1, activation='sigmoid')
])
model.compile(optimizer='adam',
              loss='binary_crossentropy',
              metrics=['accuracy'])
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 150, 150, 16)      448
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 75, 75, 16)        0
_________________________________________________________________
conv2d_1 (Conv2D)            (None, 75, 75, 32)        4640
```

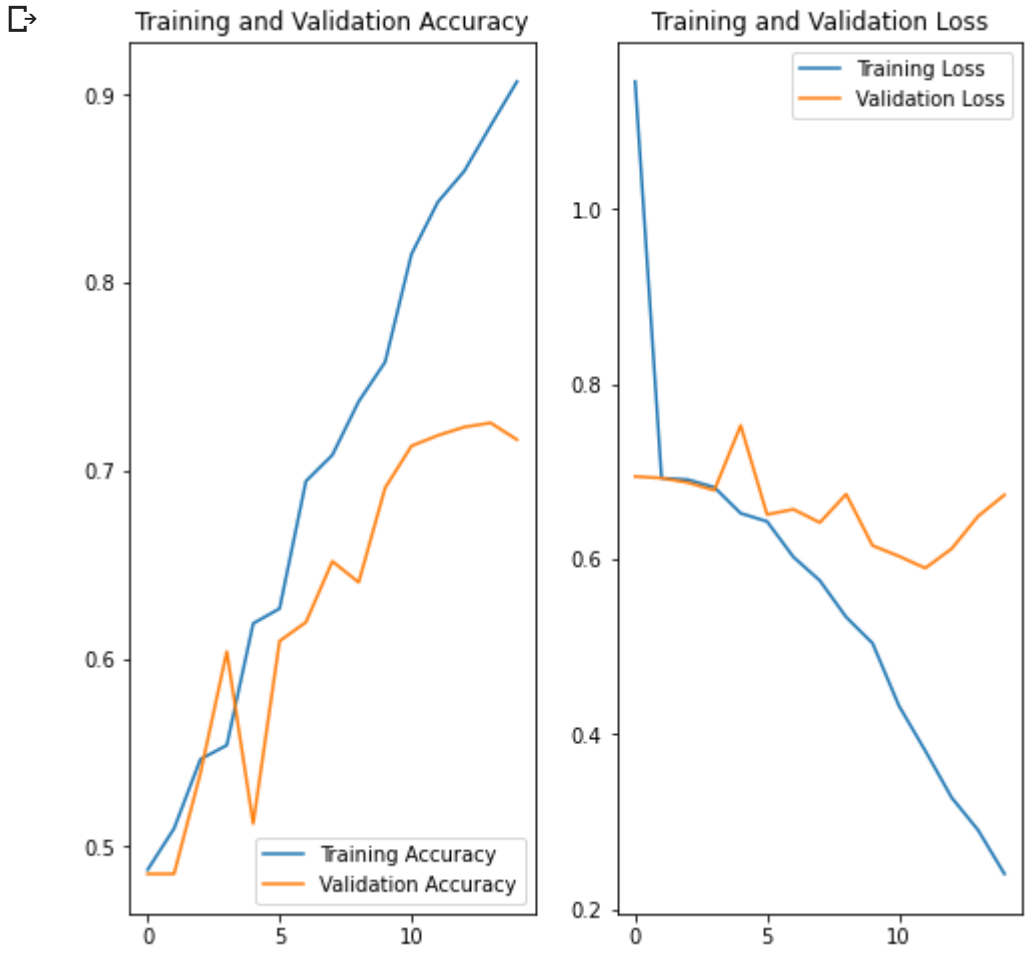
```
#Entrenamiento
history = model.fit_generator(
    train_data_gen,
    steps_per_epoch=total_train // batch_size,
    epochs=epochs,
    validation_data=val_data_gen,
    validation_steps=total_val // batch_size
)
```

