ARTIFICIAL NEURAL NETWORK

Unit-2: Perceptron

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Artificial Neural Network-Percepton

Supervised Learning view as an optimization problem

- Optimization problems means finding best solution
- Let us assume minimization of quadratic function

$$f(X) = \frac{1}{2} x^T A x - b x^T + c$$

where x is $m-by-1$ vector

A is $m-by-m$ symmetric positive definite matrix

b is $m-by-1$ vector

c is constant

Artificial Neural Network-Percepton

Supervised Learning view as an optimization problem

$$f'(x) = 0$$

$$Ax^* - b = 0$$

$$x^* = A^{-1}b$$

- Thus minimizing of f(x) and solving linear system of equations are equivalent problems

- Now, for a given matrix A, we say that a set of non-zero vectors [s(0) s(1) .... s(m-1)] is A-conjugate vectors if thefollowing condition is satisfied

$$S^T(n) A S(j) = 0 \quad \text{for } n \neq j$$

Supervised Learning view as an optimization problem

- For a given set of A-conjugate vectors, the correspondin conjugate direction method for unconstrained minimization of the quadratic error function is defined by:

$$x(n+1) = x(n) + \eta(n)s(n)$$

where x(0) is an arbitrary starting vector

$\eta(n)$ is scalar defined by

$$f\left(x(n)+\eta(n)s(n)\right) = \min_{\eta}\left(f\left(x(n)+\eta(n)s(n)\right)\right)$$

Supervised Learning view as an optimization problem

The procedure of choose learning rate so as to minimize the function f(.) for some fixed learning rate is referred as line search

$$\eta(n) = \frac{-S^T(n)AE(n)}{S^T(n)AS(n)}$$

$$\text{where} \quad x(n) - x^* = E$$

$$x^* = A^{-1}b$$

For conjugate gradient method to work we required A-conjugate vectors, which is computed as follows:

$$S(n) = r(n) + \beta(n)s(n-1)$$

$$\text{where} \quad \beta(n) = -\frac{S^T(n-1)Ar(n)}{S^T(n-1)AS(n-1)}$$

$$r(n) = b - Ax(n)$$

THANK YOU

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