Report - DeepL PW08

- Romain Capocasale
- Jean Demeusy
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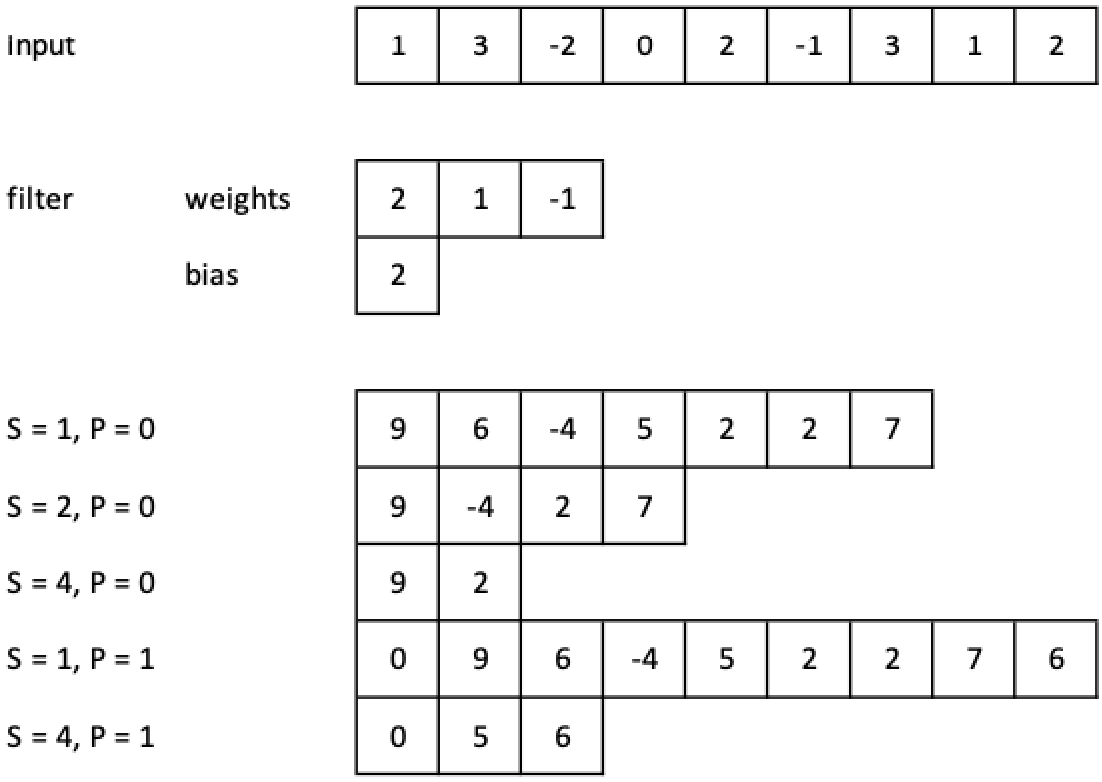
Exercice 1

a)



Input		1	3	-2	0	2	-1	3	1	2
filter	weights	2	1	-1						
	bias	2								
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		0	9	6	-4	5	2	2	7	6
S = 4, P = 1		0	5	6						

With S = 1 and P = 1, the output is the same dimension as the input. The padding requiered to get the same size is P = (size(weights)-1) / 2 = (3-1)/2 = 1.

b)

How many activation maps will we obtain ? We will have **2** actiavtion maps because there are 2 filters in the convolution layer.

With S = 1 and P = 0, what will be the dimension of the output volume ? As there is no padding and with a stride of 1, we will get an activation map of size 3x3, as there are 2 activation maps the output volume is **3x3x2**.

With S = 2 and P = 0, what will be the dimension of the output volume ?

Same principle as above, with a stride of 2 the output volume will be **2x2x2**.

Give a filter size, padding value and stride value that will preserve the spatial dimension of the input.

