Deep Learning with Keras

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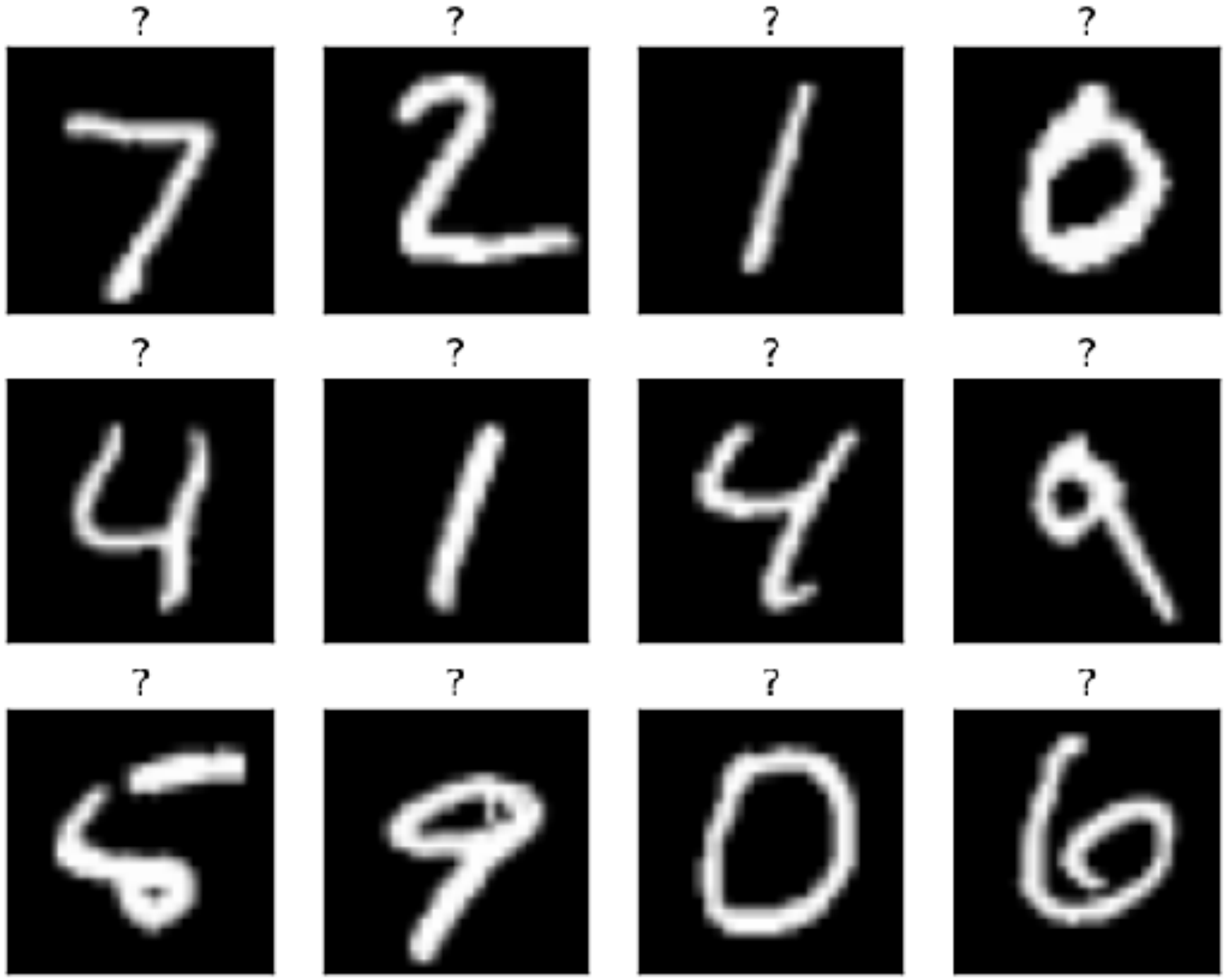
Keras

