

Design System for Discrimination Patterns Geometric Shapes using Neural Networks (Hamming @ Max net)

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Abstract: Find offers the possibility of building a software system using one of the techniques of artificial intelligence (neurons applications (Neuron networks) where this system will be able to discern patterns Geometric shapes regular and non-regular users of the type of neural networks (Hamming & Max net) With fixed weights. The network training on those forms for the first time and then the system by giving Output Matching any of these formats And at high speed.

Keywords: Geometric, neural, networks, patterns, elements, model

1. Introduction

Spread applications of artificial intelligence in the recent period Especially neural networks applications where they represent suitable to solve many problems, most notably marked by patterns and classification tool. Known in 1943 The beginning of the development of artificial neural systems have identified all of Michaeloj and Betts (McCulloch and Pitts)

Official Model first neurons computer through the model includes all the necessary elements However, the completion and implementation of the electronic model built for this model was not practical or reasonable from the technological during the period of vacuum tubes note that this model has not been applied widely to describe the physical components of computer for valves circle and thus did not become the world gave Donald Hebb (Donald Hebb) Initially planned to modernize the educational contacts neurons referred to as the law of the educational flames Learning Rule) Hebbian) I've mentioned that the flames Information can be stored in the communications links, it was delivered technology learning that has proven its benefits in future developments of this field. And that the flames of the education law Lemuel initial contribution in neural network theory has been built Wa test first neural computer study in the fifties were automatically applied communications and through This stage was the term Preston (Preceptor Called Unity, which would represent the nerve cell coined the term world Briston francs and divorced on the unit, which represents cell Nervousness, coined the term Frank Rosenblatt)) In a year 1958 . This invention was a viable machine for training for learning and classification of certain models by modulating the communication to the beginning elements. In this way it has become cope with the imagination of engineers and scientists was essential background to the calculations of this type of machine, which is still used to this day put [Kit90] [Sid98].

At the beginning of the sixties it was invented a new method called the name Adlan Adakine- for Adaptive Linear Combiner) Bernard and Douro Machin Hoff has the Haff Bernard Windrow and Marcian) Developed a very useful law

called Law and Drew Hoff education (Windrow -Haff Learning Rule).

2. Neural Networks

Neural networks composed of a set of nodes perform a special type of account collectively and that each node is a standard calculation small and these nodes can operate in parallel, where they depend on the interactions among them or how they relate to and there are some scientists are identified as:

- Mathematical models mimic the characteristics of biological systems that address information in parallel composed of relatively simple elements called Asibat.
- Is a simple class or sports entity of algorithms that are formulated schemes (Graphs These schemes are classified into a large number of algorithms and these algorithms provide a number of solutions to complex problems [Hum92].

The main activity carried out by neural networks is the process of classification and coding, and the most prominent properties of neural networks are:

- 1) Resistance to noise.
- 2) Flexibility in dealing with the distorted images systems.
- 3) Maximum resistance to discrimination incoherent images or partially decomposed.
- 4) And you can say it It is a combinations of parallel operations with the presence of a large number of operating units that stimulate by ongoing operations and the addition thread To stocks of distributed information in parallel.
- 5) operations with non-linear, ie, its ability to provide schemes include non-linear relationships anti-noise, which makes it a good source for operations and support rating (classification prediction).
- 6) high ability to adapt to the logarithm of the educational system with strong internal organization allowed to be used for internal adaptation, who lives in the vicinity of a permanent change.

2.1 Types of Neural Networks

Possible to identify the most prominent common types of neural networks, including input and learning types and some common uses and also in the table (1-1) [Mil89] [Sid98]:

Table (1-1) the most prominent types of neural networks and use

Network Hopfield	Binary	Supervised	Memory associated to distinguish letters ASCII
Network Hamming	Binary	Supervised	Contact with identical bilateral channel
Carpenter Grassberg Classifier	Binary	Supervised	Assembly (Adaptive Resonance Theory)
Perceptron	Continuous	Supervised	Distinguish simple shapes and classification
Multi-layer perceptron	Continuous	Supervised	Characterized by complex shapes and classification
Kohonen self organizing feature map	Continuous	Supervised	Vector evaluate and recognize speech, and the analogy of biological neural networks

2.2 Teaching Methods in Neural Networks

Two methods can be used to train the neural networks as a means of learning or simulation between the system and the user, and these methods are:

- 1) Supervised (Education existence Musharraf).
- 2) Unsupervised (Education with no supervisor).

