Appendix A:

Definitions of Terms

10-to-10 Line Decoder   A 10-to-10 line decoder is used in the PDG-net in order to decode the unique binary codes to different characters.

Activation   The internal state of a neuron, which is a function of the inputs, the neuron receives, is known as the activation of the neuron. The neuron sends its activation to several other neurons or an output neuron.

ADALINE   An ADALINE is a single layer ANN which contains a single unit neuron that receives input from several input neurons. It also receives an input form a neuron whose signal is always one which is used as bias.

Adaptive Resonance Theory   Adaptive Resonance Theory ANNs are developed to allow the user to control the degree of similarity of patterns placed on the same cluster.

Ambiguities   Ambiguities are generated when different segments of different characters are represented by the same vector.

Arrow Segmentation	Arrow Segmentation is the process of dividing the input character matrix taking one row and one column of matrix at a time, forming an arrow like structure, so that arrow segment makes an individual input vector.
Artificial Neural Network (ANN)	An Artificial neural network (ANN) is a network of interconnected processing units called the neurons. ANNs are designed based on the idea of the complicated network of biological neurons that makes the human brain, which makes human beings such a superb creature, having the power of learning by experience.
Axon	Output of the biological neuron is generated at the axon.
Back Propagation	Back propagation method is a learning process which propagates the error back to the hidden layers for rectification.
Baseline Pixel Burst Method (BPBM)	Baseline pixel burst method (BPBM) is the process of finding out the burst of black pixels near the baseline of a text in order to find out the joints between two characters in case of cursive type of handwriting.
Bias	A bias can be included by adding a special neuron the input of which is always '1'. The weight included on that link is also '1'.

Binarization

Binarization is the process of creating equivalent binary vector for a picture image of the text character.

Biological Neuron

A biological neuron is a processing element present in human brain which takes input from sense organs or other neurons, processes the input and produces the output in the form of knowledge. It consists of three components: its dendrite, soma cell and axon for input, processing and output.

Bivalent Vector

Bivalent vector is the vector consisting of 1 and -1 only. In case of a bivalent vector the '0' of the binary vector is replaced by '-1'.

Black Box

Black box contains a computer program which detects the difference between those characters that produces ambiguous codes and generates unique codes for each character.

Black Pixels

Black pixels are those pixels the combination of which displays a character.

Column-wise Segmentation

Column-wise Segmentation is the process of dividing the input character matrix taking one column at a time, so that each column makes an individual input vector.

Competitive ANNs	Sometimes more than one neuron in a neural network tries to fire at a time producing ambiguous results. Competitive ANNs are a special type of ANNs which solve such problems.
Contour Tracing	Contour Tracing is the process of forming a boundary around the text which touches the edges of the text.
Convergence	The process of producing standard weights which always generates the desired output in an ANN is called convergence.
Decisive Output Factor	Decisive output factor is the output produced at the final decisive layer which decides the existence of a particular character. Decisive output factor is the maximum value produced by a neuron in the final decisive layer.
Epochs	Epochs are the number of times the weights are updated before becoming standard.
Feature Extraction	Feature extraction is the process of extracting out the common features among variant character patterns which represent a particular character.

Final Decisive Layer	Final decisive layer is the input layer which decides the existence of a particular character depending upon the output generated on a particular neuron which presents a particular character.
Generalization	Generalization is the process of finding out a method to recognize handwritten characters having variant patterns.
Handwriting Patterns	Handwriting patterns are the pattern vectors which represent different handwritten characters.
Hebb ANN	Hebb is the earliest and simplest ANN. It was proposed by Hebb that an ANN can be trained by modifying the synapse weights if the ANN gives unexpected results.
Hidden Layers	Hidden layers are the weight layers present between the input neuron layers and the output neuron layers.
Hoof Segmentation	Hoof Segmentation is the process of dividing the input character matrix taking one row and two columns taking one from each end of matrix at a time, forming an horse hoof like structure, so that hoof segment makes an individual input vector.
Identical Patterns	Identical patterns are those patterns represented by the same vector.