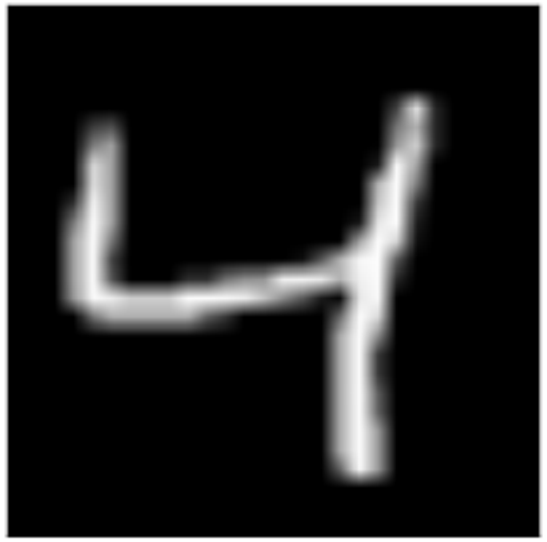
- Deep learning library in Python
- API for Theano, Tensorflow backend
- Easy to use, modular, extensible

Let’s start with an example

- 28 x 28 pixels
- 10 classes
- 60000 training, 10000 testing examples
- Find the regions in the 784 dim space that correspond to the digits



MNIST Example



```
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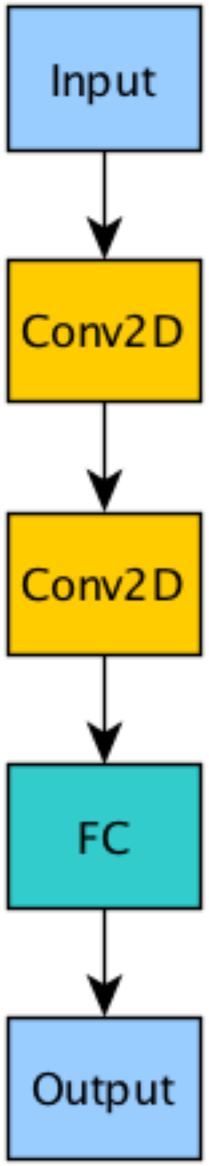
```

MNIST Classifier

→ 4



Input

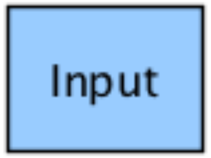
Conv2D

Conv2D

FC

Output

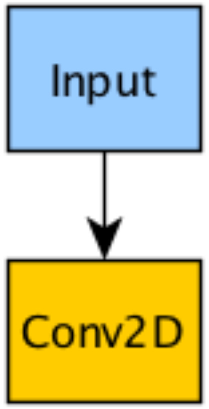
MNIST Classifier



```
from keras.datasets import mnist
(x_train, y_train), (x_test, y_test) =
mnist.load_data()

inp = Input(shape=(1,28,28))
```