```
WARNING:tensorflow:From <ipython-input-13-7de496ba4e53>:7: Model.fit_generator
Instructions for updating:
Please use Model.fit, which supports generators.
Epoch 1/15
15/15 [==============================] - ETA: 0s - batch: 7.0000 - size: 124.8
Instructions for updating:
This property should not be used in TensorFlow 2.0, as updates are applied aut
15/15 [==============================] - 4s 268ms/step - batch: 7.0000 - size:
Epoch 2/15
15/15 [==============================] - 8s 520ms/step - batch: 7.0000 - size:
Epoch 3/15
15/15 [==============================] - 8s 515ms/step - batch: 7.0000 - size:
Epoch 4/15
15/15 [==============================] - 8s 506ms/step - batch: 7.0000 - size:
Epoch 5/15
15/15 [==============================] - 8s 501ms/step - batch: 7.0000 - size:
Epoch 6/15
15/15 [==============================] - 7s 499ms/step - batch: 7.0000 - size:
Epoch 7/15
15/15 [==============================] - 7s 483ms/step - batch: 7.0000 - size:
Epoch 8/15
15/15 [==============================] - 7s 478ms/step - batch: 7.0000 - size:
Epoch 9/15
15/15 [==============================] - 7s 450ms/step - batch: 7.0000 - size:
Epoch 10/15
15/15 [==============================] - 7s 460ms/step - batch: 7.0000 - size:
Epoch 11/15
15/15 [==============================] - 7s 440ms/step - batch: 7.0000 - size:
Epoch 12/15
15/15 [==============================] - 7s 447ms/step - batch: 7.0000 - size:
Epoch 13/15
15/15 [==============================] - 7s 440ms/step - batch: 7.0000 - size:
Epoch 14/15
15/15 [==============================] - 7s 448ms/step - batch: 7.0000 - size:
Epoch 15/15
15/15 [==============================] - 7s 437ms/step - batch: 7.0000 - size:
```

```
model.metrics_names
```

```
['loss', 'acc']
```

```
#Visualizacion de Resultados
acc = history.history['acc']
val_acc = history.history['val_acc']
loss = history.history['loss']
val_loss = history.history['val_loss']
epochs_range = range(epochs)
plt.figure(figsize=(8, 8))
plt.subplot(1, 2, 1)
plt.plot(epochs_range, acc, label='Training Accuracy')
plt.plot(epochs_range, val_acc, label='Validation Accuracy')
plt.legend(loc='lower right')
plt.title('Training and Validation Accuracy')
plt.subplot(1, 2, 2)
plt.plot(epochs_range, loss, label='Training Loss')
plt.plot(epochs_range, val_loss, label='Validation Loss')
plt.legend(loc='upper right')
plt.title('Training and Validation Loss')
plt.show()
```



Generacion de más imágenes

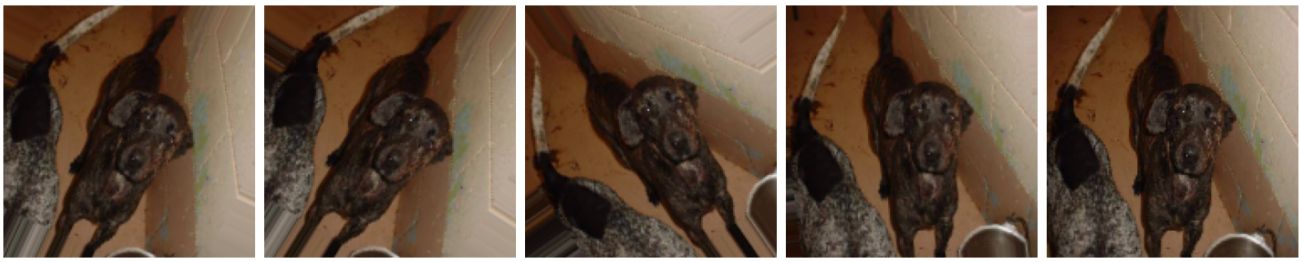
```
#Voldeo Horizontal
image_gen = ImageDataGenerator(rescale=1./255, horizontal_flip=True)
train_data_gen = image_gen.flow_from_directory(batch_size=batch_size,directory=trai
```

```
augmented_images = [train_data_gen[0][0][0] for i in range(5)] # Re-use the same cu
# above to visualize the training images plotImages(augmented_images)
```

```
Found 2000 images belonging to 2 classes.
```

```
#Rotacion
image_gen = ImageDataGenerator(rescale=1./255, rotation_range=45)
train_data_gen = image_gen.flow_from_directory(batch_size=batch_size,
                                               directory=train_dir, shuffle=True, t
augmented_images = [train_data_gen[0][0][0] for i in range(5)]
plotImages(augmented_images)
```

