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Biologically Realistic Model for 2D Pattern Recognition

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Abstract

Various algorithms are available to recognize 2D pattern based on deterministic or soft-computing techniques. Deterministic has few flaws due to limited computation boundary on the other side soft-computing technique uses single algorithm to train the process. In this work LEABRA algorithm is used to recognize 2D patterns. As it is biologically oriented so provide us with better results in comparison to other two techniques.

Keywords: LEABRA, pdp++, Error-driven, Associative learning.

1. Introduction

This paper is aimed to evaluate the importance of LEABRA (local, error-driven and associative, biologically realistic algorithm) algorithm. Researchers have worked on number of algorithms in soft-computing on the other hand we have used LEABRA as it is more realistic biologically inspired approach for cognition of object identification and is a neural based approach as it is made up of basic units which follows neurons. It is a mixture of two techniques i.e. back-propagation and hebbian rule which provides more realistic outputs. Error-driven feed-forward neural networks i.e. back-propagation satisfies the functional criteria while self-organizing hebbian associative neural network satisfy the portion of the biological constraints. As it's a combination of error-driven and self-organizing learning would not only retain respective advantages but also satisfy remaining functional and biological criteria fig.1 shows the relation between error-driven and associative [1].

There are 3 categories of neural network learning algorithm i.e. error-driven, reinforcement learning and self-organizing.

Error-driven: learn on the basis of the difference between produced output and target output.

Reinforcement algorithm: learn on the basis of positive and or negative reward signals in response to behavior.

Self-organizing algorithm: learn by applying general organizing principles to the output signals without any feedback with respect to performance. These learning rules are typically of a hebbian associative nature.

Two problems have been cited with error-driven learning i.e. the nature and origin of the target signals and nature of the error propagation mechanism. Whereas pattern recognition problem has been discussed in various journals [2] [3]. In our model, 2D pattern can be recognized more realistically since it uses LEABRA.

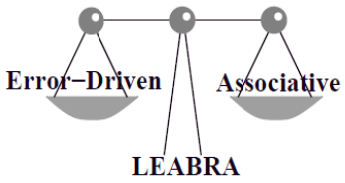

Fig. 1: A graphic representation of the central idea behind the LEABRA algorithm and its name: a balance between error-driven and self-organizing associative learning [1].

2. Pattern Recognition

Our vision plays a vital role in viewing and perception of an image. Those signals are sending to brain and then medulla oblongata works on it and image is formed in that part of brain. Thus resulting in the identification of a particular image and removing all occlusions. As in our day to day life we encounter multitude of familiar objects. Objects vary in many of the ways somewhat we can say that in the form, color and in different size. We can view objects even then also when they are partially obstructed. There is also a major way of identifying an object i.e.

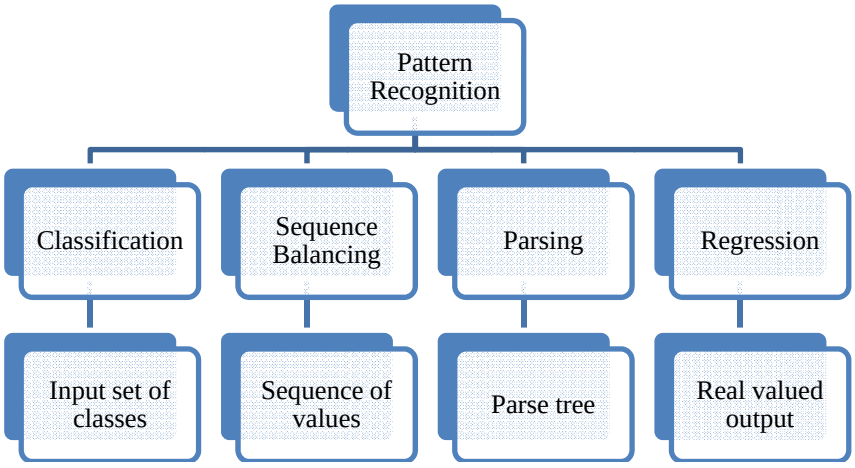

Fig. 2: Features of pattern recognition.

