An Introduction to Deep Learning With Python

[5.4] Visualizing what convnets learn

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pgs: 160 - 165

Visualizing Intermediate activations

In [1]:
```
from keras.models import load_model

model = load_model('cats_and_dogs_small_2.h5')
model.summary()
```

```
Using TensorFlow backend.

WARNING:tensorflow:From C:\Users\pablo\AppData\Roaming\Python\Python36\site-packages\tensorflow\py
thon\framework\op_def_library.py:263: colocate_with (from tensorflow.python.framework.ops) is depr
ecated and will be removed in a future version.
Instructions for updating:
Colocations handled automatically by placer.
WARNING:tensorflow:From C:\Users\pablo\Python\envs\DAVID\lib\site-packages\keras\backend\tensorflo
w_backend.py:3445: calling dropout (from tensorflow.python.ops.nn_ops) with keep_prob is deprecate
d and will be removed in a future version.
Instructions for updating:
Please use `rate` instead of `keep_prob`. Rate should be set to `rate = 1 - keep_prob`.
WARNING:tensorflow:From C:\Users\pablo\AppData\Roaming\Python\Python36\site-packages\tensorflow\py
thon\ops\math_ops.py:3066: to_int32 (from tensorflow.python.ops.math_ops) is deprecated and will b
e removed in a future version.
Instructions for updating:
Use tf.cast instead.
_________________________________________________________________
Layer (type)                 Output Shape              Param #   
=================================================================
conv2d_5 (Conv2D)            (None, 148, 148, 32)      896       
_________________________________________________________________
max_pooling2d_5 (MaxPooling2 (None, 74, 74, 32)        0         
_________________________________________________________________
conv2d_6 (Conv2D)            (None, 72, 72, 64)        18496     
_________________________________________________________________
max_pooling2d_6 (MaxPooling2 (None, 36, 36, 64)        0         
_________________________________________________________________
conv2d_7 (Conv2D)            (None, 34, 34, 128)       73856     
_________________________________________________________________
max_pooling2d_7 (MaxPooling2 (None, 17, 17, 128)       0         
_________________________________________________________________
conv2d_8 (Conv2D)            (None, 15, 15, 128)       147584    
_________________________________________________________________
max_pooling2d_8 (MaxPooling2 (None, 7, 7, 128)         0         
_________________________________________________________________
flatten_2 (Flatten)          (None, 6272)              0         
_________________________________________________________________
dropout_1 (Dropout)          (None, 6272)              0         
_________________________________________________________________
dense_3 (Dense)              (None, 512)               3211776   
_________________________________________________________________
dense_4 (Dense)              (None, 1)                 513       
=================================================================
Total params: 3,453,121
Trainable params: 3,453,121
Non-trainable params: 0
_________________________________________________________________
```

Preprocessing a single image

In [2]:

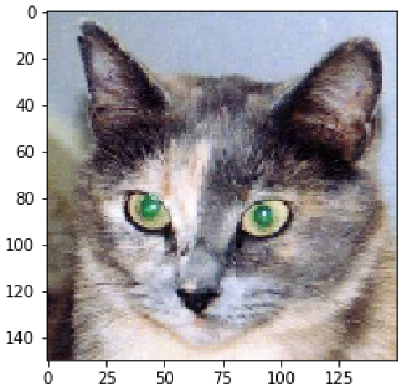
```
img_path = '../CAP_5/cats_and_dogs_small/test/cats/cat.1700.jpg'

from keras.preprocessing import image
import numpy as np

img = image.load_img(img_path, target_size=(150, 150))
img_tensor = image.img_to_array(img)
img_tensor = np.expand_dims(img_tensor, axis=0)
img_tensor /= 255.

print(img_tensor.shape)
```

```
(1, 150, 150, 3)
```

Displaying the test picture

In [4]:

```
import matplotlib.pyplot as plt

plt.imshow(img_tensor[0])
plt.show()
```



Instantiating a model from an input tensor and a list of output tensors

In [5]:

```
from keras import models

layer_outputs = [layer.output for layer in model.layers[:8]]
activation_model = models.Model(inputs=model.input, outputs=layer_outputs)
```

Running the model in predict mode

In [6]:

