机器学习及其MATLAB实现—从基础到实践 第4课

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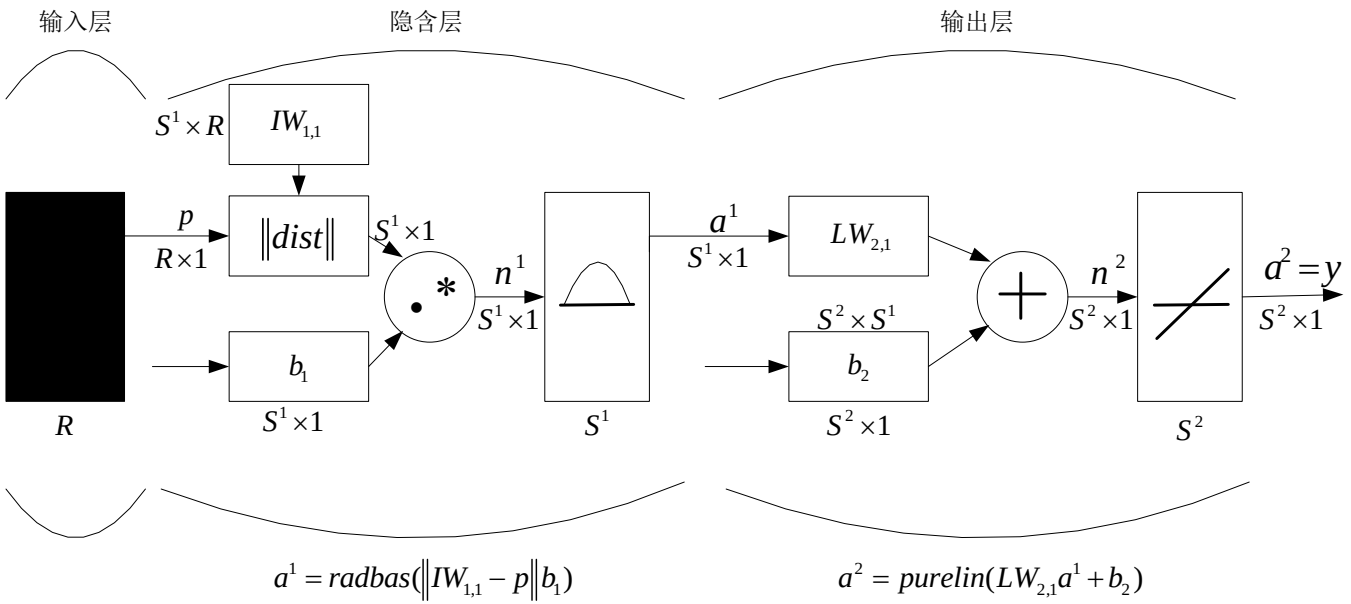
课程目录