Recognition-by-Component. Objects are divided in to geons and it is suggested that there are less than 36 geons which are combined to form an object. Consider an example of mug which is a combination of a cylinder and a handle. Recognition is an example of classification which helps in assigning input value to one of a given set of classes. There are few other example also such as regression, sequence balancing and parsing in this real valued output to each input is achieved, sequence of values are provided and parse tree to an input sentence simultaneously. There are many more methods with the help of which an object can be recognized or a pattern can be achieved.

3. Implementation

Pdp++ [4] [5] supports parallel distributed processing also supports artificial neural network architecture. It implements the LEABRA cognitive computational neuroscience. Models are constructed and examined using the pdp++ graphical user interface. If user wants to extend the code it can be extended with the help of C++ code. Pdp++ is flexible and efficient. LEABRA is used as it provides more biologically oriented results.

3.1. Network

All connections, layers, units and related objects which define a network are contained in network. It also includes the net view window which helps in viewing the graphical representation of network. Here 42 unit networks is defined, three layers are present i.e. input, hidden output layer. Connections are maintained within each layer and every unit represents a corresponding weight.

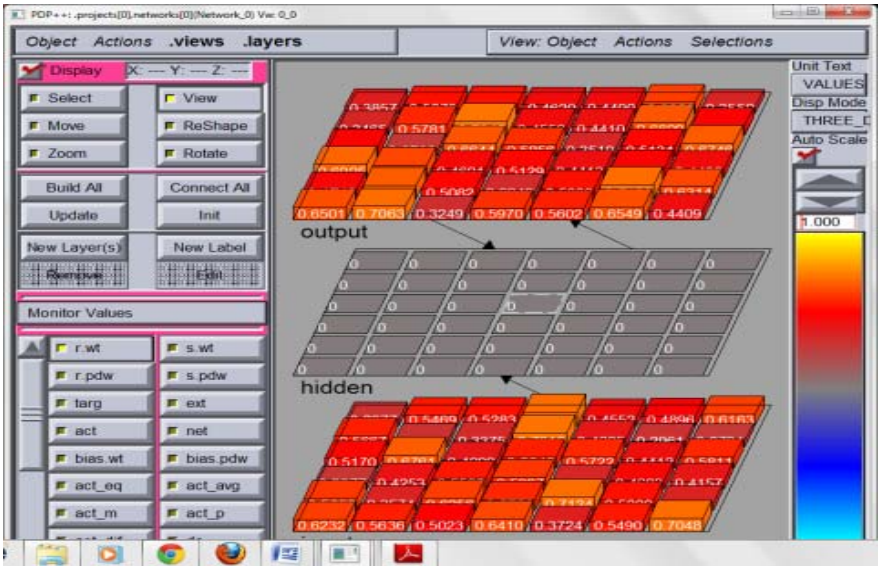

Fig. 3: Network with three layers input, hidden, output.

4. 3.2. Environment

Network exists in the environment and this environment interacts with the network. It contains events which contain individual patterns. Enviro view is for representing the graphical display. For above network environment is displayed as. Graph is plotted which acknowledges that after how many cycles errors are removed and a straight line is obtained.

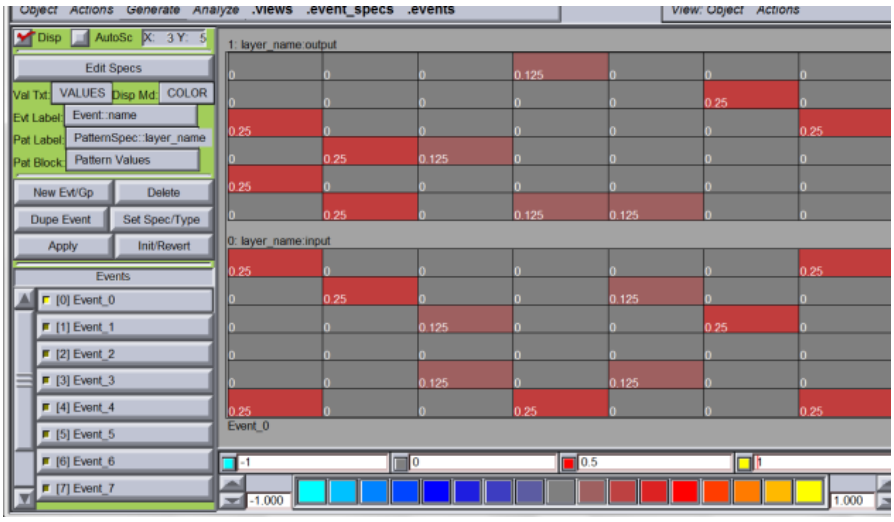

Fig. 4: Events in environment window with one overlapping unit.