The First Way

Musharraf is supposed existence during the training process for each model used for testing is over (target output) Includes Almdjlat model in addition to the desired output to determine (real output) And that in this process is to make a comparison between the real output to be network performance decrement after giving the matrix determines the weights and error vector (real vector) Where he compares (output vector) With vector output and input of the network and also compares with the desired output to determine the errors through the following equation:

$$\text{Real output} - \text{target output} = \text{error}$$

The Second Method

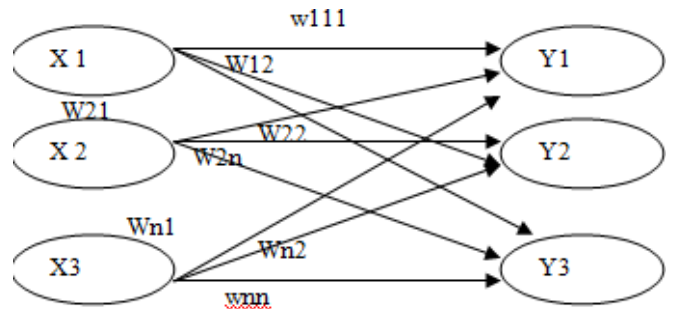
In this way does not have a supervisor to submit the required forms must therefore be on the system to learn by exploration and how the properties or structured factors in the input model demo to the user and should this learning is done through strengthening the weights elected to the contract in order to experimental models match distinguishes learning this way frequent in until the stability of the weights.

2.3 Architectural Neural Networks

1. Safety Nets Single Layer (Single Layer Network)

This network has a single layer of weights Either the input units can be defined as The signals they receive from the outside world. These units are connected in units of output (Which represents the answer to the input units) And full-link Examples include network (auto hetero Adeline

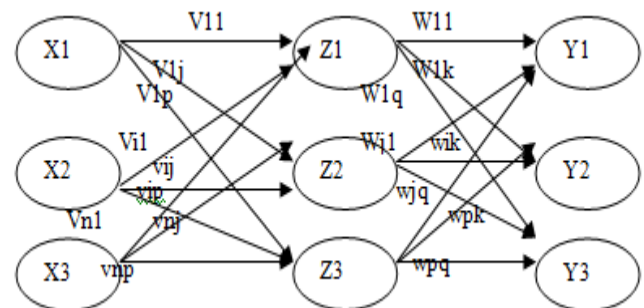
preceptor) Character error flow successor, not linked to the output units Any other units except (network Hopfield) In which all the units are the same input and output units planned (1-2) represents a model for these networks [Hum92] [Kit90].



Scheme (1-2) represents a single architectural layer networks

2. Multi-Layer Networks (Multi layer network)

Networks that are owned or layer More of the hidden nodes (Hidden nodes) It can be defined as units that do not represent the units do not enter the units can be directed to this network that solves more complex than the first type problems but have trained harder than examples (Medline, Back propagation necognatron miff) (Figure 2-2) represents a model of these networks.



Scheme (2-2) is a multi-layered network architecture

2.3.1 Competitive neural networks (Competitive Neural network)

Fall within the architecture department of networks, based on the method of learning (winner takes all), where the cells are competing with each other in order to win one of these networks at a certain time because the response from the rest of the strongest networks Examples of this type of networks (Self-Organization Map, Som Kohonen Learning, complete learning, adaptive resonance, theory (Art), counter-propagation net).

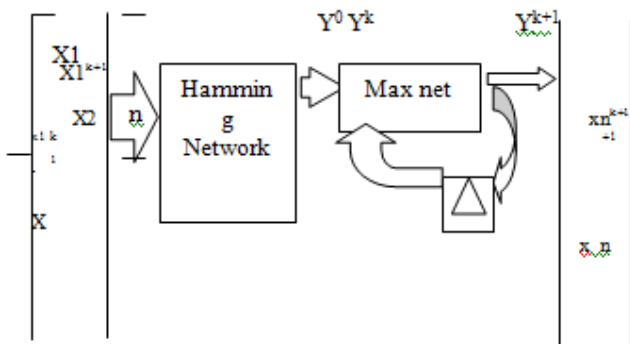
2.3.2 Network (Perceptron)

Is one of the single-layer networks may represented the network in 1954 was named Palmdrick because they assumed to be a simplified model of Albalogh techniques to address the relevant information to feel any sense that perceived in the form Simplified contain two separate layers of cells is a layer input and output, and these cells feed The output layer cells, but not vice versa, and the cells entered the class Ataatsal Abedha interconnected to the other. The conduct of operations by the weights and that fueled this front Nutrition Network [Ric87].