RBF神经网络概述

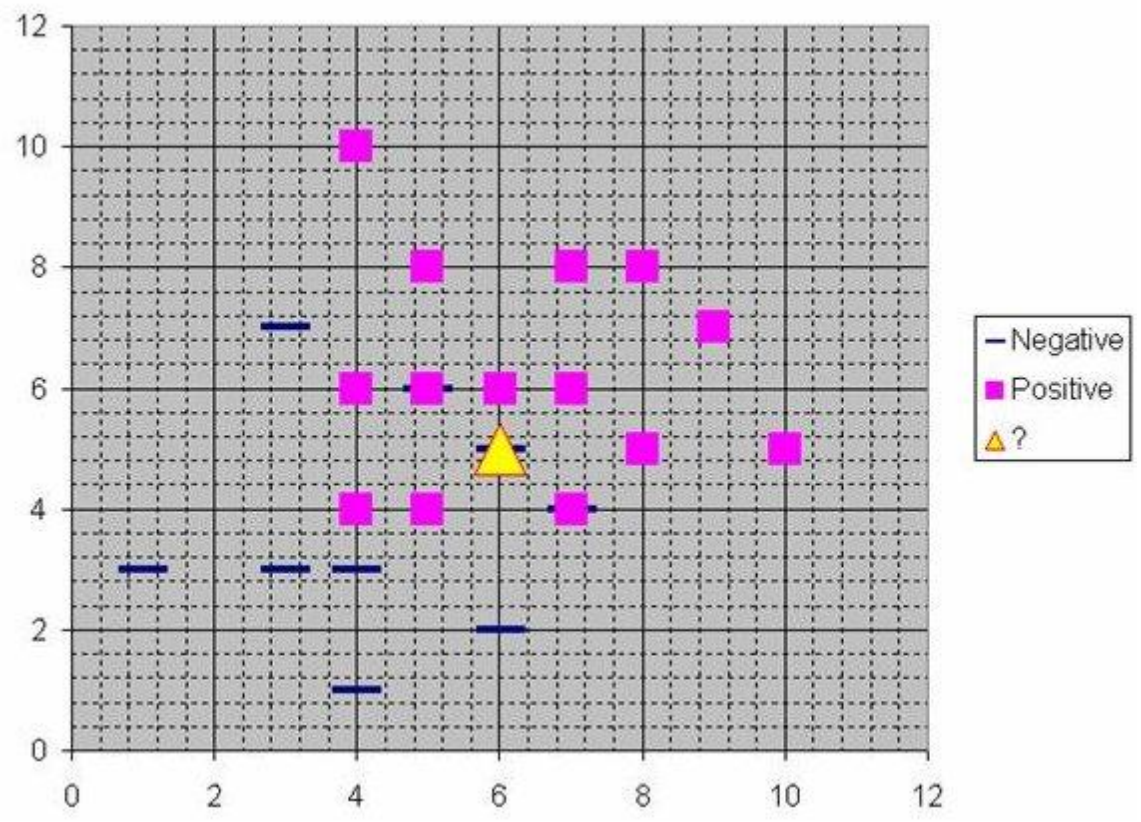
- A **radial basis function network** is an artificial neural network that uses **radial basis functions** as activation functions.
- It is a **linear combination** of radial basis functions. $\varphi(\mathbf{x}) = \sum_{i=1}^{N} a_i \rho(||\mathbf{x} - \mathbf{c}_i||)$



GRNN神经网络概述

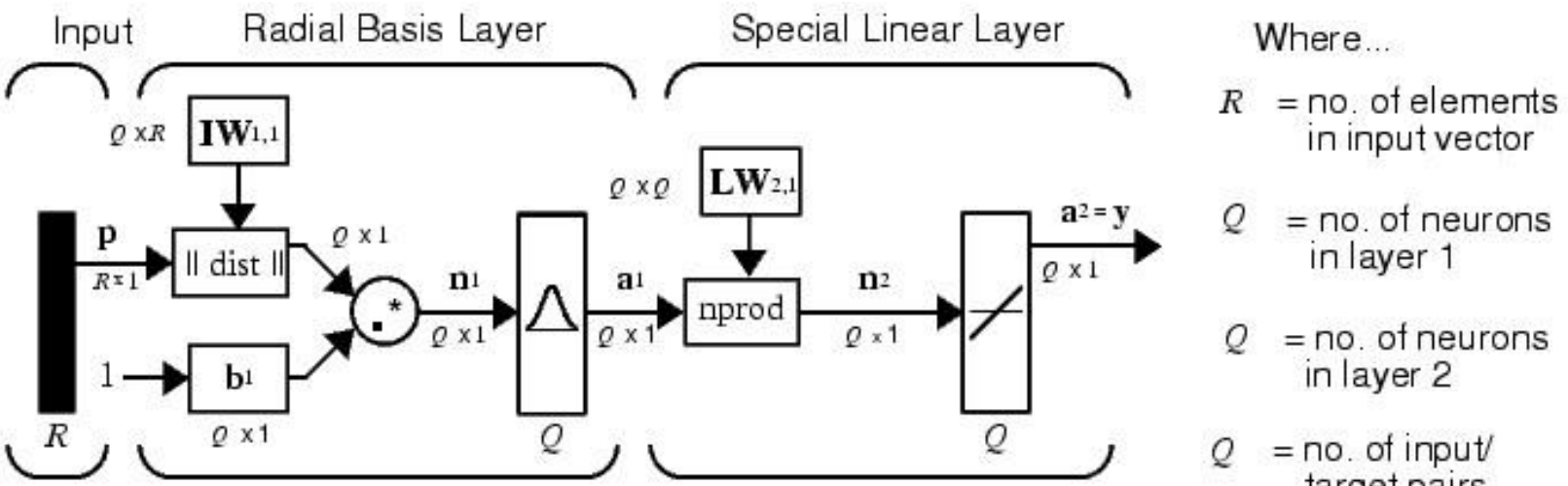
Problem

- Assume that each case in the training set **has two predictor variables**, *x* and *y*.
- Also assume that the target variable has two categories, ***positive*** which is denoted by a square and ***negative*** which is denoted by a dash.
- suppose we are trying to predict the value of a new case represented by the **triangle with predictor values *x*=6, *y*=5.1**.
- Should we predict the target as positive or negative?



