Artificial Neural Networks

Exercise 2

Radial-Basis Function and Self Organization

3.2

* what is the lower bound for a number of training examples(N)?

That should be n

* What happens with the error if N=n? why?

It would be 0, since the weights will match up to fit the given data exact

* Under what condition, if any, does (4) have a solution in this case?

When n=N, the equations must be independent. Each training pattern active unique (different ) hidden neuron

* During training we use an error measure defined over the training examples. Is it good to use this measure when evaluating the performance of the network?

No . Test error is used for evaluating the performance of the network. Training error does not show the generalization ability.

4.1Approximation of sin(2x)

The function has 4 peaks and 2 start & stop points, so to approximate it we need at least 6 units.

By changing the input interval to (-pi/4 : 2pi –pi/4)we could approximate sin2x with 5 units





Approximation of square (2x)



Unit=60 good approximation

Unit =63 residual=1e-15 (n=N)

4.2 Online training using the delta rule (function= sin2x)

Etha = 0.2, iteration= 20000 Etha = 0.2, iteration= 10000

Etha = 0.5, iteration= 20000 Etha = 3.7, iteration= 20000

Etha = 2.5, iteration= 20000 Etha = 3.5, it eration= 40000 (residual= 0.01)

Online training using the delta rule(function= cos(pow2(x)))

Etha = 1.2, iteration= 10000 Etha = 1, iteration= 20000

Etha = 3, iteration= 20000 Etha = 3.7, iteration= 20000

Online training using the delta rule(function= (pow2(x) & log2(x))

Etha = 3.5, iteration= 20000 Etha = 3.5, iteration= 20000

5. RBF Placement by Self Organization

5.1.1 Using Competitive **Learning** (CL) for vector Quantization, (one iteration)

units= 3 units= 5 units=5



5.1.2 Using Competitive **Learning** (CL) for vector Quantization, (Successive iterations)

units= 3 units= 5 units=5

5.2.1 Using Expectation Maximization algorithm (EM) (single winner strategy)

units= 3 units= 5 units=5

5.2.2 Using Expectation Maximization algorithm (EM) (allowing all units to move)

units= 3 units= 5 units=7

6. Function Approximation for Noisy data

units= 50 units= 50 with using low pass filter

units= 20



Units=5