MNIST Classifier



```
from keras.datasets import mnist
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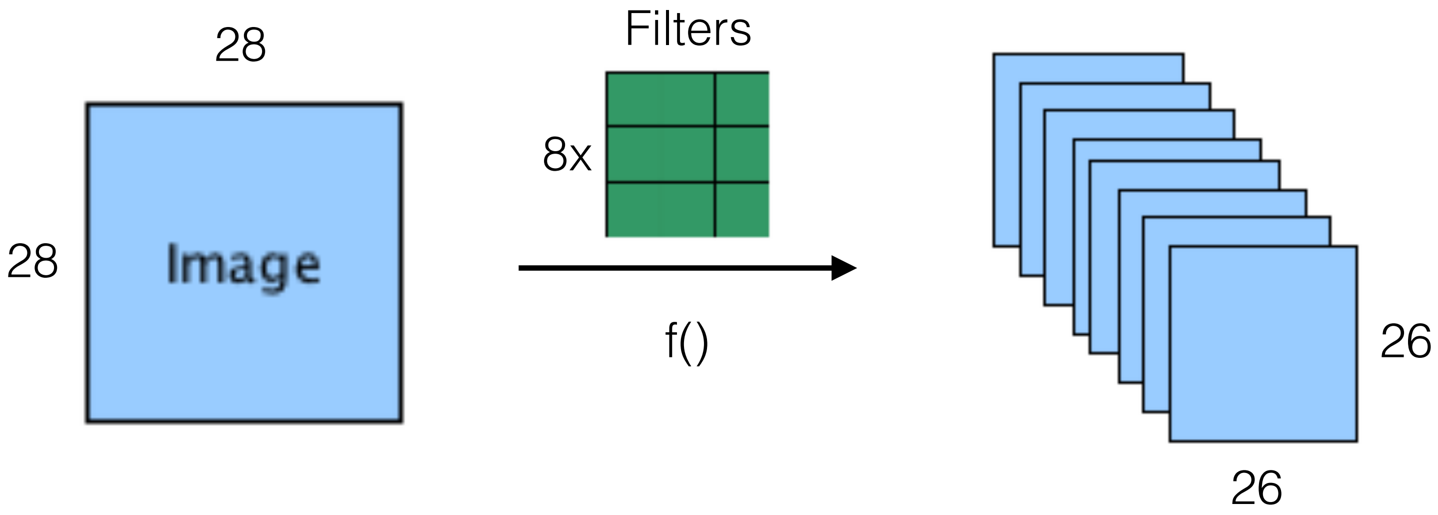
inp = Input(shape=(1,28,28))
L1 = Conv2D(8, 3, activation='relu')(inp)
```



