

## Pattern and Bangla Speech Recognition by Back-Propagation Neural Network

Nisha Singh, Kriti Changle, Sumit Bola, Richa Chouhan

Department of Computer Science and Engineering, Jayoti Vidyapeeth Women's University, Jaipur, Rajasthan, India.

[nishasinghmay@gmail.com](mailto:nishasinghmay@gmail.com), [kriti.changle@gmail.com](mailto:kriti.changle@gmail.com), [skbola@jvwu.ac.in](mailto:skbola@jvwu.ac.in), [richa1chouhan@gmail.com](mailto:richa1chouhan@gmail.com)

### Abstract:

The categorization of data patterns refers the perception of pattern recognition and pattern recognition distinguishing data patterns into predefined situations of classes. In this paper there are different methods for recognizing patterns. The purpose of this analysis paper is to abridge the methods used in different stages of a pattern recognition system and discover the best appropriate technique with its advantages over other techniques to distinguish the complex patterns along with other real-life applications.

**Keywords:** Back propagation Algorithm, multifaceted pattern, Pattern Recognition, Supervised Learning, Generalized delta rule, hidden layer, Unsupervised Learning, Multilayer network, Particle Swarm optimization.

### Introduction

Digital information is represented in form of signals similar to audio, video, words, character or a figure and digital information is represented by software design pattern. The procedure of distinguishing the patterns into a set of predefined classes based on annotations or some past information or fact of the network is referred as recognition. The pattern recognition is useful in the field of biometrics, repossession of multimedia databases, email spam filtering, detection of credit card frauds, data mining, system security, evaluating audio/video and speech signals, image dispensation and handwritten character recognition, face recognition, web penetrating, medical diagnosis, face detection, etc.

For pattern recognition there are various approaches used depending upon the category or nature of pattern preferred. These contain different type of approaches like Syntactic or structural approach, Neural Network approach, hybrid approach and template matching. A pattern is represented as an unchanging length vector in case of statistical approach. In dimensional space the vector occupies mutually exclusive regions in case of spatial view. Using probability distribution functions the feature spaces are created for, the decision boundaries.

The multifaceted pattern is center of attention on the analogy is the Syntactic approach. In this Syntactic approach, the base pattern is represented as collection sub pattern. Syntactic approach is the interconnection between the sub patterns.

Hybrid approach is third kind of approach for pattern recognition and hybrid stage is used at appropriate stage of pattern recognition. Last but not the least, artificial

neurons and their interconnections is the basic concept of neural network. Neural network is mainly used to conclude the data patterns through the estimate of input-output associations. In this approach there are various algorithms defined like Radial Basis Function (RBF) Networks, Self Organizing Map (SOM), Feed Forward Network and Back Propagation Algorithm used in various Applications. There are various advantages of neural network over supplementary techniques used for pattern recognition in various aspects. Feedback information is used to improve the performance of network. Feedback information is obtained from variation between the net and desired result. Feedback information will then be used to adjust the connections between the neurons at the input layer so that the actual result matches the desired one. Feedback information has self-organizing, self-adaptive characteristics to improve the efficiency of the network used in pattern recognition.

### Literature Review

**Back-Propagation Artificial Neural Network Techniques for Optical Character Recognition:** In this paper conclude that printed or handwritten complete alphanumeric character is recognized at high speed by scanning the paper or document with Optical Character Recognition (OCR) system. OCR device convert the character on paper or document into ASCII (machine understanding language) data or code. Matrix or Template Matching and Feature Extraction that is two methods to implement OCR device.

**Optimizing Back - Propagation using PSO\_Hill and PSO\_A\*:** In this research paper conclude that

There are many issues, complexity and local minima problem come when we use back propagation algorithm. Particle Swarm optimization (PSO) algorithms resolve most of the complexity of Back propagation algorithm. In back propagation algorithm two main algorithm is used to resolve all complexity and that algorithm is PSO\_Hill and PSO\_A\* .Both the algorithm is used as te optimization algorithm.

Advantage of PSO\_Hill and PSO\_A\* is provide feed forward neural network for back propogation algorithm. For non-linear problem back propagation algorithm is used.

**Offline Character Recognition Using Monte Carlo Method and Neural Network:** In this research paper concludes that novice method to recognize the offline alphanumeric characters this is called as character divider approach. Divider approach can be used after pre-processing stage. Vector contour is a pioneering approach for quality extraction. OCR software, ANPR software is used for character recognition.

**Recognition of ECG Patterns Using Artificial Neural Network** stated that the artificial neural network work in two phases:

- 1) Training phase
- 2) Test phase

In training phase the connection weights are automatically adjusted to map the input to the corresponding output. In test phase, the already trained network is testing against a sample of patterns. The several pattern recognition works on partitioning and probability estimation properties. One of the objectives in pattern recognition is to partition the input feature space into regions, with one region, possibly noncontiguous, associated with each of the classes.

