COLOR IMAGE ENCODING BASED ON LUMINANCE & CHROMINANCE WITH HUFFMAN

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***Abstract*— Huffman Coding is the most popular technique for removing coding redundancy. It is error free technique and when coding the symbols of an information source individually, it yields the smallest possible number of code symbols per source symbol.**

Keywords- BPT, RGB color image, Y, Cb, Cr components

Introduction (Huffman's approach)

The first step in Huffman's approach is to create a series of source reductions by ordering the probabilities of the symbols under consideration and combining the lowest probability symbols into a single symbol that replaces them in the next source reduction. This process repeated until a reduced source with two symbols is reached. The second step in Huffman's procedure is to code each reduced source, starting with the smallest source and working back to the original source. Huffman's procedure creates the optimal code for a set of symbols and probabilities subject to the constraint that the symbols be coded one at a time. After the code has been created, coding and/or decoding is accomplished in a simple lookup table manner.

I. EXPLANTION WITH EXAMPLE

LET'S IMAGINE THAT THERE IS THIS DATA STREAM THAT IS GOING TO BE ENCODED BY HUFFMAN ENCODING :

AAAABCDEEEFFGGGH

THE FREQUENCY AND PROBABILITY FOR EACH UNIQUE VALUE THAT APPEARS ARE AS FOLLOWS :

Value	Frequency	Probability
A	4	0.25
B	1	0.0625
C	1	0.0625
D	1	0.0625
E	3	0.1875
F	2	0.125
G	3	0.1875
H	1	0.0625

Table 1: Frequency

From the statistical model the encoder can build a minimum code for each and store it in the conversion table. The algorithm pairs up 2 values with the least probability, in this case we take **B** and **C** and combine their probability so as to be treated as one unique value. Along the way each value **B**, **C** and even **BC** is being assigned a **0** or **1** on their branch. This means that **0** and **1** will be the least significant bits of the codes **B** and **C** respectively. From there the algorithm compares the remaining values for another 2 values with the smallest probability and repeat the whole process again until they extend up to form a structure of a up-side down tree. The whole process is illustrated as on the next page.

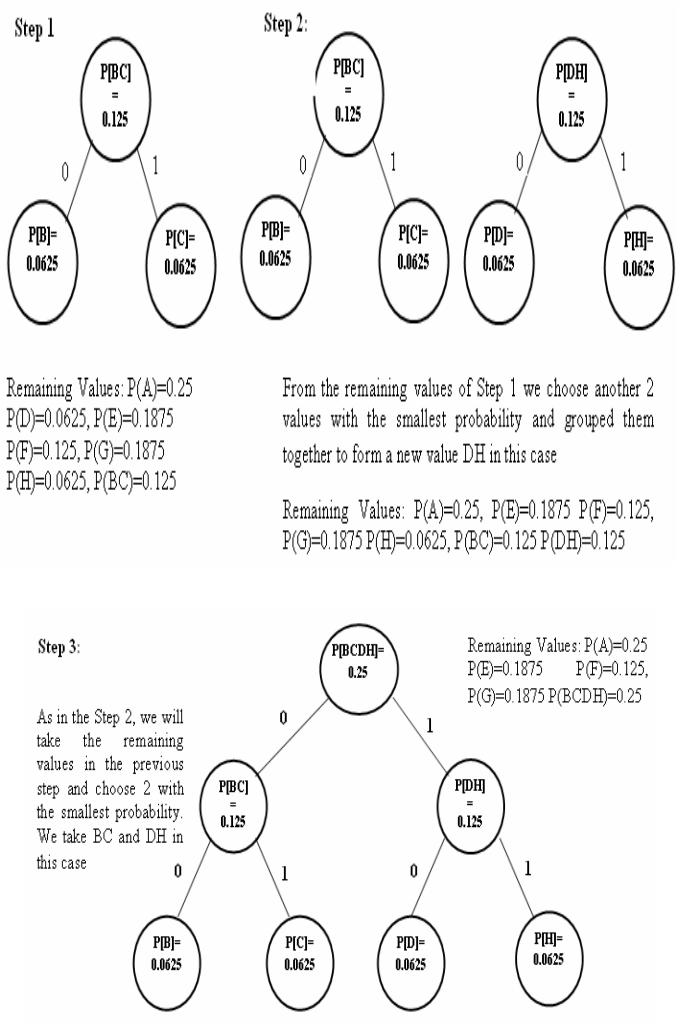
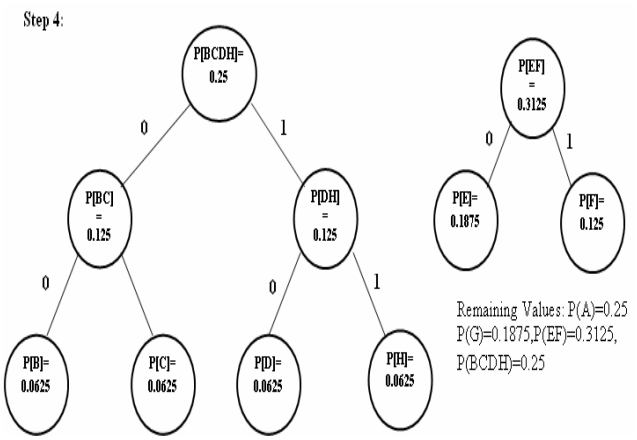