MNIST Classifier

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inp = Input(shape=(1,28,28))
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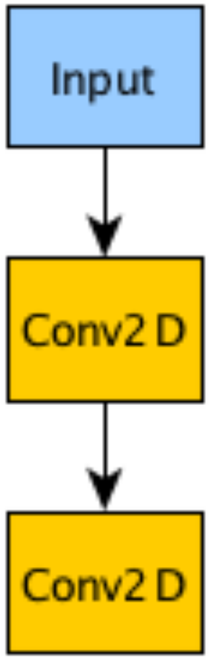
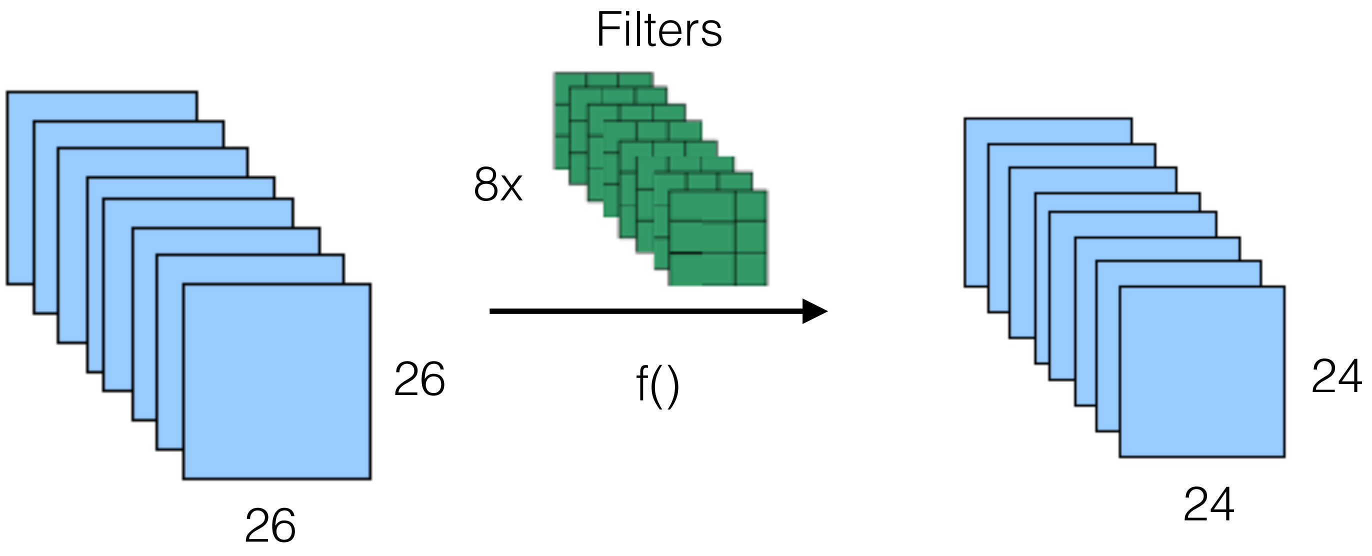
L2 = Conv2D(8, 3, activation='relu')(L1)
```





MNIST Classifier

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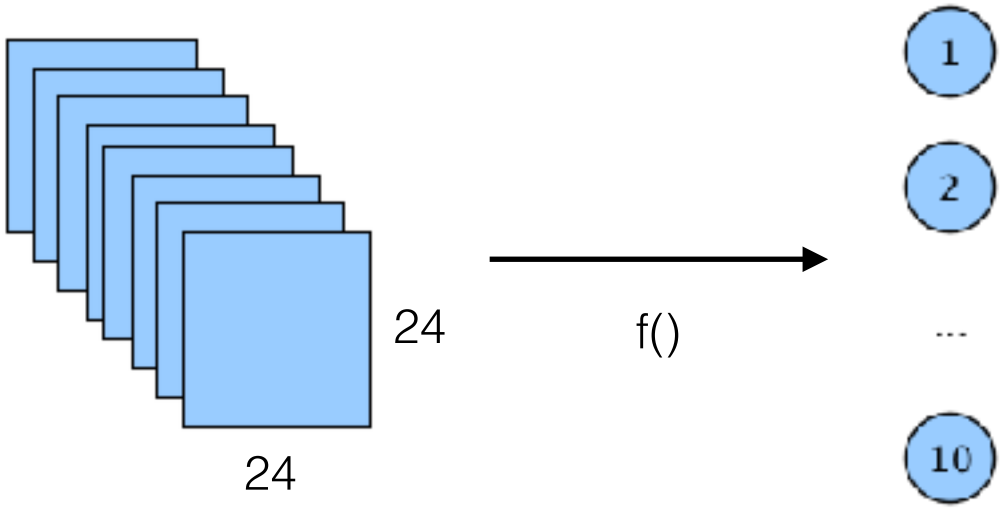
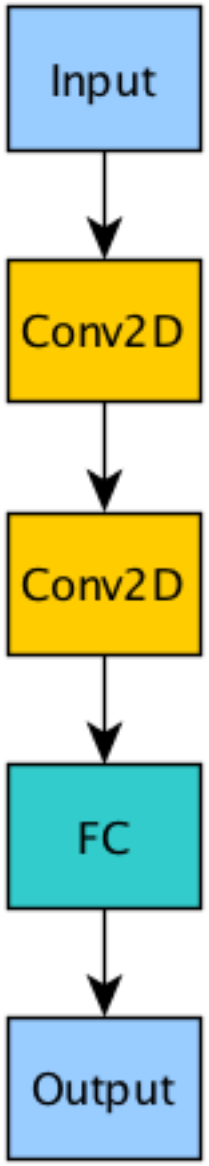
L2 = Conv2D(8, 3, activation='relu')(L1)
L3 = Flatten()(L2)
out = Dense(10, activation='softmax')(L3)
```





