

20.1) Training a Convnet on a Small Dataset

Vitor Kamada

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Chollet (2018): Ch 5.2

<https://www.manning.com/books/deep-learning-with-python>

<https://github.com/fchollet/deep-learning-with-python-notebooks/blob/master/5.2-using-convnets-with-small-datasets.ipynb>

Dogs vs Cats Kaggle Competition in 2013

	Original	Small
Dogs	12,500	1000
Cats	12,500	1000
Total	25,000	2000
Size Compr.	543 MB	
Accuracy	95%	



<https://www.kaggle.com/c/dogs-vs-cats/data>

Building Network

```
model = models.Sequential()
model.add(layers.Conv2D(32, (3, 3), activation='relu',
                      input_shape=(150, 150, 3)))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(64, (3, 3), activation='relu'))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(128, (3, 3), activation='relu'))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(128, (3, 3), activation='relu'))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Flatten())
model.add(layers.Dense(512, activation='relu'))
model.add(layers.Dense(1, activation='sigmoid'))
```

```
from keras import optimizers
```

```
model.compile(loss='binary_crossentropy',
              optimizer=optimizers.RMSprop(lr=1e-4),
              metrics=['acc'])
```

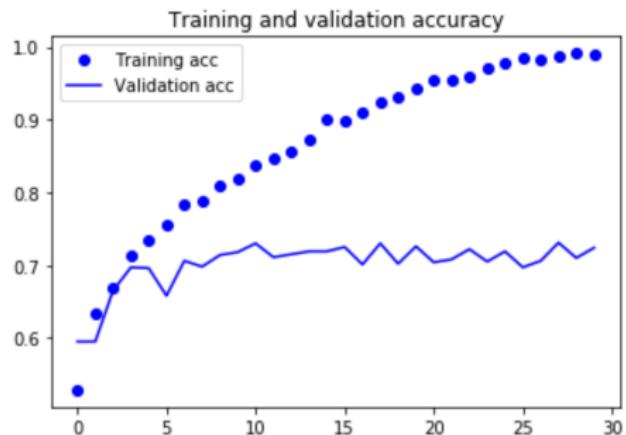
model.summary()

Layer (type)	Output Shape	Param #
conv2d_1 (Conv2D)	(None, 148, 148, 32)	896
max_pooling2d_1 (MaxPooling2D)	(None, 74, 74, 32)	0
conv2d_2 (Conv2D)	(None, 72, 72, 64)	18496
max_pooling2d_2 (MaxPooling2D)	(None, 36, 36, 64)	0
conv2d_3 (Conv2D)	(None, 34, 34, 128)	73856
max_pooling2d_3 (MaxPooling2D)	(None, 17, 17, 128)	0
conv2d_4 (Conv2D)	(None, 15, 15, 128)	147584
max_pooling2d_4 (MaxPooling2D)	(None, 7, 7, 128)	0
flatten_1 (Flatten)	(None, 6272)	0
dense_1 (Dense)	(None, 512)	3211776
dense_2 (Dense)	(None, 1)	513

Data Preprocessing

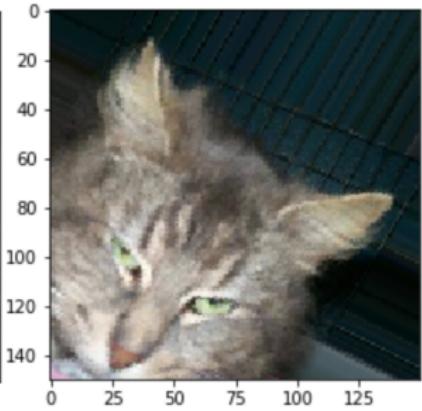
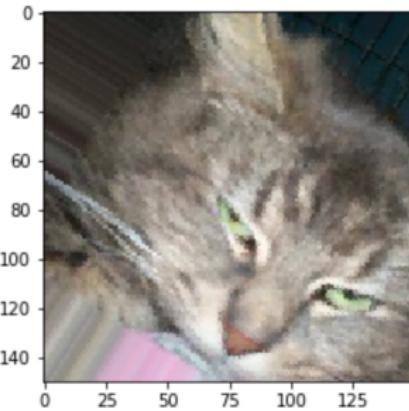
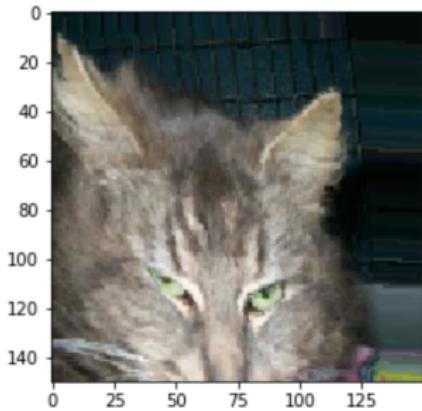
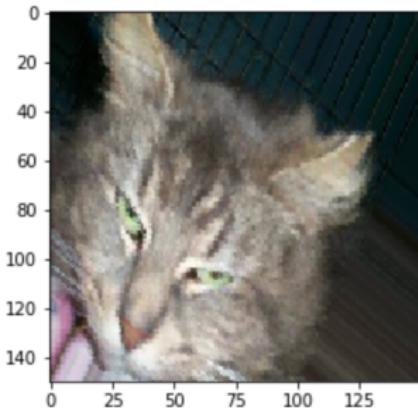
```
from keras.preprocessing.image import ImageDataGenerator  
  
# All images will be rescaled by 1./255  
train_datagen = ImageDataGenerator(rescale=1./255)  
test_datagen = ImageDataGenerator(rescale=1./255)  
  
train_generator = train_datagen.flow_from_directory(  
    # This is the target directory  
    train_dir,  
    # All images will be resized to 150x150  
    target_size=(150, 150),  
    batch_size=20,  
    # Since we use binary_crossentropy loss, we need  
    class_mode='binary')  
  
validation_generator = test_datagen.flow_from_directory(  
    validation_dir,  
    target_size=(150, 150),  
    batch_size=20,  
    class_mode='binary')
```

Validation Accuracy stalls at 70-72%



Using Data Augmentation

```
datagen = ImageDataGenerator(  
    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')
```



Add a Dropout Layer

```
model = models.Sequential()
model.add(layers.Conv2D(32, (3, 3), activation='relu',
                      input_shape=(150, 150, 3)))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(64, (3, 3), activation='relu'))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(128, (3, 3), activation='relu'))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(128, (3, 3), activation='relu'))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Flatten())
model.add(layers.Dropout(0.5))
model.add(layers.Dense(512, activation='relu'))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(loss='binary_crossentropy',
              optimizer=optimizers.RMSprop(lr=1e-4),
              metrics=['acc'])
```

Validation Accuracy of 82%