- Filter size = 2x2x3

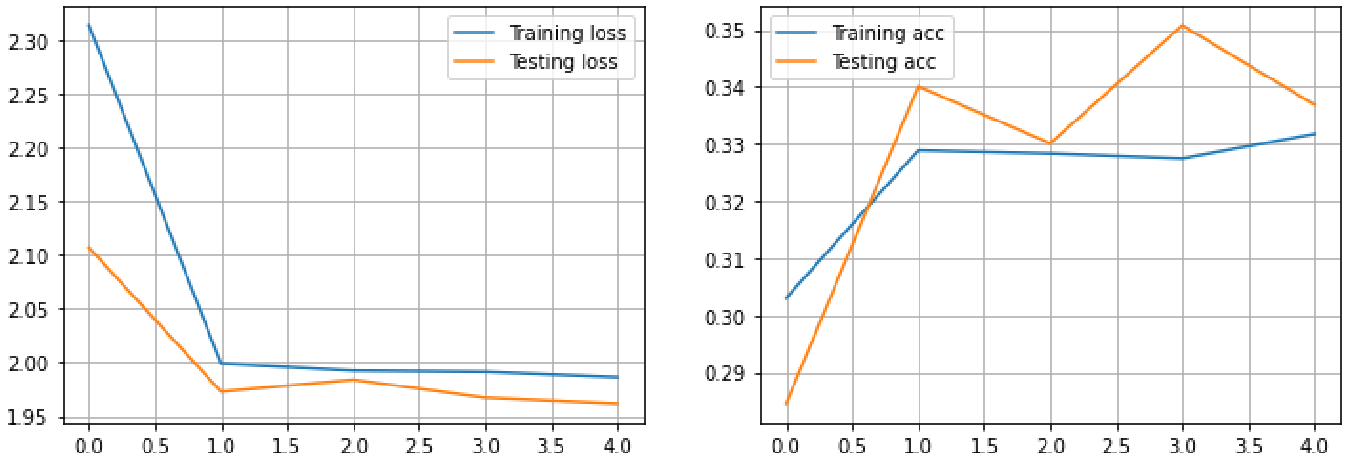
- Padding value = 1
- Stride = 1

Exercice 2

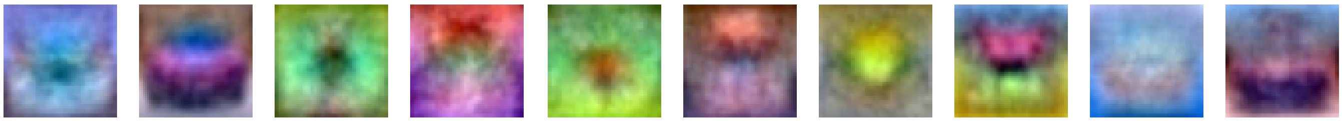
One-layer network and weight visualisation

Dense	Architecture	Acc. train %	Acc. test%
1	Layer1: DENSE 10 neurons, activation = "softmax", l2 regularization	33.3	33.7

Loss/acc plot:



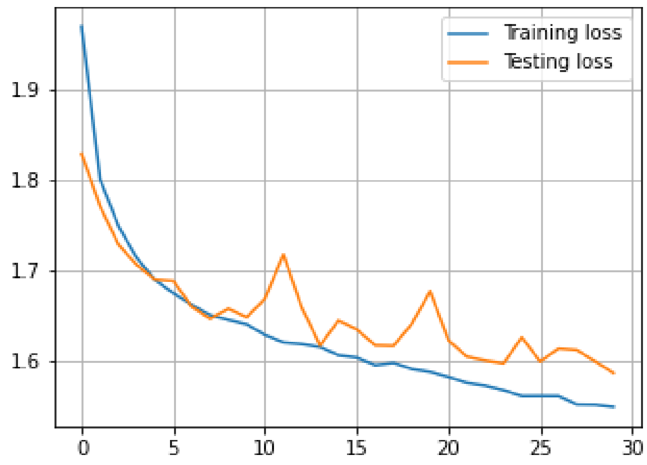
Weights visualisation

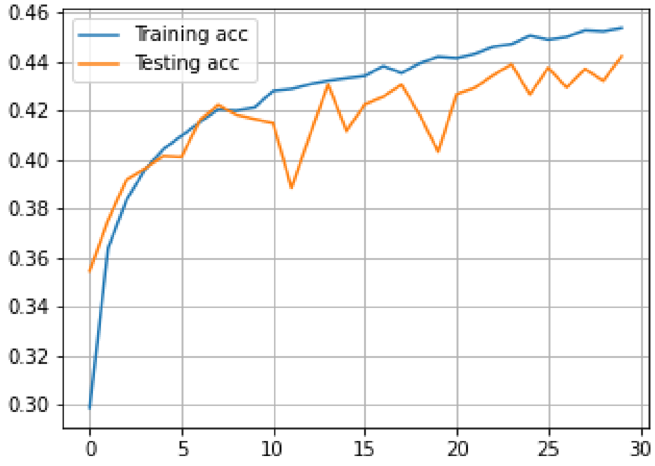


Two-layers network

Dense	Architecture	Acc. train %	Acc. test%
1	Layer1: DENSE 128 neurons, activation = "relu"; Layer2: DENSE 10 neurons, activation = "softmax". batch size: 128	45.5	44.2

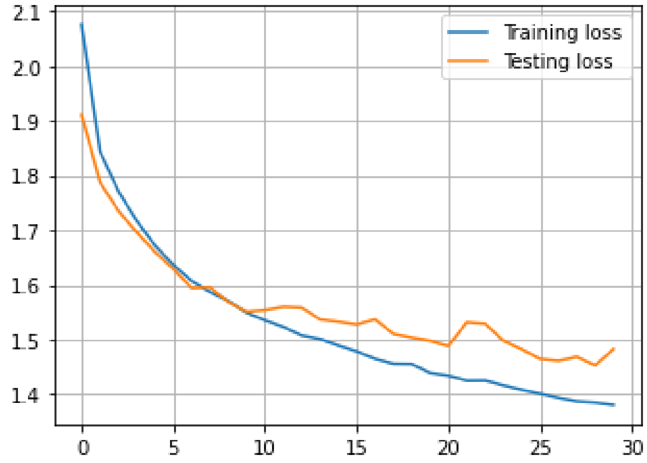
Loss/acc plot:

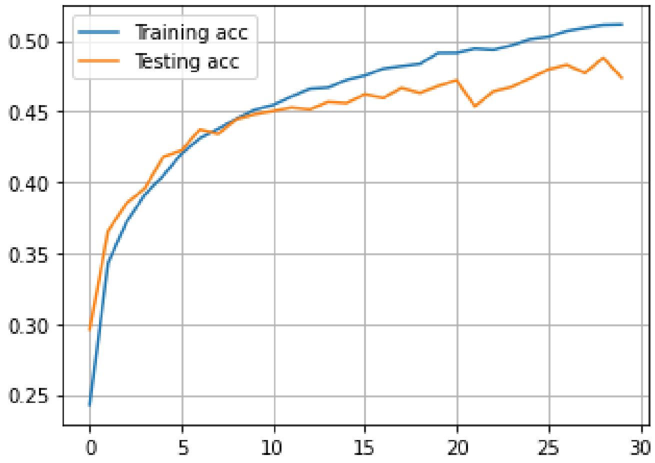




Dense	Architecture	Acc. train %	Acc. test%
BEST	Layer1: DENSE 128 neurons, activation = "relu"; Layer2: DENSE 32 neurons, activation = "relu"; Layer3: DENSE 10 neurons, activation = "softmax". batch size: 256	51.3	47.4

Loss/acc plot:



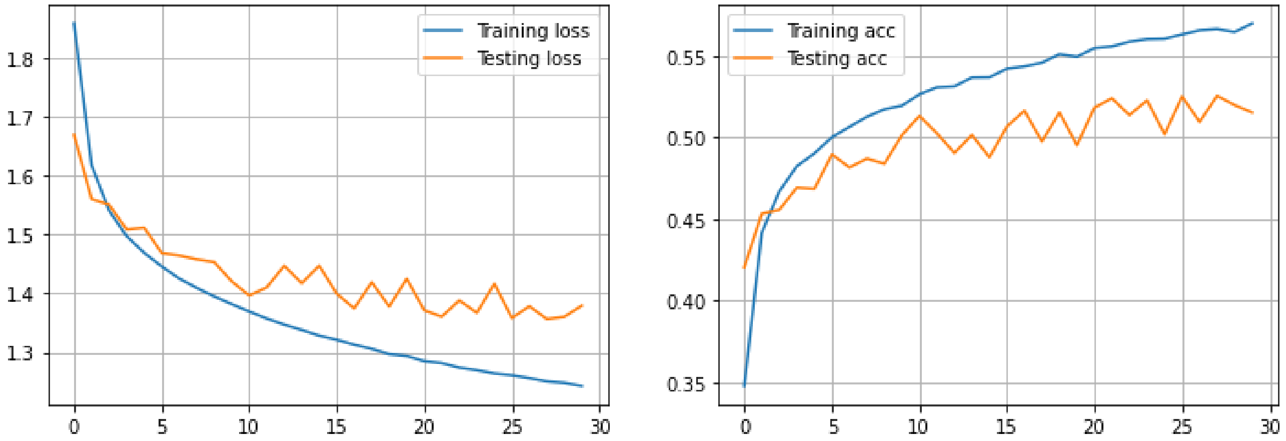


Exercice 3

Simple CNN

CNN	Architecture	Acc. train %	Acc. test%
1	Layer1 : CONV D=32, w=h=3, S=1, P='same', activation='relu; Layer2 : MAXPOOL S=1, size=2; Layer3 : DENSE 10, activation='softmax'	57.0	51.8

Loss/acc plot:



Discussion from previous exercice :

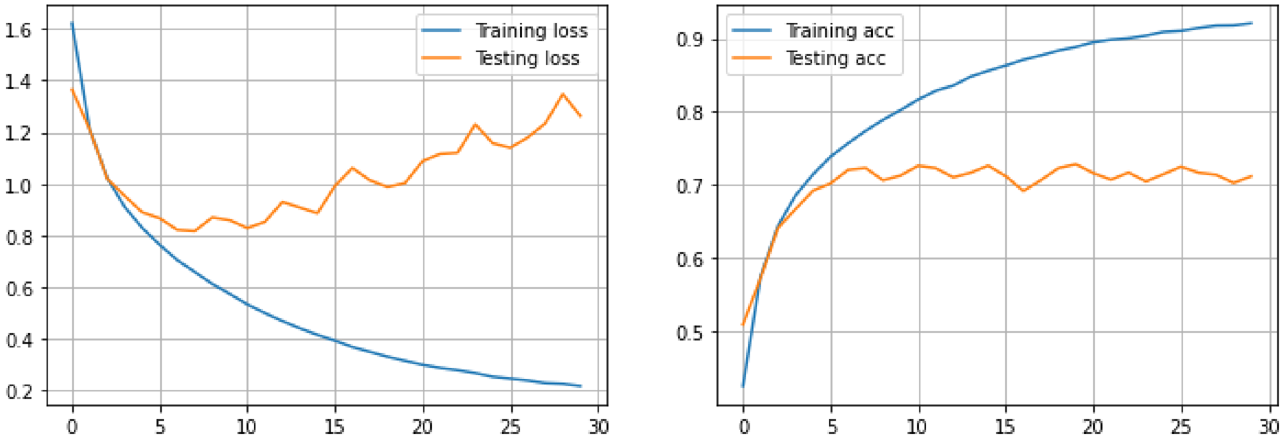
We can see that the model based on CNN is way more accurate than the previous MLP model : the accuracy with CNN layers is around 7% higher than the Dense network. This seams logical, as the type of layer used here is coherent with the type of data passing through the network (images). CNN layers allows to keep spatial information in the image, where MLP flatten all dimensions to a single vector for each image. However, as the scores in the next point show, we can get better results by changing the configuration of the CNN network and in particular by adding more convolution layers.