Figure 1 : Steps in deriving a conversion Table in Huffman Encoding



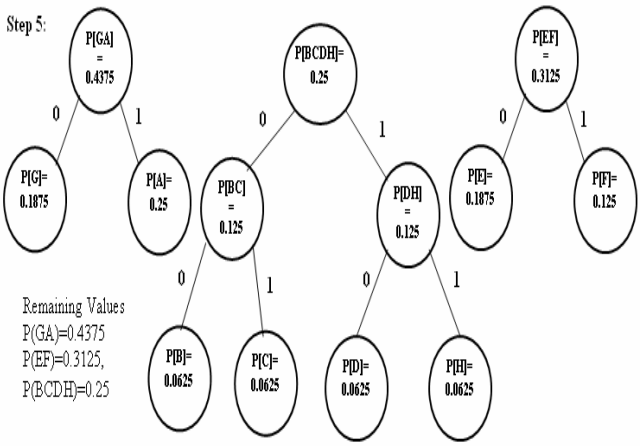
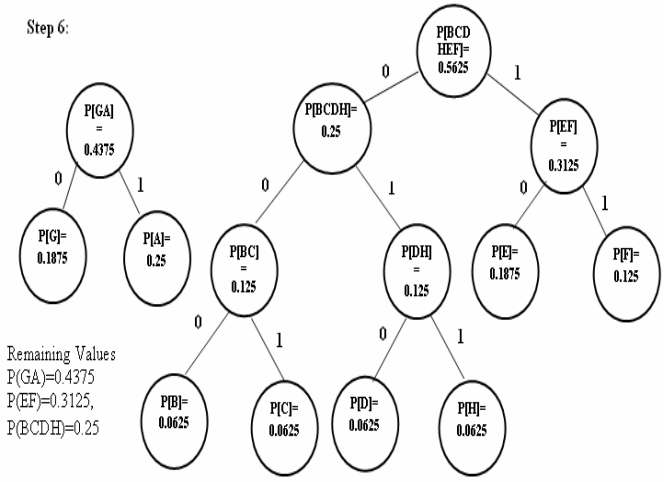


Figure:2 ***(Continued)*** Steps in deriving a conversion Table in Huffman Encoding



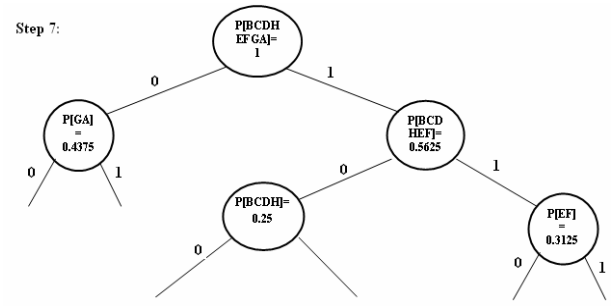


Figure 3 : ***(Continued)*** Steps in deriving a conversion Table in Huffman Encoding

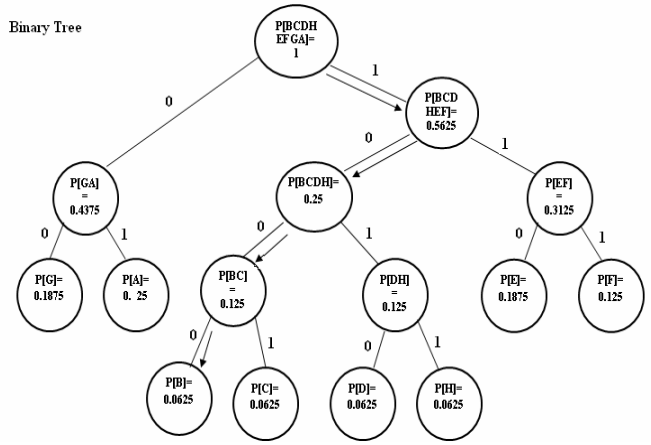


Figure 4: ***(Continued)*** Steps in deriving a conversion Table in Huffman Encoding

The binary code for each of the unique value can then be known following down from the top of the up-side down tree (most significant bit) until we reached the unique value we want (least significant bit). Let's take for example we want to find the code for B : Follow the path shown by the arrow on the diagram above, and arrive on B. Notice that beside each of the paths we take, there is a bit value, combining each of these values which we came across, and we will get the code for B : 1000. The same approach is then used to find all of the unique values, and their codes are then stored in the conversion table The values and corresponding codes are as given in the following table.