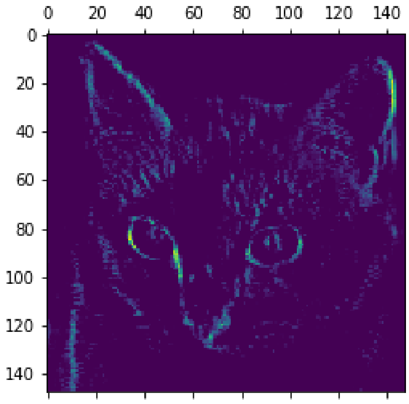
```
activations = activation_model.predict(img_tensor)
first_layer_activation = activations[0]
print(first_layer_activation.shape)
```

```
(1, 148, 148, 32)
```

Visualizing the fourth channel

```
In [7]: plt.matshow(first_layer_activation[0, :, :, 4], cmap='viridis')
```

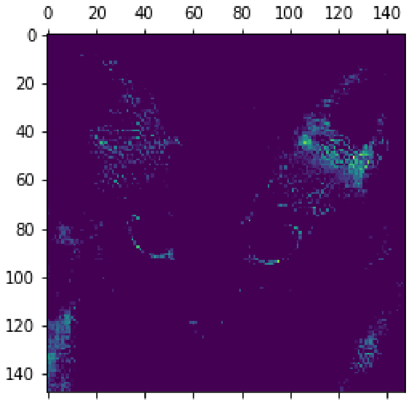
```
Out[7]: <matplotlib.image.AxesImage at 0x16de72cf240>
```



Visualizing the seventh channel

```
In [8]: plt.matshow(first_layer_activation[0, :, :, 7], cmap='viridis')
```

```
Out[8]: <matplotlib.image.AxesImage at 0x16de73430b8>
```

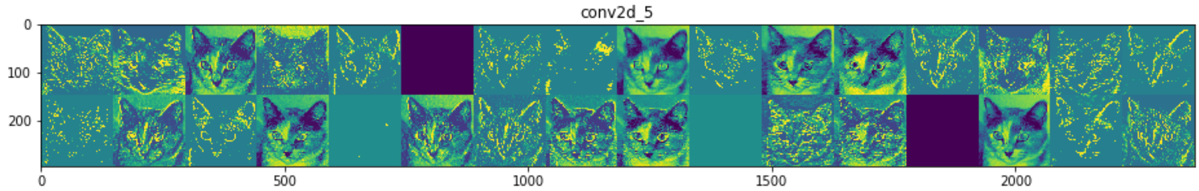


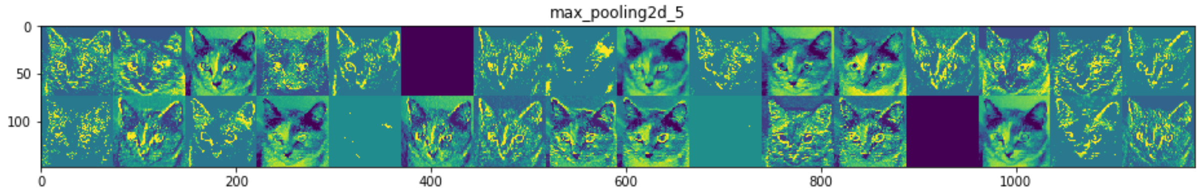
Visualizing every channel in every intermediate activation

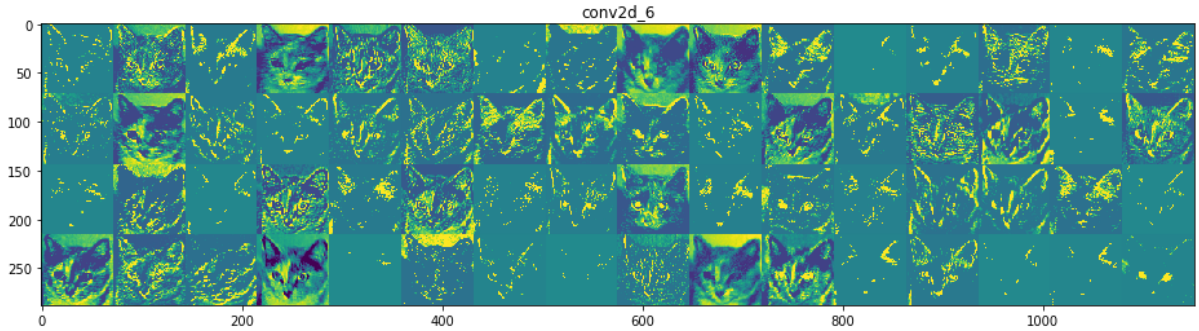
In [9]:

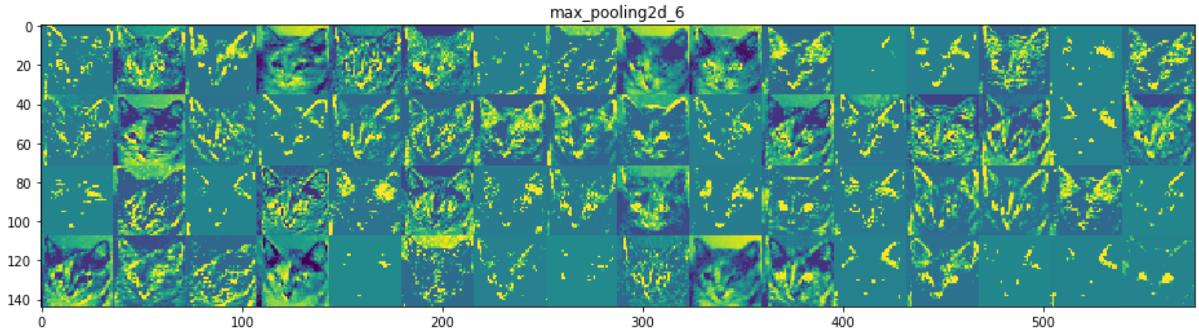
```
layer_names = []

for layer in model.layers[:8]:
    layer_names.append(layer.name)

images_per_row = 16

for layer_name, layer_activation in zip(layer_names, activations):
    n_features = layer_activation.shape[-1]

    size = layer_activation.shape[1]

    n_cols = n_features // images_per_row
    display_grid = np.zeros((size * n_cols, images_per_row * size))

    for col in range(n_cols):
        for row in range(images_per_row):
            channel_image = layer_activation[0, :, :, col * images_per_row + row]
            channel_image -= channel_image.mean()
            channel_image /= channel_image.std()
            channel_image *= 64
            channel_image += 128
            channel_image = np.clip(channel_image, 0, 255).astype('uint8')
            display_grid[col * size : (col + 1) * size,
                         row * size : (row + 1) * size] = channel_image

    scale = 1. / size
    plt.figure(figsize=(scale * display_grid.shape[1],
                        scale * display_grid.shape[0]))
    plt.title(layer_name)
    plt.grid(False)
    plt.imshow(display_grid, aspect='auto', cmap='viridis')
```

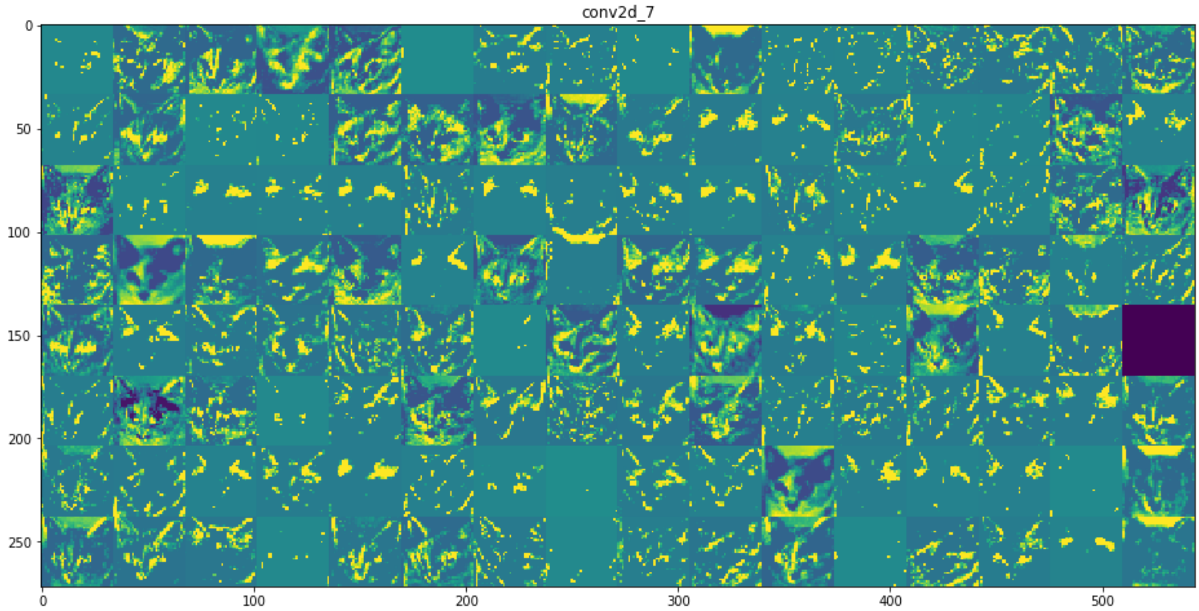
```
C:\Users\pablo\Python\envs\DAVID\lib\site-packages\ipykernel_launcher.py:20: RuntimeWarning: inval
id value encountered in true_divide
```