Deeper CNN

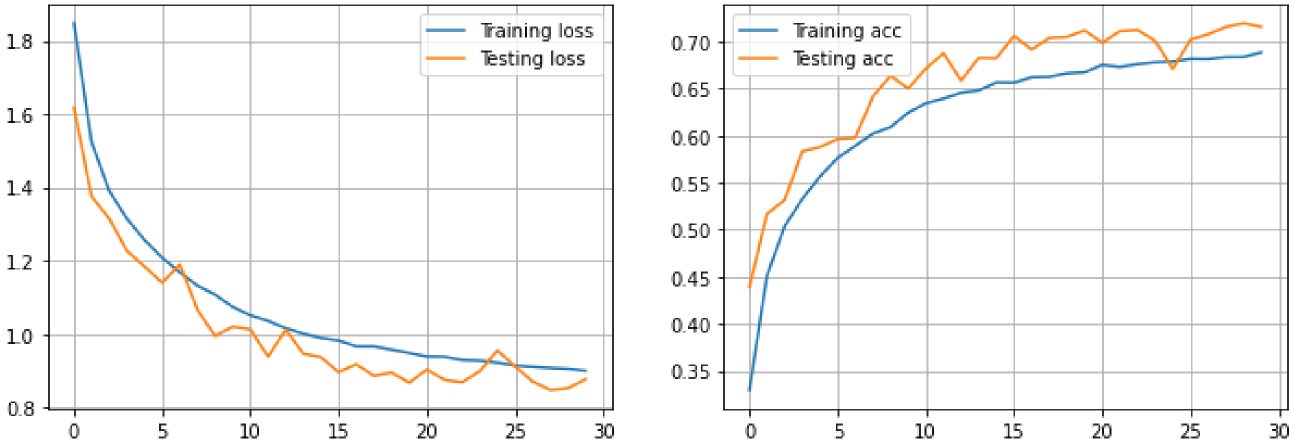
CNN	**Architecture**	**Acc. train %**	**Acc. test%**
1	Layer1 : CONV D=32, w=h=3, S=1, P='same', activation='relu; Layer2 : CONV D=32, w=h=3, S=1, P='same', activation='relu; Layer3 : MAXPOOL S=1, size=2; Layer4 : DROPOUT : 0.25; Layer4 : CONV D=64, w=h=3, S=1, P='same', activation='relu; Layer5 : DENSE 10, activation='softmax'	92.0	71.1
2	Layer1 : CONV D=32, w=h=3, S=1, P='same', activation='relu; Layer2 : CONV D=32, w=h=3, S=1, P='same', activation='relu; Layer3 : MAXPOOL S=1, size=2; Layer4 : DROPOUT : 0.5; Layer5 : CONV D=32, w=h=3, S=1, P='same', activation='relu; Laye6 : DROPOUT : 0.5; Layer7 : DENSE 10, activation='softmax'	68.9	71.5
3	Layer1 : CONV D=32, w=h=3, S=1, P='same', activation='relu; Layer2 : CONV D=32, w=h=3, S=1, P='same', activation='relu; Layer3 : MAXPOOL S=1, size=2; Layer4 : DROPOUT : 0.5; Layer5 : CONV D=32, w=h=3, S=1, P='same', activation='relu; Laye6 : DROPOUT : 0.5; Layer7 : DENSE 128, activation='relu'; Layer8 : DROPOUT ; Layer9 : DENSE 10, activation='softmax'	65.80	69.4

CNN	Architecture	Acc. train %	Acc. test%
4	LLayer1 : CONV D=32, w=h=3, S=1, P='same', activation='relu; Layer2 : DROPOUT 0.2;Layer3 : CONV D=32, w=h=3, S=1, P='same', activation='relu; Layer4 : MAXPOOL S=1, size=2;Layer5 : CONV D=64, w=h=3, S=1, P='same', activation='relu; Layer6 : DROPOUT 0.2;Layer7 : CONV D=64, w=h=3, S=1, P='same', activation='relu; Layer8 : MAXPOOL S=1, size=2;Layer9 : CONV D=128, w=h=3, S=1, P='same', activation='relu; Layer10 : DROPOUT 0.2;Layer11 : CONV D=128, w=h=3, S=1, P='same', activation='relu; Layer12 : MAXPOOL S=1, size=2;Layer13 : DROPOUT 0.2;Layer14 : Dense 1024, activation='relu'Layer15 : DROPOUT 0.2;Layer16 : Dense 512, activation='relu'Layer17 : DROPOUT 0.2;Layer18 : Dense 10, activation='softmax'	80.8	76.3