2.3.3 Network (Hamming & Max net)

In this section we will cover the two layers of seed (Two-layer classified) Bipolar bilateral vector (Hamming .network and max-net) Diagram of the network shown in Figure (3-2), which ranked the distance (Hamming distance) Smaller, value-bound transactions missing (incomplete) or bustling provided in the input. This is a test performed substantially by the network Hamming Only. The network Hamming The distance is calculated for each type and select the product was a distance Hamming Near, The distance Hamming Is the number of bits that do not match the entrance to the corresponding bits of the model. The network Hamming Only. The network Hamming The distance is calculated for each type and select the product was a distance Hamming Near the distance Hamming Is the number of bits that do not match the entrance to the corresponding bits of the model. The network Hamming Is the type of front Nutrition (Forward feed type) And be the first layer of the work network Hamming Class p It owns p Neurons(Neuron) Director. Post the strongest nerve cell is indicative of the value of HD Near between input and Class which represents the nerve cell.

That is appropriate to the correct part of the network Hamming Responsible for linking the input vector with vectors stored.



(Figure 3-2) (Diagram of a work of HD Near

The main work of network Hamming It is to find similarities between the entrance and the weight vectors for each nerve cells (Neuron) , That the most effective nerve cell (Active neuron) Elect later Network (Max net) , Used as an output final.

3. Building Network Hamming

Suppose that the styles that will be stored by giving (1), S (2),, S (P) S Those patterns. It can be stored in the network L. Hamming By choosing weights as follows:

$$S_1(1), S_2(1), \dots, S_n(1)$$

$$S_1(2), S_2(2), \dots, S_n(2)$$

$$WH = 2/1$$

$$S_1(P), S_2(P), \dots, S_n(P)$$

For the purpose of finding a distance Hamming Heading a bilateral between two poles is the number of different bits
 $HD(x, s(m)) = (\text{number of different bits})$
 From the distance Hamming , We own

$$X t S (m) = (n-HD (x, s (m))) -HD (x, s (m))) - HD (x, s (m))$$

$$\dots (1.1 a)$$

Or equivalently
 (Or equivalently)

$$2/1 X t S (m) = n / 2 - HD (x, s (m)) \dots \dots (1.1 b)$$

Alan network with the introduction of the vector x Value for produce X 1 S (m) (2/1) As the input node M , Where p ,, 1.2 m = Add fixed for 2 unit value/ n Entrance to all neurons, become the final results for m net As follows:

$$Net (m) = 2/1 X t S (m) + n / 2 \text{ for } m = 1.2, \dots .P \dots \dots (2-1 a)$$

We can express our above definition as follows:
 Net m = n-HD (x, s (m)) (2-1 .b)

Let's link the neurons in the network Hamming With activation function in the form of nerve cells need to accomplish only for linear standardization (.b 2-1) like so:
 $F(\text{net } m) = (2/1) \text{ Net } m, \text{ for } m = 1.2, \dots P$

Where the doorways between 0, n We get on the outputs for each registered between 1.0 or more, the number node node with the highest output in the end refers to the category in which the number (x) Is the youngest HD .

The input vector is completely identical to the class m .. Which should match with the condition $0 HD =$, Is the index by 1 $f(\text{net}) = \text{Input vector which complements the prototype of the class } m$ This will result in $0 f(\text{net } m) =$.

Acceptable in the network Hamming Essentially determines the classification only in the first layer of the network (Figure 3-1).

Calculated the actual outcome similar values. As we can see the network by Category Hamming Performing front Nutrition and immediate manner[Hum92] [Yao99] .