Image Thinning	Image thinning is a process where the thick line of the character is reduced by removing pixels from the edges by maintaining the connectivity and keeping in mind that the thin shaped limbs of the character must not be shortened.
Input Pattern Segmentation	Input Pattern Segmentation is the process of dividing the input character matrix taking one block of matrix at a time, so that each block makes an individual input vector.
Input Vector	The input vector is the vector equivalent to the character input matrix presented to the input neuron layer of the ANN.
Learning rate	Learning rate is the number of epochs skipped between epochs in order to obtain the standard weights. It can be one or more depending upon the intensity of epochs required to obtain standard weights.
MADALINE	Multilayer ADALINE is known as MADALINE.
MATLAB	MATLAB is a software package for high performance numerical computation and visualization. It provides an interactive environment with loads of built in functions for technical computation, graphics and animation.

Multiple Layer ANNs	Multiple layer ANNs consist of two or more number of layers of weights sandwiched between input neuron layer and the output neuron layer.
Neocognitron	Kunihiko Fukushima and his colleagues at NHK Laboratories in Tokyo have developed a series of specialized neural networks to recognize characters. One of those ANN is known as Neocognitron.
Noise Removal	Noise removal is a process where unwanted pixels in the texts are removed by applying some methods.
Output Vector	The output vector is the output pattern corresponding to a character input vector, produced at the output neuron layer of the ANN.
Pattern Recognition	Pattern recognition can be defined as the classification of data based on knowledge already gained or on statistical information extracted out of the patterns.
Perceptron	Perceptron is a simple and single layer ANN. Perceptron is far better than some other single layer ANNs like Hebb and Sigmoid. In a simple peceptron one or more than one neurons are connected to a single neuron with the help of weights.

Pixel Density Gradient	Pixel density gradient is the variation in the densities of pixels at various portions of different characters.
Preprocessing	Preprocessing is the method of refining the handwritten character pattern in order to make the pattern simple, compact and free of noise, so that the pattern can be presented to the ANN without losing vital information.
Reference Line Estimation	This is another preprocessing technique which is helpful in determining the features in a text.
Row-wise Segmentation	Row-wise Segmentation is the process of dividing the input character matrix taking one row at a time, so that each row makes an individual input vector.
Self Organizing Maps	Unsupervised types of ANNs are also called Self-organizing maps which group similar input vectors together without the use of training data. A number of input vectors are presented to the ANN without setting any weights or using fixed weights. The ANN modifies the weights in order to assign the most similar input vectors to same output cluster. A vector is produced by the ANN that represents each cluster which is called exemplar. Actually, unsupervised training is used in those situations where answer is not known in advance.

Signal Processing	Signal processing is an engineering discipline which deals with the implementation of filters to remove or reduce unwanted frequency components from an information bearing signal.
Single Layer ANN	Single layer ANNs are those ANNs which consists of only a single layer of weights sandwiched between two layers of neurons viz. input neuron set and the output neuron set.
Slider Drifting	Slider drifting is the process of drifting a cursor, called slider, towards the right hand side of the text image matrix in search of the column containing all white pixels in order to find out gaps between characters.
Standard Weights	Standard weights are those weights which generates the output vector equal to the target vector.
Supervised Learning	Supervised learning means training with the help of a teacher. Target outputs are known in advance. ANNs are trained to produce weights which generate the target values.
Target Vector	The target vector is the desired output vector to be produced at the output layer of the ANN.
Threshold	Threshold is the net output value that decides when the neuron will fire.

Training the ANN	Training the ANN is the process of generating standard weights so that the weights always produce desired outputs for the characters presented to the ANN.
Unique binary codes	Unique binary codes are the combination of bit patterns which represents a particular character. These bit patterns are produced at the output layer of the PDG-net.
Unsupervised Learning	Unsupervised learning means learning without the help of a teacher. Target outputs are not known in advance. ANNs map themselves to produce the target values.
Weights	The links between the neurons contains some values called weights. The weights on the links either exaggerate or inhibit the processing power of the neurons.