MNIST Classifier

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inp = Input(shape=(1,28,28))
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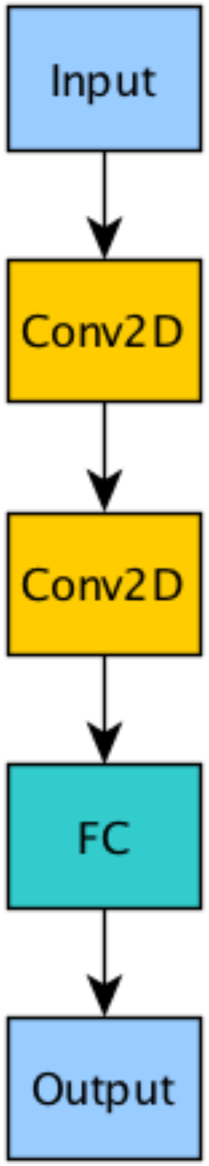
L2 = Conv2D(8, 3, activation='relu')(L1)
L3 = Flatten()(L2)
out = Dense(10, activation='softmax')(L3)

model = Model(inputs=inp, outputs=out)
model.compile(loss='categorical_crossentropy',
optimizer='adam', metrics=[‘acc'])

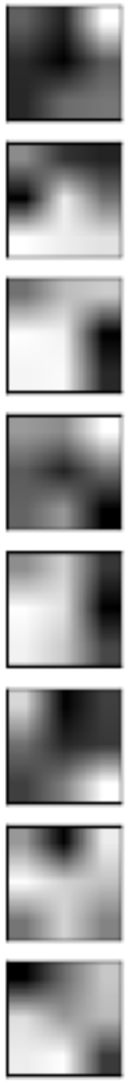
h = model.fit(x_train, y_train, validation_split=0.1,
batch_size=32, epochs=5)
```

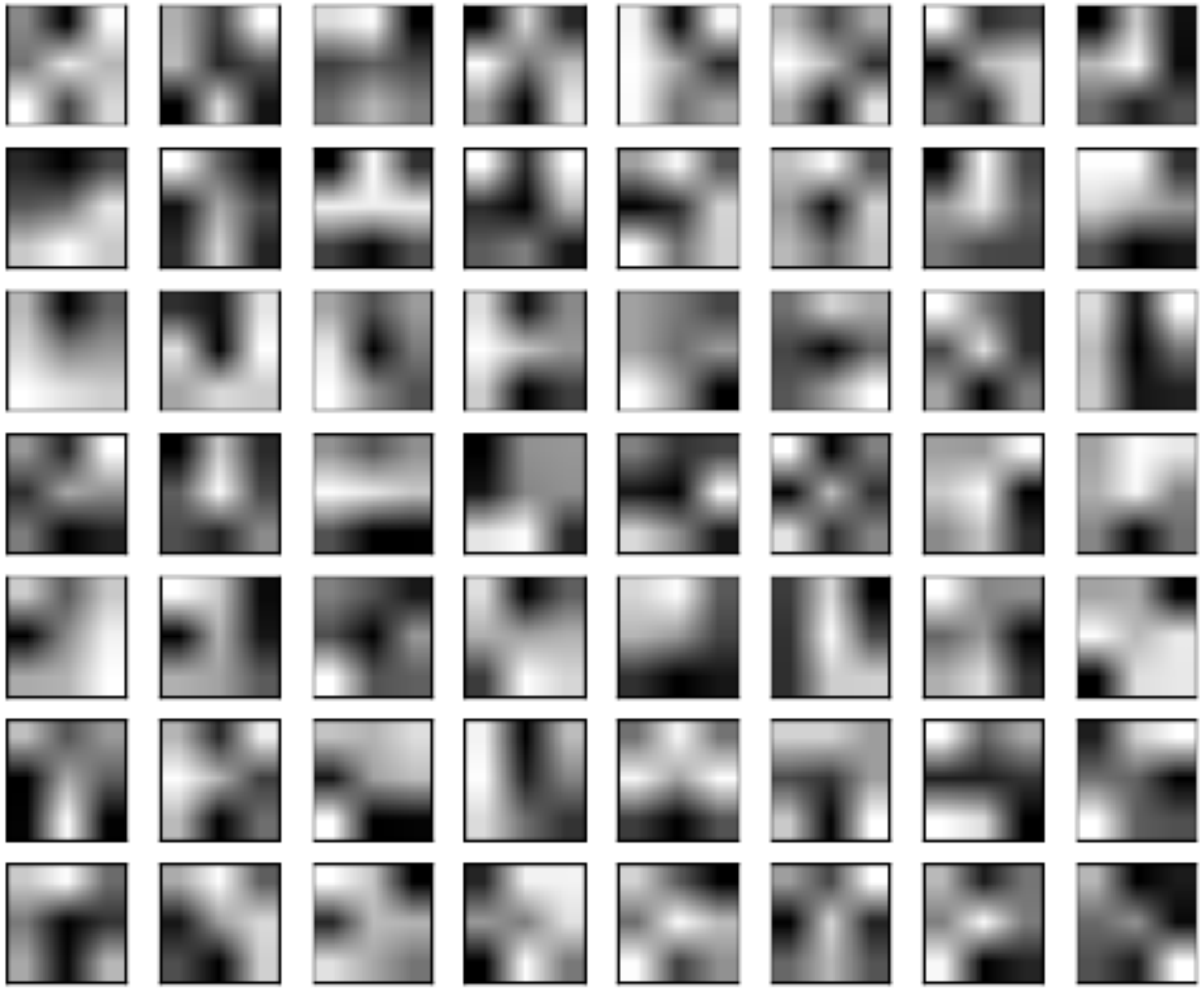


- What is epoch?
- Batch size?

MNIST Classifier

