Machine Learning Homework 3

1. **Briefly** answer the following questions:

(1) Why do neural networks need activation functions?

(2) Briefly describe the influence of the value of the learning rate on the training of the neural network.

(3) What advantages does CNN have over fully connected DNN in image classification?

2. The input size of AlexNet is 227×227×3. Given CONV1:

(CONV1): 96 11x11 filters at stride 4, pad 0

What is the output size after CONV1? Write out the calculation process.

3. Convolution and Pooling Operations：

(1)The 4×4 feature map is convolved with a 3×3 convolution kernel (stride = 1). Calculate feature maps output in both cases respectively:

a) No padding;

b) 0 is padded around the feature map to keep the output feature size unchanged

1	2	3	0
0	1	2	3
3	0	1	2
2	3	0	1

Feature Map

2	0	1
0	1	2
1	0	2

Kernel

(2). The given feature maps are max-pooled and average-pooled respectively using a 2×2 pooling layer (stride = 2). Calculate the output feature map.

1	4	2	1
5	8	3	4
7	6	4	5
1	3	1	2

Feature Map

Submission

1. **Format**: Please submit a pdf/doc/docx file and name it in this format:

   HW3+Student_ID+Name. Example: HW3+1234567+张三.pdf

2. **Deadline**: 2025/6/20 23:59. You have 14 days.

3. Please submit your homework to **Canvas**.

4. **Late policy**: **7** free late days

   a) Use up to 4 late days per assignment.

   b) Afterwards, 25% off per day late.