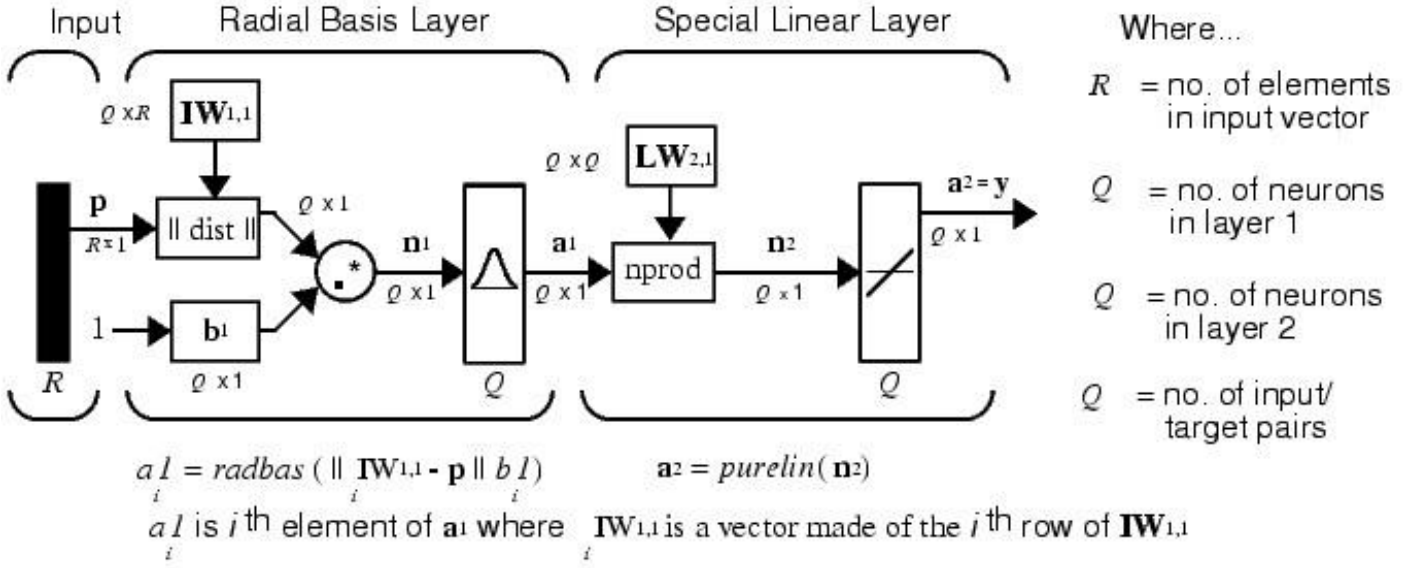
GRNN神经网络概述

- A **generalized regression** neural network (GRNN) is often used for **function approximation**.
- It has a **radial basis layer** and a **special linear layer**.
- It is similar to the radial basis network, but has a slightly **different second layer**.



GRNN神经网络概述

- The first layer is just like that for **newrbe** networks. It has **as many neurons as** there are input/ target vectors in **P**. The first-layer weights are set to **P'**. The bias $\mathbf{b}^1$ is set to a **column vector** of 0.8326/SPREAD.
- The second layer also has as many neurons as input/target vectors, but here **LW{2,1} is set to T.**
- Suppose you have an input vector **p** close to $\mathbf{p}_i$, one of the input vectors among the input vector/target pairs. This input **p** produces a layer 1 $\mathbf{a}^i$ output **close to 1**. This leads to a layer 2 output **close to** $\mathbf{t}_i$.