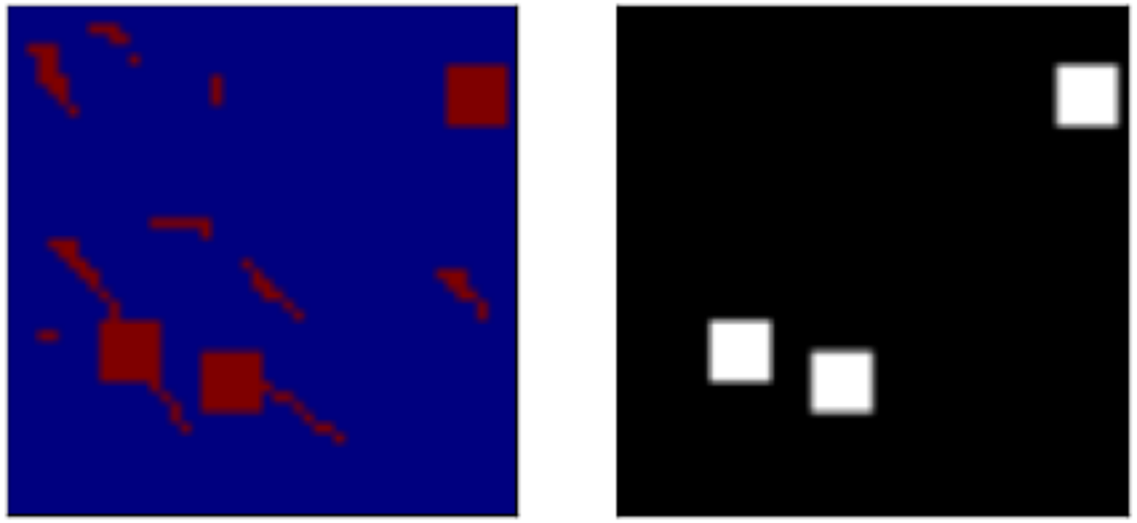
```
w1=model.layers[1].get_weights() # shape: (3,3,1,8)
w2=model.layers[2].get_weights() # shape: (3,3,8,8)
```





Segmentation

- Randomly generated dataset
- 2000 examples
- 50 x 50 pixels
- Segment rectangles

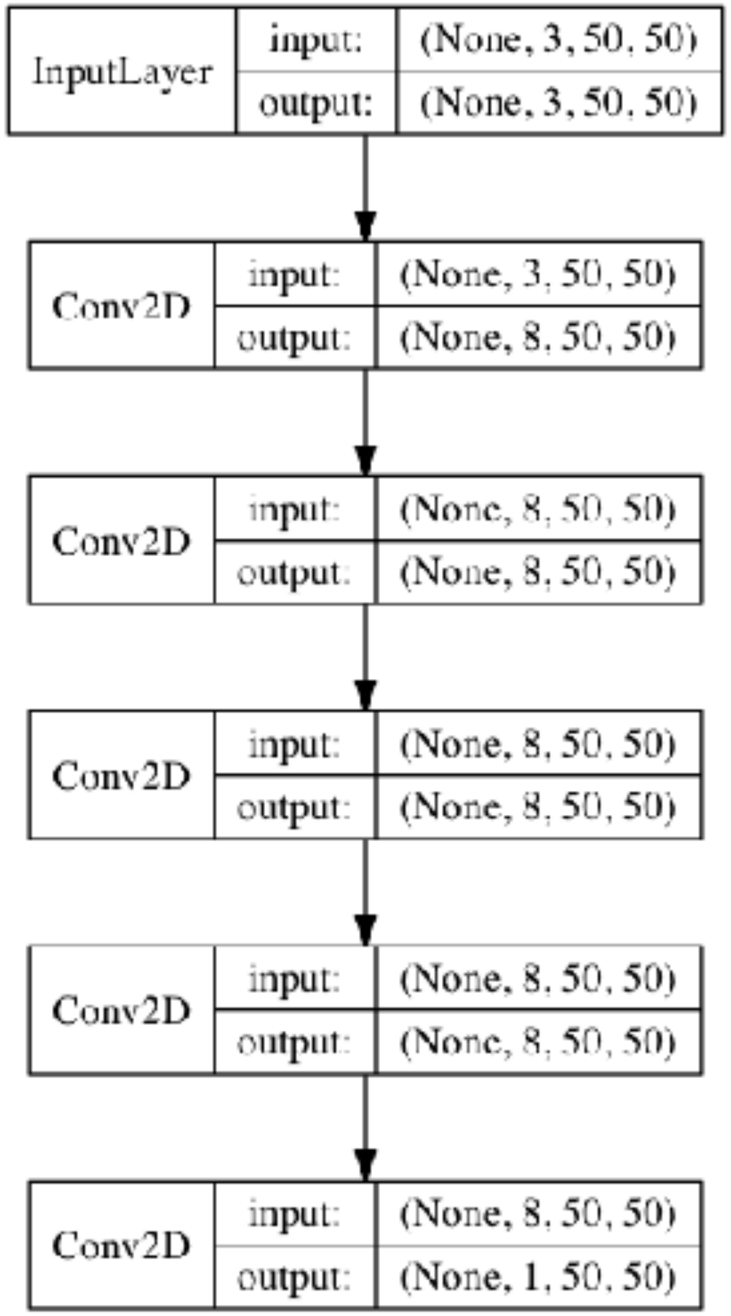


Segmentation