The network is not Max net The second layer of the work represents It works as a network to recall (restore) repeated in helping similar pattern holds for the network Specifications Hopfield As follows:

- Nutrition character of the front and has a single character with P Of neurons.
- Qatari elements of the matrix weight is always 1, and all other elements are e -.

$$W_{ij} = \begin{cases} 1 & \text{if } i = j \\ -e & \text{otherwise} \end{cases}$$

- The initial entries are real preparation within the limits] 0.1 [

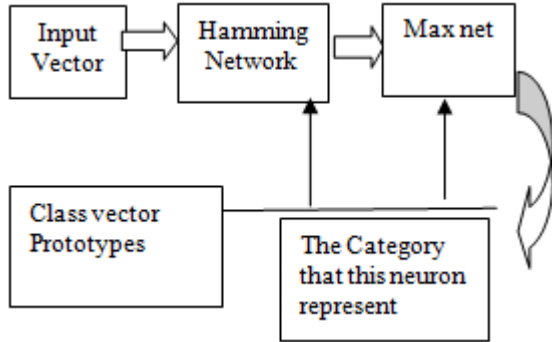
- Activation function of each neuron is:

$$f(\text{net}) = \begin{cases} 0 & \text{Net} < 0 \\ \text{Net} & \text{net} > 0 \end{cases}$$

4. The Proposed Method

The proposed method is that we store the number of prototypes for a number of geometric shapes of each model is stored in a matrix (5 * 5). And then we use the network Hamming And that you configure a matrix weights W

Matrices of confusion stored where this matrix be its ranks as well as the then finding the values of L .net and F (net) . As well as we use the network L. Max net First you build a matrix of weights W1 By its size and its elements depend on the number of shapes stored, Then the number of operations to choose a model that is more similar to the shape entrance and this figure is the purpose of the system (3.1) represents a blueprint for the proposed system.



(Figure 1-3) outline the proposed system

Structure of the system consists of two layers of the seed vectors bipolar bilateral: -

El Network Hamming Be the first layer of the system work. The purpose is to calculate the value of (12 -HD) Nutrition in a manner where the front is HD Distance Hamming Transactions between research and vector model product was bitter Ps.

The second layer of the work, called the MAXNET. It works as a network repeated recall in her job Assistant pattern only suppress the values for MAXNET Which produced a preliminary contract instead of holding maximum results for the first layer.

Input patterns (number and forms):

The patterns are entered (square, rectangle, triangle, parallelogram, certain, cubic, hexagonal regular shape, irregular geometric shape represents two triangles opposite-bound head, right-angled triangle, a geometric shape irregular represents a share, star, irregular geometric shape It represents parallelograms interconnected).

The input is the number of shapes 12 regular and irregular shape as shown in Table (1-3) and the representation of these patterns have matrices are as follows:

Table (1-3) between the vectors models

A 9 [25] = {1,1,1, -1, -1.1, -1, -1.1, -1.1, -1, -1, -1,1,1, -1, -1.1, -1,1,1,1, -1, -1};	A 5 [25] = {-1, -1.1, -1, -1, -1.1, -1, -1.1, -1, -1, -1.1, -1.1, -1, -1, -1.1, -1, -1, 1,1, -1, -1, -1};	A 1 [25] = {1,1,1,1,1,1, -1, -1, -1,1,1, -1, -1, -1,1,1, -1, -1, -1, 1,1,1,1,1};
A 10 [25] = {1,1,1,1,1, -1.1, -1.1, -1, -1, -1.1, -1, -1, -1.1, -1.1, -1, 1,1,1,1,1,1};	A 6 [25] = {-1,1,1,1, -1, -1.1, -1, -1.1, -1.1, -1, -1, -1, -1.1, -1, -1, -1, -1, -1, -1, -1, -1};	A 2 [25] = {1,1,1,1,1,1, -1, -1, -1,1,1, -1, -1, -1,1,1,1,1,1, -1, -1, -1, -1, -1};

