

5DV121
Fundamentals of Artificial Intelligence
Assignment 5
ANN

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Contents

1	Algorithm	1
1.1	File Management	1
1.2	Training	1
1.3	Testing	1
1.3.1	Back Propagation	1
2	Discussion	2

1 Algorithm

Our program is divided into three main parts. File Management, Training, and Testing.

1.1 File Management

Our program reads the files and saves the training-images in a array containing a 2d array on each index which represents each image. The training-keys are read and their values are stored in an array containing the keys value. The test is read and stored the same way as the training-images.

1.2 Training

The training also known as our preceptor uses the Back Propagation algorithm to train the program (see section 1.3.1). The training uses 2/3 of the input.

Our program uses four synapses (aka nodes), one for each classification (key). Each synapse has the same size as the given images and is initiated with random numbers. The synapses is later calculated (see Figure 1 to represent one of four given emotional states: Happy, Sad, Mischievous and Angry. The synapses is later used to work as and reference in the testing (see section 1.2).

1.3 Testing

This part of the program is used to classify the remaining 1/3 of the input (see Figure 1). This part of the program also writes the result of the classification. The result is later used in the automatic testing when handing in the assignment.

1.3.1 Back Propagation

One of the most popular training algorithm. It is an supervised learning method which uses nodes and an error function. The method calculates the gradient of the error function with respect to the nodes weights. We use it in the following way: We run the test for all the images a fixed amount of time and if our recognised error is low enough we break from the loop earlier. Then we train on 2/3 of the training_data and test on 1/3. To see how the training works (see Figure 1).

```
1 # Back-propagation training and testing
2
3 function sigmoid(image, synapse) {
4     return 1 / (1 + exp(-(dot(image, synapse))))
5 }
6
7 function main() {
8     images = read_file(images.txt)
9     keys = read_file(keys.txt)
10    test = read_file(test.txt)
11
12    # training
13    error = 32
14    synapses[4, 400] = random(0, 1)
15    constant = 0.06
16    for 100 times
17        if error < 0.09 # If good enough result
18            break
19        error = 0
20
21        for i in size(images)
22            if i \% 3 != 0 # Train on 2/3
23                for j in 4
24                    synapses[j] += constant * image * (keys[j] == (i + 1) - \
25                    sigmoid(image, synapses[j]))
26            else # Test on 1/3
27                for j in 4
28                    error += sum(pow(answer == (i + 1) - sigmoid(image, synapses[j], 2)))
29
30        error = error / size(images)
31
32    # Print test result
33    for i in size(test)
34        print "Image" + (i + 1) + ": " + max(loop over synapses and return array of \
35        4 pow((answer == (j + 1)) - sigmoid(image, synapses[j], 2)
36 }
```

Figure 1 – Pseudo Code of our Program.

2 Discussion

The overall work went fine, but we faced some complications along the way. We had some difficulties to understand the assignment since there were a lot of math which we did not find a good explanation of and we had to dig a bit on the internet to find a good explanation of back-propagation. After discussions with teachers and classmates and by searching the web we began to understand the algorithm and we got a good result which we are satisfied with.

We choose to use the Back Propagation algorithm, since it was one of the most popular and there were many tutorials online. After that we adapted the algorithm to our assignment and divided the main parts into functions. Here we faced some issues. We were not sure what the different functions actually did, mostly since there were math without a good explanation. But over time it started to clear up and we started to get some results. We also used pen and paper to draw how our program

should work which helped a lot in the process.

As said above the main problems were mostly related to understanding the main algorithm. We learned a great deal through this assignment and it was really fun and we are very satisfied with our result.