```
inp = Input(shape=(3,50,50))
L1 = Conv2D(8, 3, activation='relu',
           padding='same')(inp)
L2 = Conv2D(8, 3, activation='relu',
          padding='same')(L2)
L3 = Conv2D(8, 3, activation='relu',
          padding=‘same')(L2)
L4 = Conv2D(8, 3, activation='relu',
          padding='same')(L3)
out = Conv2D(1, 1, activation='sigmoid',
             padding='same')(L4)

model = Model(inputs=inp, outputs=out)
model.compile(loss=dsc_loss,
optimizer='adam',
               metrics=[‘acc’, dsc])

h = model.fit(x, y, validation_split=0.1,
batch_size=32, epochs=5)
```



InputLayer | input: (None, 3, 50, 50) | output: (None, 3, 50, 50)

Conv2D | input: (None, 3, 50, 50) | output: (None, 8, 50, 50)

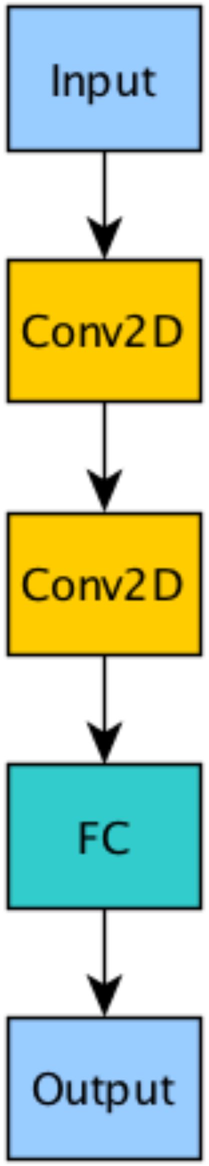
Conv2D | input: (None, 8, 50, 50) | output: (None, 8, 50, 50)

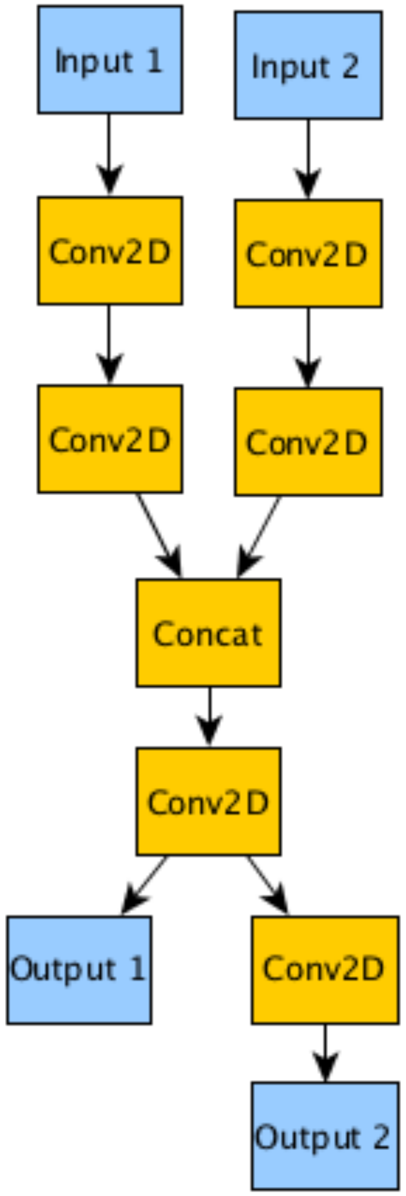
Conv2D | input: (None, 8, 50, 50) | output: (None, 8, 50, 50)

Conv2D | input: (None, 8, 50, 50) | output: (None, 8, 50, 50)

Conv2D | input: (None, 8, 50, 50) | output: (None, 1, 50, 50)

Architectures





Basic Layers

- Fully Connected

```
Dense(dims, activation)
```

- Convolutional

```
Conv1D(filters, kernel_size, strides, padding, activation)
Conv2D(filters, kernel_size, strides, padding, activation)
```

- Pooling and upsampling

```
MaxPooling2D(pool_size, strides, padding)
AveragePooling2D(pool_size, strides, padding)
UpSampling2D(size)
```

- Merge

```
Concatenate()
Add()
Multiply()
```

Other Layers

- Dropout
- BatchNormalization
- Activation: linear, relu, LeakyRelu, sigmoid, tanh, etc
- Noise
- SimpleRNN
- Lambda

Summary

- Create a model

```
model = Model(inputs=[inp1, inp2], outputs=[out1, out2])
```

- Configure learning

```
model.compile(loss={out1: 'mse', out2:'categorical_crossetropy'},
              loss_weights={'out1': 0.3, 'out2': 0.7},
              optimizer='sgd', metrics=['acc', my_metric_fnc])
```

- Train

```
model.fit(x, y, batch_size, epochs, validation_data)
```

- Test

→ `model.predict` → car

Keras Overview

- Neural Network is a keras Model
- Architecture is a graph of layers
- Configure Model: loss function, optimiser
- Train

Thank You!

https://github.com/agis85/keras_tutorial