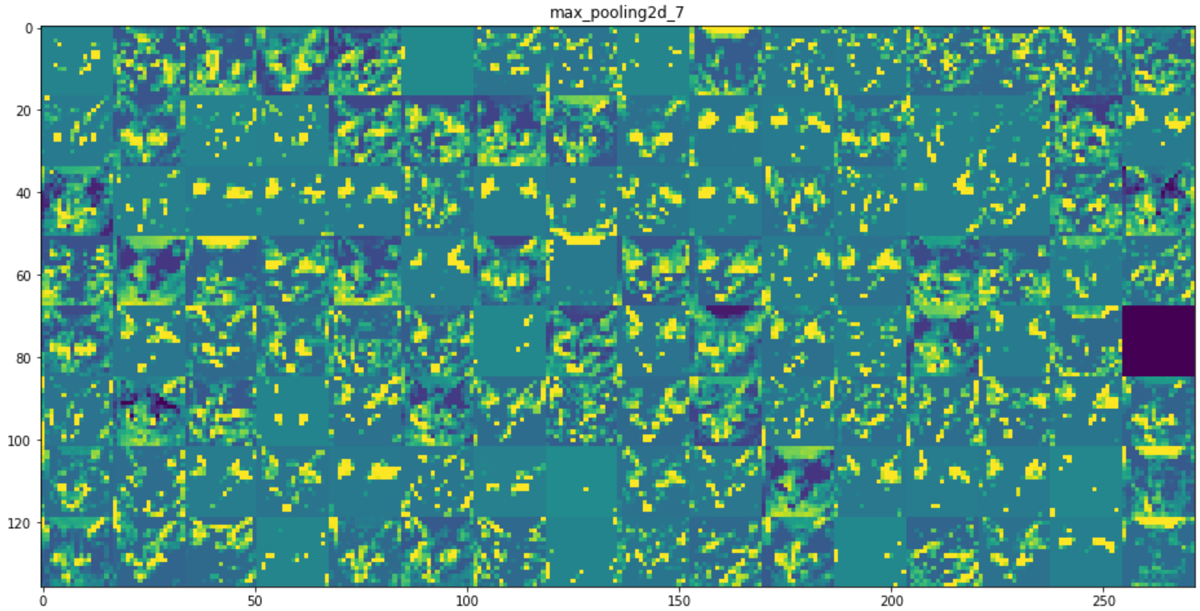


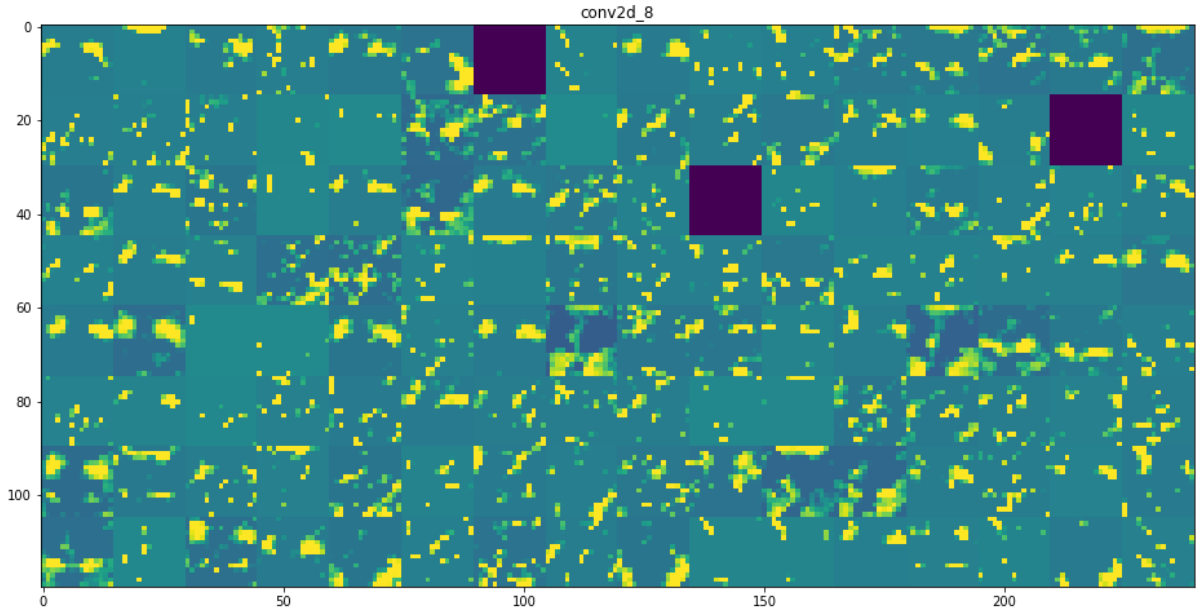