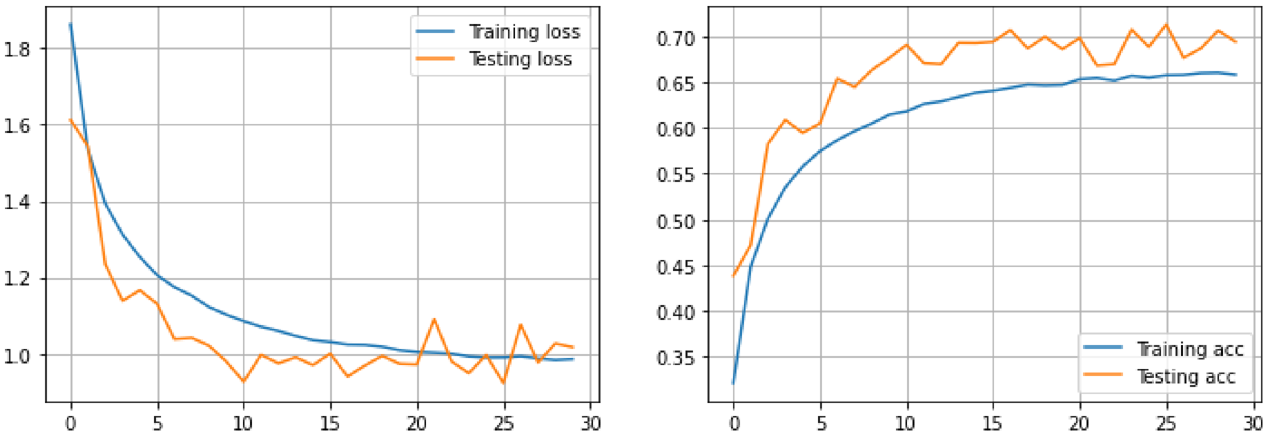
CNN 1 Loss/acc plot:



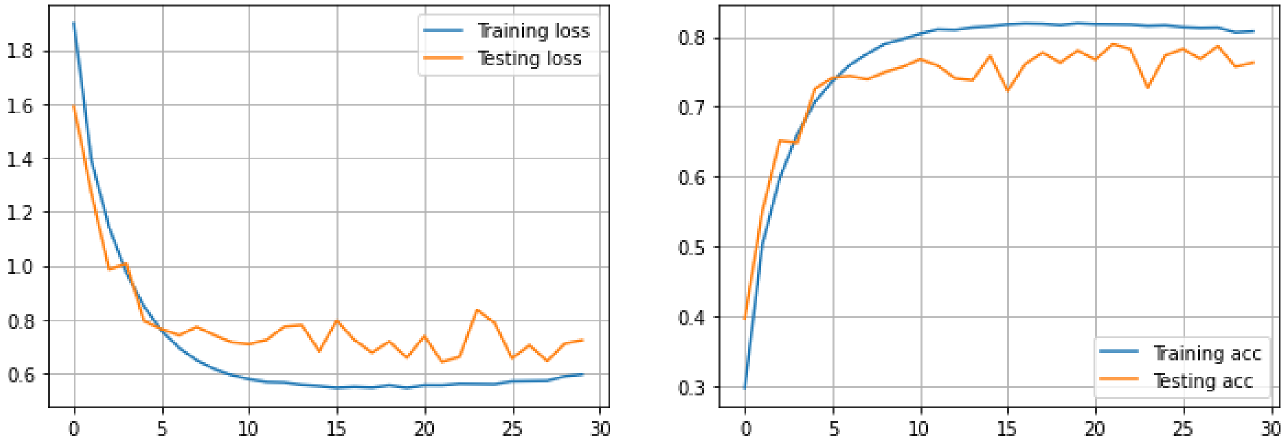
CNN 2 Loss/acc plot:



CNN 3 Loss/acc plot:



CNN 4 Loss/acc plot:



Discussion : It can be seen that the best result is obtained with the 4th CNN architecture. This architecture has more Convolution/Maxpooling layer and with more filter on the convolution layer. This configuration also has 2 Dense layers (one of 1024 and one of 512) compared to the others. We also notice that this configuration does not overfit the data (compared to the first configuration for example). This is the 4th configuration with an accuracy of 76.3 on the test set which is retained.