Value (key)	Huffman Code
A	01
B	1000
C	1001
D	1010
E	110
F	111
G	00
H	1011

Table 2 Encoding Lookup table

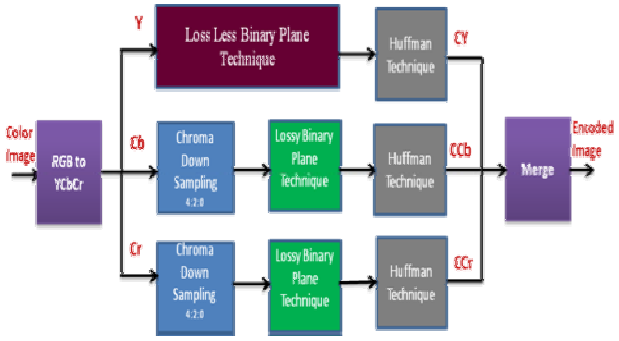


Figure 5 Compression Model using Huffman Technique

Figure 3 shows the Compression model using Huffman Technique.Here RGB color image is converted into Y Cb Cr components .The Y component of the image is compressed using Lossless BPT and then Huffman technique is applied for further compression .the remaining Cb ,Cr components arte down sampled (4:2:0) individually .these down sampled images are compressed using loss BPT and Huffman technique is applied for further compression individually Finally all compressed components (After applying Huffman) are merged to get compressed bit stream of image .

II. PROCEDURE HUFFMAN CODE

/* subroutine to apply Huffman coding on bpds file and generate final form of compressed file*/
//data items
hmc table //hash table to hold Huffman look up table
lstNodes //linked list of nodes
key //unique byte value of intermediate file
count //on occurrences of the key value
cByte
hcode //holds Huffman code a byte

BEGIN
open bpds file
while((key=read(bpds file))!=eof)
BEGIN
search for key in hmc Table
if found **then**
increment count for the key
write back(key,count) to the hmc Table
else
write(key,1) to the hmc Table
END
close(bpds file)
for every key in hmc Table
BEGIN
construct a node with probability of occurrence
insert into lstNodes in such way that the nodes in ascending order based on probability
END
build the tree
assign the tree
assign code "" to root
repeat until all nodes are assigned a code
BEGIN
assign parentcode+"0" to left child
assign parentcode+"1"to right child
END
from the tree build a hash table to hold the (key,Huffmancode)
open bpds file
open comp file
while((cByte=read(bpds file))!=eof)
BEGIN
search for the key cByte in the hmc Table
move the Huffman code for the key in hcode
write hcode to comp file
END
close bpds file
close comp file
END

III. REFERENCES

[1] M.Ashok, Dr.T.Bhaskar Reddy, Dr.B.Eswara Reddy,"Binary wavelet transform for image representation",IJEST,vol3,no.8,Aug 2011,pg.no:6286-6290
[2] N. Subhash Chandra , M.Balraju, Dr. S.Mahaboob Basha , M. Rama Krishna Reddy ,Dr. T.Bhaskara Reddy,Dr.A.Govardhan,"Loss-less compression of images using binary plane, difference and huffman coding (bdh technique)",Journal of Theoretical and Applied Information Technology.
[3] S.Mahaboob Basha,Dr.B.Sathyanarayana and Dr. T. Bhaskara Reddy " Image Compression Using Binary Plane Technique",Library progress,vol1.27,no:1,June-2007,pg.no:59-64
[4] G. K Wallace, "The JPEG still picture compression standard.",IEEE Trans. Consumer Electron, Vol 38, No 1, Feb 1992.
[5] Baligar, V.P. Patnaik, L.M., and Nagabhushana, G.R. "High compression and low order linear predictor for lossless coding of grayscale images", Image Vis. Computer, 2003, 21, pp. 543–550
[6] Hong Pan, Li-Zuo Jin, Xiao-Hui Yuan, Si-Yu Xia, Jiu-Xian Li, and Liang-Zheng Xia ," A Binary wavelet
based scheme for gray scale image compression" ICASSP ', Proceedings of the 2009 IEEE International
Conference on Acoustics, Speech and Signal Processing.
[7] Lute kamstra, "The design of linear binary wavelet transforms and their application to binary image compression" IEEE International Conference on Image Processing III. Pg:241-244.
[8] Lute kamstra, " Non linear binary wavelet transforms and their application to binary image compression", IEEE International Conference on Image Processing III. Pg:593-596.
[9] N F law H.Oan,W C Siu, "Lossless image compression using binary wavelet transform IET image processing", Vol 1,no.4 2007
[10] Won-Gyu Kim, Oh-Jin Kwon, Myung-Ho Kang," A binary wavelet transform based authentication algorithm for binary Images"
[11] ITU-recommendations for JPEG compression standard http://www.itu.int/rec/T-REC-T.81/en
[12] N. Jayant," Signal Compression: technology targets and research directions," IEEE J. Select Areas Communications, Vol. 10, No.5, pp 796 – 818 , June 1992.
[13] Rafael C.Gonzalez, Richard E. Woods "Digital Image Processing" Second edition Pearson Education, Printice Hall.

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