A 11 [25] = {-1, -1.1, -1, -1,1,1, -1,1,1,1, -1.1, -1.1, -1,1,1,1, -1,1, 1, -1.1, -1, -1, -1};	A 7 [25] = {-1,1,1,1, -1, -1.1, -1, -1.1, -1.1, -1, -1.1, -1, -1, -1, -1, -1, -1, -1, -1};	A 3 [25] = {-1, -1.1, -1, -1, -1.1, -1,1, -1,1,1,1,1,1, -1, -1, -1, -1, -1, -1, -1, -1, -1};
A 12 [25] = {-1,1,1,1,1,1,1,1, -1.1, -1, -1,1,1,1,1,1,1,1,1, -1, -1, -1, 1,1,1,1,1};	A 8 [25] = {1, -1, -1, -1,1,1, -1.1, -1.1, -1.1, -1, -1.1, -1, -1, 1, -1,1,1,1,1,1};	A 4 [25] = {-1,1,1,1,1,1,1,1,1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1};

When the network Hopfield It is:

- 1) Building matrix weights w Arrays of stored patterns where these matrices are ranks and be resized is (12 * 25), where 12 represents the number of shapes stored and 25 is the size of the matrix each of these forms is (5 * 5).
- 2) Enter the matrix (X °), Which represents the shape that will compares with confusion stored to distinguish any shapes to be stored more similarity.
- 3) Find function net Where is calculated as follows:

Net = 1/2 w * x + 1 / 2

4. Find function F (net) Where there are as follows:

F (net) = 1/2 * (Net)

When the network Max net It is:

- 1) Choose the lateral interaction coefficient E And which should be between <E <1 / P 0, which is used in the construction of the matrix weightsW1 .
- 2) Matrix building W1 Which are the main elements of its diameter is equal to 1 The rest of the elements are e -.
- 3) The finding values net [I] So calculated as follows
 $S = S + (W1 [I] [J] * NET [L])$
 Where 12 , 1.2 I =
 25 , ... 1.2 K =
- 4) Calculated value F (net [I]) As follows:
 $F (net [I]) = net [I] \text{ if } net [I] > 0$
 $F (net [I]) = 0 \text{ Other wise}$
- 5) Tested if only one of the functions F (net [I]) Not worth 0 will go out of this test and continue until the condition is met.
- 6) Will test hash F (net [I]) Which is not equal to 0 to any of formats stored return this form which is similar to the entrance even if by less than 100% is.

5. Results

A network is not trying to teach Hamming The introduction of vector model class as the input be custom-user system desire to be either similar to a vector completely patterns, for example, square or rectangle where are compared by the system to any patterns similar to 100% or be different something input and thus the proportion of similarities will be reduced.

Then try to distinguish vector bustling transactions or under which, for example, it provided in the input vector that represents the style and the result has a box you will be very satisfactory and higher level of Success Rate

The following are the results of network Hamming 12 model as shown in Table (2-3):

Table (2-3) shows the results of Hamming 12 model

0.36	0.28	0.36	0.44	0.28	0.68	1	A1
0.6	0.52	0.52	0.52	0.36	1	0.68	A 2
0.68	0.68	0.76	0.6	1	0.36	0.28	A 3
0.68	0.68	0.6	1	0.6	0.52	0.44	A 4
0.68	0.52	1	0.6	0.76	0.52	0.36	A 5
0.76	1	0.52	0.68	0.68	0.52	0.28	A 6
1	0.76	0.68	0.68	0.68	0.6	0.36	A 7
0.36	0.36	0.52	0.36	0.44	0.36	0.6	A 8
0.6	0.44	0.68	0.52	0.52	0.6	0.68	A 9
0.4	0.4	0.56	0.56	0.4	0.4	0.56	A 10
0.6	0.6	0.68	0.52	0.6	0.52	0.36	A 11
0.44	0.68	0.44	0.52	0.44	0.44	0.44	A 12

6. Discuss the Results

This case represents the design of a work the distance (Hamming) For 12 pattern that the initial vector model shown in Table 1-2 as a symbol vector class models as rows of a matrix weight w .

We choose the input vector which are all elements = 1.

Net The entrance vector is calculated as follows: $2 \text{ Net} = w * x + 1 /$

Net [12] = { 16,14,8,8,14,8,12,12,15,13,20 }

$F(\text{net [12]}) = \{ 0.64,0.56,0.23,0.32,0.32,0.56,0.32,0.48,0.48,0.6,0.52,0.8 \}$

We choose $2e = 1 /$

The result after a network application Max net :

Net [12] = { 0,0,0,0,0,0,0,0,0,0,0,8 }

This means that the top of the output node of the network (Hamming) Is 12 which is similar to the final shape and 64%.

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