

Lecture 1: Introduction to biological and artificial neural networks

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The exercises have been implemented in R and document generated using sweave.

Exercise 1

Try to implement an artificial neuron in any selected programming language. Use the schema given in the lecture.

Implementation of the neuron:

```
> #Neuron as a function of weight vector and input vector
> # w - weight vector
> # x - input vector
> neuron<-function(w,x,theta=0.5){
+   #return step function of dot product between weight and input vectors
+   return(as.numeric(sum(w*x)>=theta))
+ }
```

Carry out simulations for five different values set of weights. For each values set give three sets of inputs. Write experiments results in the report together with theoretically calculated values:

```
> set.seed(123)
> #For 5 different weight vectors
> for(i in 1:5){
+   #generate randomly vectors:
+   w<-runif(3,-100,100)
+   #For each weight generate 3 inputs
+   for(j in 1:3){
+     input<-runif(3,-100,100)
+     #compute neuron value
+     writeLines(paste("For neuron with weights:",paste(w,collapse = ","),
+ "and\ninputs:",paste(input,collapse=","),"the output is: ", neuron(w,input),"\\n"))
+   }
+ }
```

For neuron with weights: -42.4844959750772,57.6610270887613,-18.20461563766 and inputs: 76.6034808009863,88.0934568587691,-90.8887001220137 the output is: 1

For neuron with weights: -42.4844959750772,57.6610270887613,-18.20461563766 and inputs: 5.62109760940075,78.4838088788092,10.2870028931648 the output is: 1

For neuron with weights: -42.4844959750772,57.6610270887613,-18.20461563766 and inputs: -8.67705293931067,91.3666690699756,-9.3331687618047 the output is: 1

For neuron with weights: 35.5141270905733,14.5266803912818,-79.4150634668767 and inputs: 79.9649940803647,-50.782453129068,-91.5880932938308 the output is: 1

For neuron with weights: 35.5141270905733,14.5266803912818,-79.4150634668767 and inputs: -34.4158561434597,90.9007298294455,77.9078632127494 the output is: 0

For neuron with weights: 35.5141270905733,14.5266803912818,-79.4150634668767 and inputs: 38.5606812313199,28.1013627536595,98.8539553247392 the output is: 0

For neuron with weights: 31.1411598231643,41.7060936335474,8.81320494227111 and inputs: 18.8284040894359,-42.168052541092,-70.5772705376148 the output is: 0

For neuron with weights: 31.1411598231643,41.7060936335474,8.81320494227111 and inputs: 92.6048465073109,80.4598090238869,38.1410556845367 the output is: 1

For neuron with weights: 31.1411598231643,41.7060936335474,8.81320494227111 and

inputs: 59.0934835374355,-95.0772630982101,-4.44080578163266 the output is: 0

For neuron with weights: 51.6919075045735,-56.7184128332883,-36.3637984730303 and
inputs: -53.6748429294676,-71.4399955235422,-17.0907328370959 the output is: 1

For neuron with weights: 51.6919075045735,-56.7184128332883,-36.3637984730303 and
inputs: -17.2551347408444,-26.2309098150581,-69.5110504515469 the output is: 1

For neuron with weights: 51.6919075045735,-56.7184128332883,-36.3637984730303 and
inputs: -72.2387873101979,-53.3931801095605,-6.80750994943082 the output is: 0

For neuron with weights: -46.8054719269276,71.5655430685729,-90.8337666653097 and
inputs: -11.559985158965,59.7849691286683,-75.620148004964 the output is: 1

For neuron with weights: -46.8054719269276,71.5655430685729,-90.8337666653097 and
inputs: 12.1895967517048,-58.693722076714,-74.4936699513346 the output is: 1

For neuron with weights: -46.8054719269276,71.5655430685729,-90.8337666653097 and
inputs: 50.6615728605539,79.0090718306601,-25.1074448227882 the output is: 1