Practical work 08 – Convolutional Neural Networks with Keras

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Exercice 1 **Computation of convolutions**

(a)

S=1, P=0

9	6	4	5	2	2	7

S=2, P=0

9	4	2	7

S=4, P=0

9	2

S=1, P=1

1	9	6	4	5	2	2	7	6

S=4, P=1

0	5	6

We got the same dimension as the input with S=1 and P=1.

(b)

i. One output volume of two activation maps. 3x3x2.
ii. 3x3x2
iii. 2x2x2
iv. With a filter with of dimension 2x2x3, S=1 and P=0.
v.

Activation1 [:,:,0]

1	1	2
3	-1	6
6	2	4

Activation2 [:,:,1]

3	2	7
-1	3	7
4	1	6

Exercice 2 **MLP with Keras on CIFAR10**

```
Test loss: 1.3741181241989135
Test accuracy: 0.515
```

With 300 hidden layers with Relu activation, follow by a dropout of 0.2, then again 100 hidden layers with Relu activation and finally the output layer for the 10 classes with the sigmoid activation.

Exercice 3 **CNN with Keras on CIFAR10**

Simple CNN

```
10000/10000 [==============================] - 4s 414us/step
50000/50000 [==============================] - 19s 375us/step
Train accuracy: 0.77516
Test accuracy: 0.6448
```

Layer1, Conv D=32 3x3, S=1, P='same'
Layer2, Activation Relu
Layer3, Max Pooling 2x2
Layer4, Dense 1x1x10
Layer5, Activation Softmax

Deeper CNN

CNN	Architecture	Accuracy Train %	Accuracy Test %
1 30 epochs	Layer1, Conv D=32 3x3, S=1, P='same' Layer2, Activation Relu Layer3, Max Pooling 2x2 Layer4, Dense 1x1x10 Layer5, Activation Softmax	0.77516	0.6448
2 30 epochs	Layer1, Conv D=32 3x3, S=1, P='same' Layer2, Activation Relu Layer3, Conv D=32 3x3, S=1, P='same' Layer4, Activation Relu Layer5, Max Pooling 2x2 Layer6, Dropout 0.25 Layer7, Conv D=64 3x3, S=1, P='same' Layer8, Activation Relu Layer9, Conv D=64 3x3, S=1, P='same' Layer10, Activation Relu Layer11, Max Pooling 2x2 Layer12, Dropout 0.25 Layer13, Dense 1x1x512 Layer14, Activation Relu Layer15, Dropout 0.5	0.879	0.778

	Layer16, Dense 1x1x10 Layer17, Activation Softmax		
4	Layer1, Conv D=32 3x3, S=1, P='same' Layer2, Activation Relu Layer3, Conv D=32 3x3, S=1, P='same' Layer4, Activation Relu Layer5, Batch Normalization Layer6, Max Pooling 2x2 Layer7, Dropout 0.2 Layer8, Conv D=32 6x6, S=1, P='same' Layer9, Activation Relu Layer10, Conv D=32 6x6, S=1, P='same' Layer11, Activation Relu Layer12, Batch Normalization Layer13, Max Pooling 2x2 Layer14, Dropout 0.3 Layer15, Dense 1x1x512 Layer16, Activation Relu Layer17, Dropout 0.5 Layer18, Dense 1x1x10 Layer19, Activation Softmax	0.825	0.762
5	Layer1, Conv D=32 3x3, S=1, P='same' Layer2, Activation Relu Layer3, Conv D=32 3x3, S=1, P='same' Layer4, Activation Relu Layer5, Batch Normalization Layer6, Max Pooling 2x2 Layer7, Dropout 0.25 Layer8, Conv D=64 3x3, S=1, P='same' Layer9, Activation Relu Layer10, Conv D=64 3x3, S=1, P='same' Layer11, Activation Relu Layer12, Batch Normalization Layer13, Max Pooling 2x2 Layer14, Dropout 0.25 Layer8, Conv D=128 3x3, S=1, P='same' Layer9, Activation Relu Layer10, Conv D=128 3x3, S=1, P='same' Layer11, Activation Relu Layer12, Batch Normalization Layer13, Max Pooling 2x2 Layer14, Dropout 0.25 Layer15, Dense 1x1x512 Layer16, Activation Relu	0.825	0.7618

	Layer17, Dropout 0.5 Layer18, Dense 1x1x10 Layer19, Activation Softmax		