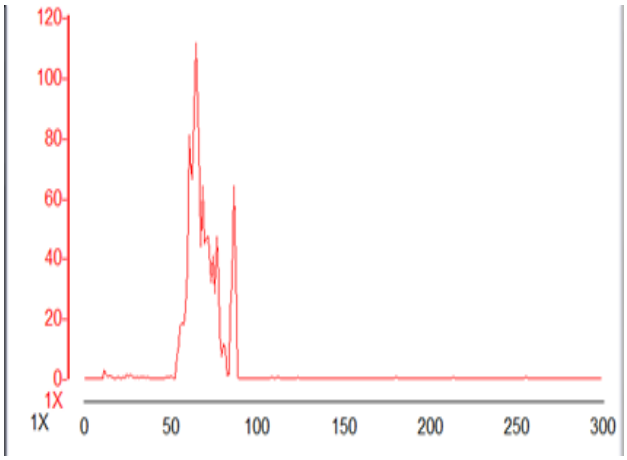

Fig. 5: Graph representing the cycles after which error is removed and a straight line is obtained.

3.3. Process

Process is being created which has following things such as. Train process which calls Epoch process number of times which then iterates over events. Then each event is processed by one or more settling process. Settling phase consist of multiple iterations over the cycle process. Performs one cycle of activation updating the network.

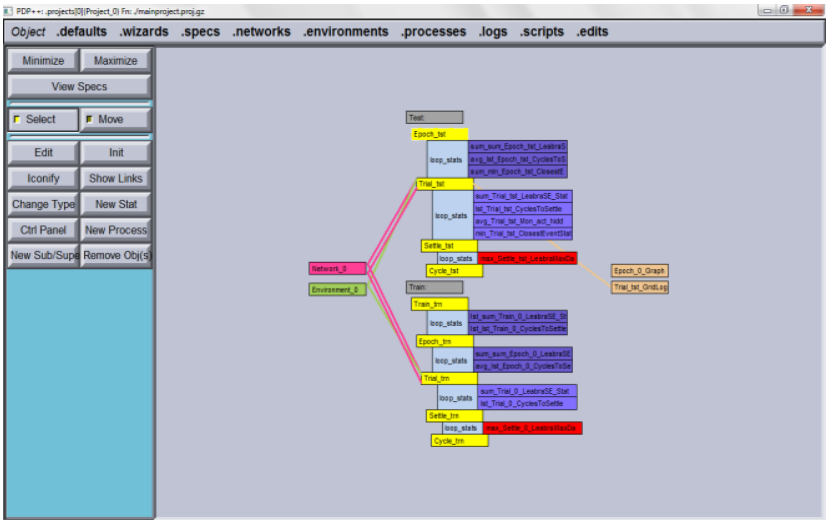

Fig. 5: Training and testing process to train and test the network.

5. Result

The result shows that the network is trained for a set of objects and recognizes the input pattern of the environment events. The network was tested on 10 environment events and found that sum-se error is zero in all the cases.

trial	Event	sum_se	tst cycles
0	Event_0	0	60
1	Event_1	0	60
2	Event_2	0	60
3	Event_3	0	60
4	Event_4	0	60
5	Event_5	0	60
6	Event_6	0	60
7	Event_7	0	60
8	Event_8	0	60
9	Event_9	0	60

Fig. 6: Every event has zero sum_se value representing output for corresponding input.

6. Conclusion

In model limited no of units are used in representation of 10 characteristics of pattern. Efforts are being done to train and test the network for pattern having huge no of properties with the help of higher no of units.

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