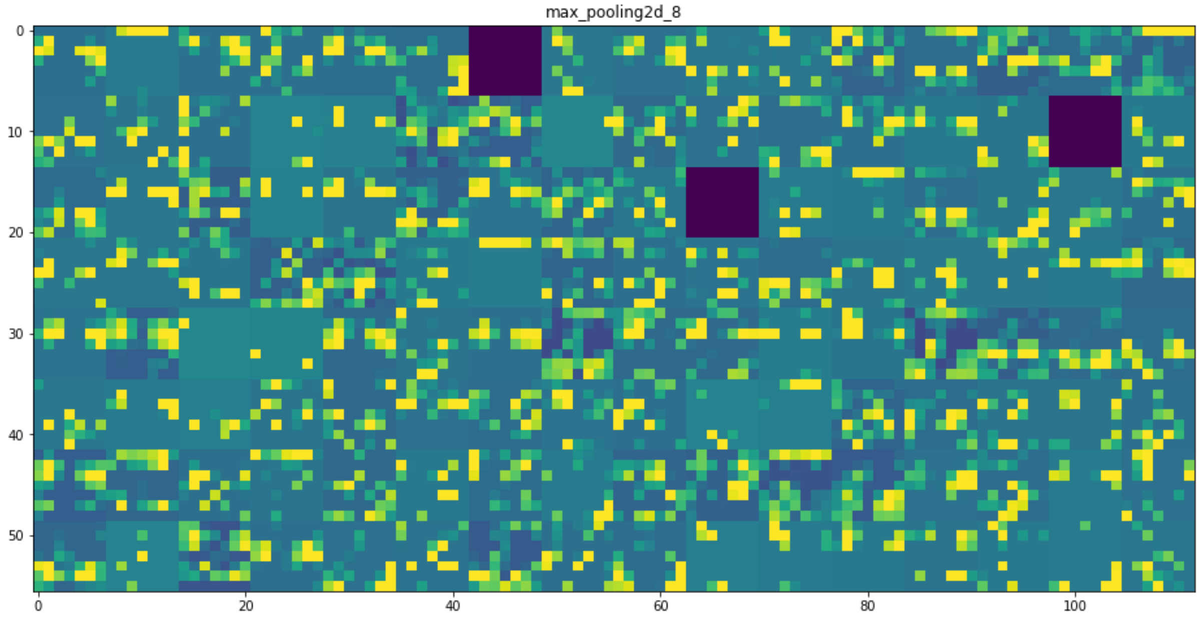












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