**Generalized Delta Rule (Back-Propagation):**

A supervised learning algorithm is known as generalized delta rule. Generalized delta rule that find a relationship between the target result and actual result. Generalized delta rule is used to train a multilayer neural network .Through network connection weight and biases the input pattern is passed in the network during the training period. In very small random numbers is assigned to value and biases. In this rule the of input and output pair weight is modify repeatedly and the modification of weight reduces the network error.

Process of training is given below:

- 1) The input pattern is assigned to input neurons and these input pattern is send to hidden layer with weights and these hidden layer compute the activation and then this input neuron is send to output pattern with weight

and compute the activation , which represent the output response in the network of input pattern.

- 2) There is slight error in the between the desired result and computed result.
- 3) The weight and biases is updated by network error.

**4 main factors for the modification of weight is:**

- a) Learning rule
  - b) Derivative of activation function
  - c) Error term
  - d) Current activity
- 4) Error is computed by hidden layer.
  - 5) After computing the error, the same equation used in output pattern is used to update weight of the input-to-hidden units.

Same procedure is repeated if more than one hidden layer is present and there is error in each hidden layer, as an error signal, can be propagated backwards to an adjacent layer. The learning process occur again when the input pattern is presented is next training pattern.

**Back-propagation Algorithm working**

There are two phase in which application involve in generalized delta rule. In first phase each output unit compute the output value and through network input propagate in forward direction. Error is computed by comparing the desired output with the calculated output. In second phase a backward pass involve calculating the appropriate weight change, in backward pass generalized delta rule. Sigmoid activation function is used to adjust the weight. The weight of a connection is adjusted by an amount proportional to the product of an error signal  $\delta$ , on the unit k receiving the input and the output of the unit j sending this signal along the connection:

$$\Delta_p w_{jk} = \gamma^p_h \gamma^p_o$$

- The error signal for an output unit is given by:  
 $\delta^p_o = (d^p_o - \gamma^p_o) F'(s^p_o)$

**Conclusion**

There are various approaches for pattern recognition but neural network is more efficient approach for complex pattern recognition. Neural network is efficient algorithm usage for complex pattern recognition, adaptive learning and better tolerance to fault though more time may be required to train the network for very complex patterns. The system developed with Back propagation neural network at a time is used to recognize ten Bangla digit, for multiple speaker recognition accuracy is 92% . The developed system will produce better result in noise free environment.

**Future Scope**

Data mining, web security, medical diagnosis is main real life application at which neural network methodology is used. Back propagation for neural network is sequential

learning approach in which learning machine take input one by one and proceed to provide high level of network for concurrent pattern recognizing.

### References

1. <http://www.ijser.org/researchpaper/Backpropagation-Algorithm-An-Artificial-Neural-Network-Approach-for-Pattern-Recognition.pdf>.
2. <http://arxiv.org/ftp/arxiv/papers/1308/1308.3785.pdf>
3. Md. Abul Hasnat Jabir Mowla Mumit Khan, "Isolated and Continuous Bangla Speech Recognition: Implementation, Performance and application perspective", Conference Papers (Centre for Research on Bangla Language Processing) Department of Computer Science and Engineering, BRAC University, Bangladesh, 2007.
4. Md. Saidur Rahman, "Small Vocabulary Speech Recognition in Bangla Language", M.Sc. Thesis, Dept. of Computer Science & Engineering, Islamic University, Kushtia-7003, July-2004.
5. Gongtian Shen, Qingru Duan, Bangxian Li and Qizhi Liu from National Center of Boiler and Pressure Vessel Inspection and Research on "The Investigation of Artificial Neural Network Pattern Recognition of Acoustic Emission Signals for Pressure Vessel"
6. [http://en.wikipedia.org/wiki/Pattern\\_recognition](http://en.wikipedia.org/wiki/Pattern_recognition)
7. [http://en.wikipedia.org/wiki/Artificial\\_neural\\_network](http://en.wikipedia.org/wiki/Artificial_neural_network)
8. Lin He, Wensheng Hou and Chenglin Peng from Biomedical Engineering College of Chongqing University on "Recognition of ECG Patterns Using Artificial Neural Network.
9. L.Wallman, T.Laurell and C.Balkenius, L.Montelius, F.Sebelius, H.Holmberg, "Pattern recognition of nerve signals using an artificial neural network".
10. Sergiy Stepanyuk, "Neural Network Information Technologies of Pattern Recognition", MEMSTECH '2010, 20-23 April 2010, Polyana-Svalyava (Zakarpattaya), Ukraine