
huffmanCodebook

```
function [ CodeBook ] = huffmanCodebook( imgBW )

% This function generates Huffman dictionary (aka codebook) from a BW image
% Input: imgBW, which is a black and white image (UINT8)
% Output: CodeBook, which is a 'table' for converting 256 grayscale levels to
% the corresponding codewords
% Note: Some of the codewords might be 'null' due to the absence of certain pixel
% You can add the input/output arguments if needed.
```

Entropy and probability distribution

```
[height,width] = size(imgBW);
if (width>1)
    imgBW = reshape(imgBW, [1,(height*width)]);
end
```

```
% Calculate probability for each symbol
% freq = tabulate(imgBW);
% P = freq(:,3)./100;
% symbols = freq(:,1);

%
[freq,symbols] = histcounts(imgBW,-255:256);
symbols(end) = [];

P = freq./sum(freq);
```

```
%%%%%%%%% GÖR TEMPBOOK TILL EN KOLUMN, SORTERA TEMPBOOK OCH SYMBOLERNA
%%%%%%%%% MED HJÄLP AV SANNOLIKHETERNA OCH LÄGG IHOP
```

Create codebook

```
tempbook = cell(length(symbols),2); % List of codewords, same length as number of
for i=1:length(symbols)
    tempbook{i,1} = symbols(i);
end

mEvents = num2cell(1:length(P)); % Changing list for events, merged and single
mProb = P; % Changing list for probabilities, merged and single

% Loop until there is only 1 merged value left
while(length(mEvents) > 1)

    % Sort the list of merged/single probabilities
    % and retrieve both a list of probabilities and index values of the
    % events
    [sProb, sInd] = sort(mProb);

    % Get the events with the smallest probabilities from merged list
    % events are in a cell array with all the sub-events in the cell
```

```

smallestE1 = mEvents{sInd(1)};
smallestE2 = mEvents{sInd(2)};

% Add a 0 to the codeword of the smallest probability
% and all the sub-probabilities "under" the chosen node
for i = 1:length(smallestE1)
    tempbook{smallestE1(i), 2} = ['0', tempbook{smallestE1(i),2}];
end

% Add a 1 to the codeword of the second smallest probability
% and all the sub-probabilities "under" the chosen node
for i = 1:length(smallestE2)
    tempbook{smallestE2(i), 2} = ['1', tempbook{smallestE2(i),2}];
end

% Add the events to the merged event cell array, as a cell of
% both the events to be able to add code to them
mEvents{end+1} = [smallestE1, smallestE2];

% Add the sum of both the probabilities to the merged probabilities to
% be able to sort them into the "tree"
mProb(end+1) = sProb(1)+sProb(2);

% Remove the single events and probabilities as they now exists as
% merged cells
mEvents(sInd(1:2)) = [];
mProb(sInd(1:2)) = [];

end

CodeBook = tempbook;

```

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