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Design and Analysis of Algorithms.

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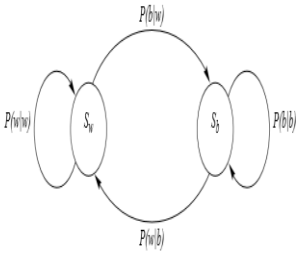
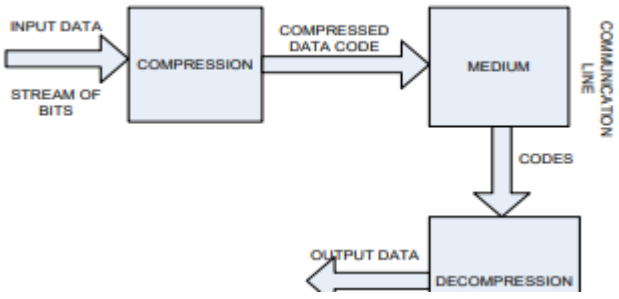
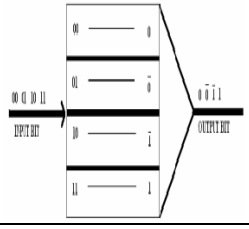
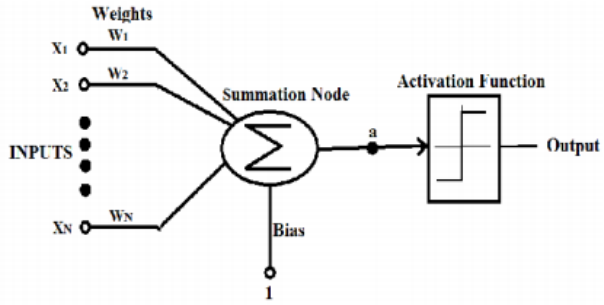
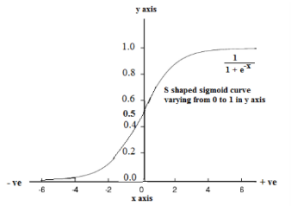
Mathematical Preliminaries are very important for the lossless data compression as we have to gather the compression without losing the data at any cost. So here are some models and papers discussed which are used in the compression.

Problem Statement with Mathematical Model.	Dependence.	Further Work.	Advancement.
One of the most popular way of representing data is through the markovs model as it is a process of discrete time markovs chain with sequence in kth order of markovs chain. $P(x_n \mid x_{n-1}, \ldots, x_{n-k}) = P(x_n \mid x_{n-1}, \ldots, x_{n-k}, \ldots).$	There can be a dependence in the linear manner as output will be given by white noise having equation. $x_n = \rho x_{n-1} + \epsilon_n$	It doesnot require to be linear only for image it can have the white and black pixel also on which one pixel is dependent on another pixel which is: 	Markov model can be used in the text compression as the probability of preceding letter is heavily depended on the next letter. The kth of the markov model is widely known as finite context model.
Data compression is most widely used technique for the representation of the data in fewer bits as compared to what it has been in its original form. It helps in reducing hard disk space and transmission bandwidth. There are two types of compression techniques Lossy and lossless. In lossless technique every bit in the file remain as orginal after the compression while in Lossy some redundant information can be reduced. 	In this technique the data bits can be represented into it half as 128 bits will be represented in the 64 bits. Similarly 64 bits into 32 bits and going on. The truth table will be. A B Z 0 0 0 0 1 $\bar{0}$ 1 0 $\bar{1}$ 1 1 1 Truth table of proposed technique In table 1: Resultant output is 0 when two input bits are 0 and 0 Resultant output is 1 when two input bits are 1 and 1 Resultant output is $\bar{0}$ when two input bits are 0 and 1 Resultant output is $\bar{1}$ when two input bits are 1 and 0	Input data sequence is checked where it is even or odd. If even then process or if odd then add a bit either 0 or 1 depend on last bit. If the last bit of input sequence is 0 then add 0 or if the last bit of input sequence is 1 then add 1.Then it feed to our proposed technique. In this method two bits are collected and converted it into one bit using table 1. So we can get compress data. 	This is also one of the good data compression techniques but it must be looked into the concern with how it decodes to the further the on big data because reducing bits on large data can cause problems but it can be handled if taken care of properly.

The neural network is massively parallel distributed processor that has a natural propensity for storing experiential knowledge and making it available for the use. The artificial neural network is similar to that of how a brain works. It has the input layer which takes some input and make summation then place the output in such a manner.  	Sigmoid function is a function which gives the sigmoid curve given by formula $$S(t) = \frac{1}{1+e^{-t}}.$$ Sigmoid functions are very similar to the input-output relationships of biological neurons, although not exactly the same. Sigmoid function exhibits smoothness and has the desired asymptotic properties. The sigmoid curve is shown in below. As t goes to minus infinity, S(t) goes to 0. As t goes to infinity, S(t) goes to 1. As t =0, S(t) =0.5  	Error correction is a technique which is used to measure the actual output to the desired output. Error values can be used by back propagation and adjusting the weights of the input in the first layer $$\text{error} = \frac{\text{actual output - ANN output}}{\text{actual output}}$$ If error is greater than the threshold then using the back propagation check updated weights and compute the summation.	The ANN can be used in the prediction of the rainfall using back propagation as well as comparison of Dynamic and Static neural network can also be made. The model can also be used for the long-range parameters and pattern recognition.
Source output consists of 4 bit word {0,1,2,…..,15}.The source encoder encodes each value by shifting out the less significant bit. The output alphabet for the source coder is {0,1,2,……,7}. At the receiver we cannot recover the original value. Let X be random variable that takes values from source alphabet X={x0,x1,……,xn-1} and Y takes the random variable values form reconstruction variable Y={y0,y1,….,ym-1}. $$H(X) = -\sum_{i=0}^{N-1} P(x_i)\log_2 P(x_i)$$ $$H(Y) = -\sum_{j=0}^{M-1} P(y_j)\log_2 P(y_j).$$	A measure of relationship between two random variables is called conditional entropy. $$i(A) = \log\frac{1}{P(A)} = -\log P(A).$$ In a similar manner, the conditional self-information of an event A, given that another event B has occurred, can be defined as $$i(A|B) = \log\frac{1}{P(A|B)} = -\log P(A|B).$$	As In case of self-information we are generally interested in the average value of the self-information. The conditional entropy with source and reconstruction is defined as: $$H(X|Y) = -\sum_{i=0}^{N-1}\sum_{j=0}^{M-1} P(x_i|y_j)P(y_j)\log_2 P(x_i|y_j)$$ $$H(Y|X) = -\sum_{i=0}^{N-1}\sum_{j=0}^{M-1} P(x_i|y_j)P(y_j)\log_2 P(y_j|x_i).$$	The amount of uncertainty About source X and reconstruct Y. The additional knowledge of Y should reduce uncertain X. $$H(X|Y) \le H(X)$$

While Paper 3 consists of the artificial neural network which helps in solving the rice problem in some state of India.

Reference:

1) Introduction to data compression by Khalid Sayood

Markov model 2.3.3 page 23-26

2) An Improved Data Compression Method for General Data by Salauddin Mahmud

3) DESIGN AND DEVELOPMENT OF ARTIFICIAL NEURAL NETWORKING (ANN) SYSTEM USING SIGMOID ACTIVATION FUNCTION TO PREDICT ANNUAL RICE PRODUCTION IN TAMILNADU S.Arun Balaji1 and K.Baskaran2

4) Introduction to data compression by Khalid Sayood

Conditional Entropy 8.4.1 page 202-204