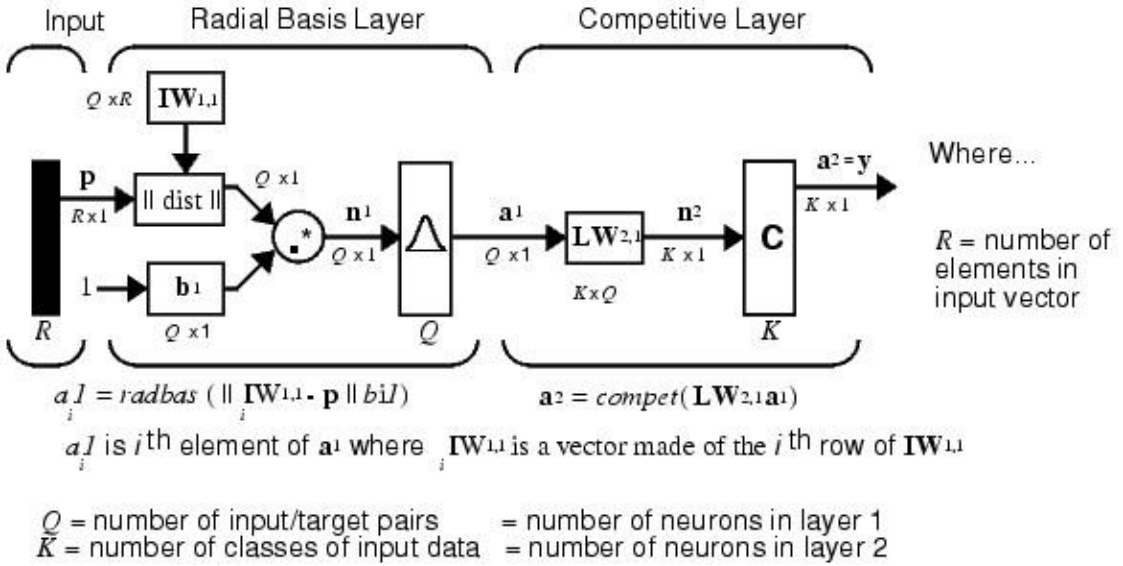


GRNN神经网络概述

- Here the **nprod** box shown below (code function **normprod**) produces S2 elements in vector n2. Each element is the **dot product** of a row of LW2,1 and the input vector a1, all **normalized** by the sum of the elements of a1.
- A larger spread leads to a large area around the input vector where layer 1 neurons will respond with significant outputs.
- If spread is **small**, the radial basis function is very **steep**, so that the neuron with the weight vector closest to the input will have a much larger output than other neurons.
- If spread becomes **larger**, the radial basis function's slope becomes **smoother** and several neurons can respond to an input vector. The network then acts as if it is taking a weighted average between target vectors whose design input vectors are closest to the new input vector.

PNN神经网络概述

- The first-layer input weights, $IW^{1,1}$ (net.IW{1,1}), are set to the **transpose** of the matrix formed from the Q training pairs, **P'**.
- The second-layer weights, $LW^{1,2}$ (net.LW{2,1}), are set to the matrix T of target vectors. **Each vector has a 1 only in the row** associated with that particular class of input, and 0's elsewhere. (Use function **ind2vec** to create the proper vectors.)



重点函数解读

- **newrbe**
  - Design exact radial basis network
  - net = newrbe(P,T,spread)
- **newgrnn**
  - Design generalized regression neural network
  - net = newgrnn(P,T,spread)
- **newpnn**
  - Design probabilistic neural network
  - net = newpnn(P,T,spread)
- **cputime**
  - Elapsed CPU time

重点函数解读

- **round(ceil、fix、floor)**
  - Round to nearest integer
  - Y = round(X)
- **length(size)**
  - Length of vector
  - n = length(X)
- **find**
  - Find indices and values of nonzero elements
  - [row,col] = find(X, ...)
- **.* ./ .\ .^ ..... vs * / \ ^ .....**
  - Multiplication (.*) right division (./) left division (.\) power (.^)
  - matrix multiplication (*) matrix right division (/) matrix left division (\) matrix power (^)

案例分析

RBF——近红外光谱汽油辛烷值预测

GRNN、PNN——鸢尾花种类识别

炼数成金逆向收费式网络课程

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Thanks

FAQ时间