```
Found 2000 images belonging to 2 classes.
```



```
#Aumento de zoom
# zoom_range from 0 - 1 where 1 = 100%.
image_gen = ImageDataGenerator(rescale=1./255, zoom_range=0.5) #
train_data_gen = image_gen.flow_from_directory(batch_size=batch_size,
                                               directory=train_dir,shuffle=True, ta
augmented_images = [train_data_gen[0][0][0] for i in range(5)]
plotImages(augmented_images)
```

```
Found 2000 images belonging to 2 classes.
```

```
#Union de todas las imagenes
image_gen_train = ImageDataGenerator(rescale=1./255,rotation_range=45,
                                     width_shift_range=.15, height_shift_range=.15,
train_data_gen = image_gen_train.flow_from_directory(batch_size=batch_size,
directory=train_dir, shuffle=True,target_size=(IMG_HEIGHT, IMG_WIDTH),class_mode='b
```

```
augmented_images = [train_data_gen[0][0][0] for i in range(5)]
plotImages(augmented_images)
```

```
Found 2000 images belonging to 2 classes.
```

```
#datos de validacion
image_gen_val = ImageDataGenerator(rescale=1./255)
val_data_gen = image_gen_val.flow_from_directory(batch_size=batch_size,
                                                 directory=validation_dir,target_si
print(val_data_gen)
```

```
Found 1000 images belonging to 2 classes.
<tensorflow.python.keras.preprocessing.image.DirectoryIterator object at 0x7fe
```

```
#Cracion del modelo
model_new = Sequential([
    Conv2D(16, 3, padding='same', activation='relu',
           input_shape=(IMG_HEIGHT, IMG_WIDTH ,3)),
    MaxPooling2D(),
    Dropout(0.2),
    Conv2D(32, 3, padding='same', activation='relu'),
    MaxPooling2D(),
    Conv2D(64, 3, padding='same', activation='relu'),
    MaxPooling2D(),
    Dropout(0.2),
    Flatten(),
    Dense(512, activation='relu'),
    Dense(1, activation='sigmoid')
])
#Compilacion del modelo
model_new.compile(optimizer='adam',
              loss='binary_crossentropy',
              metrics=['accuracy'])
model_new.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_3 (Conv2D)            (None, 150, 150, 16)      448
_________________________________________________________________
max_pooling2d_3 (MaxPooling2 (None, 75, 75, 16)        0
_________________________________________________________________
dropout (Dropout)            (None, 75, 75, 16)        0
_________________________________________________________________
conv2d_4 (Conv2D)            (None, 75, 75, 32)        4640
_________________________________________________________________
max_pooling2d_4 (MaxPooling2 (None, 37, 37, 32)        0
_________________________________________________________________
conv2d_5 (Conv2D)            (None, 37, 37, 64)        18496
_________________________________________________________________
max_pooling2d_5 (MaxPooling2 (None, 18, 18, 64)        0
_________________________________________________________________
dropout_1 (Dropout)          (None, 18, 18, 64)        0
_________________________________________________________________
flatten_1 (Flatten)          (None, 20736)             0
_________________________________________________________________
dense_2 (Dense)              (None, 512)               10617344
```

```
#Entrenamiento
history = model_new.fit_generator(
    train_data_gen,
    steps_per_epoch=total_train // batch_size,
    epochs=epochs,
    validation_data=val_data_gen,
    validation_steps=total_val // batch_size
)
```

```
Epoch 1/15
15/15 [==============================] - 14s 959ms/step - batch: 7.0000 - size
Epoch 2/15
15/15 [==============================] - 16s 1s/step - batch: 7.0000 - size: 1
```

```
acc = history.history['acc']
val_acc = history.history['val_acc']
loss = history.history['loss']
val_loss = history.history['val_loss']
epochs_range = range(epochs)
plt.figure(figsize=(8, 8))
plt.subplot(1, 2, 1)
plt.plot(epochs_range, acc, label='Training Accuracy')
plt.plot(epochs_range, val_acc, label='Validation Accuracy')
plt.legend(loc='lower right')
plt.title('Training and Validation Accuracy')
plt.subplot(1, 2, 2)
plt.plot(epochs_range, loss, label='Training Loss')
plt.plot(epochs_range, val_loss, label='Validation Loss')
plt.legend(loc='upper right')
plt.title('Training and Validation Loss')
plt.show()
```