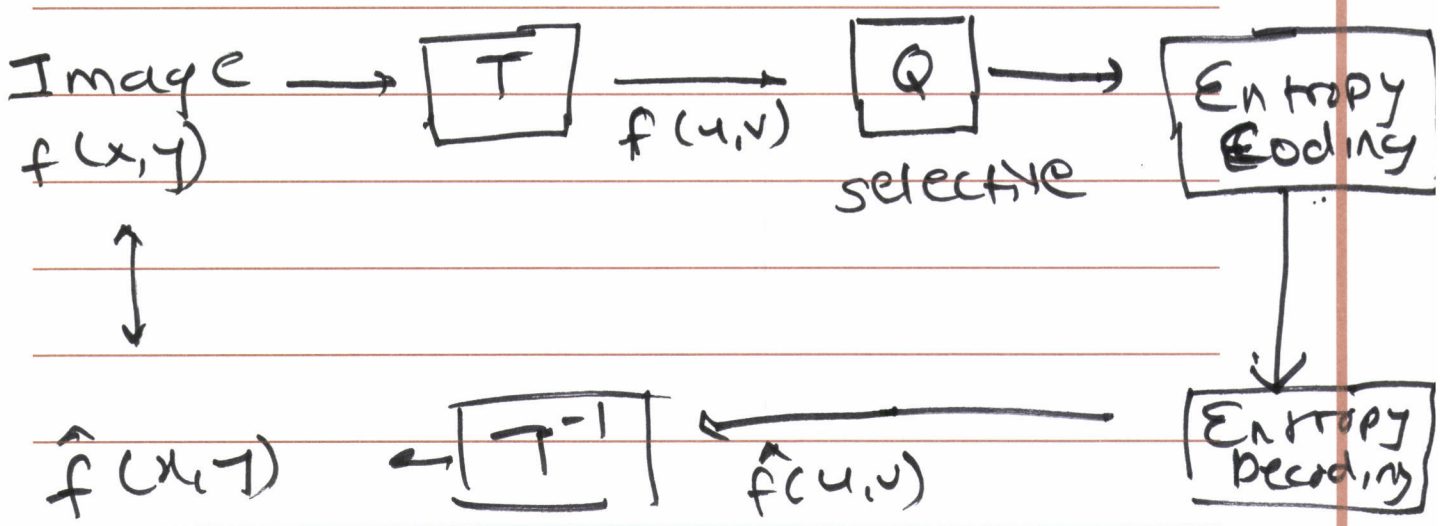
Image Compression

- Lossless
  - RLE
    - tiff, ~~rla~~
    - rla, pict
  - Dictionary
    - gif, png
  - prediction
    - JPEG lossless
  - statistical Encoding
- Lossy
  - spatial domain
    - scalar Q
    - vector Q
  - Tranform
    - DFT
    - DCT (JPEG)
    - KLT
  - subband
    - wavelets
    - (JPEG 2000)

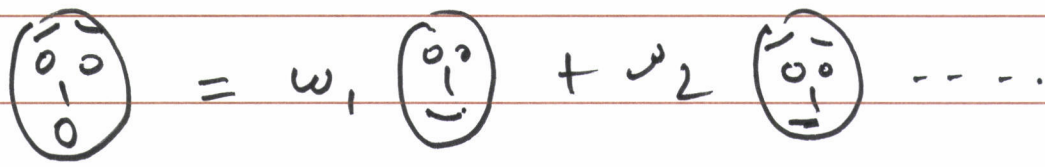


3d point

$$P = x\vec{i} + y\vec{j} + z\vec{k}$$

linearly independent vector

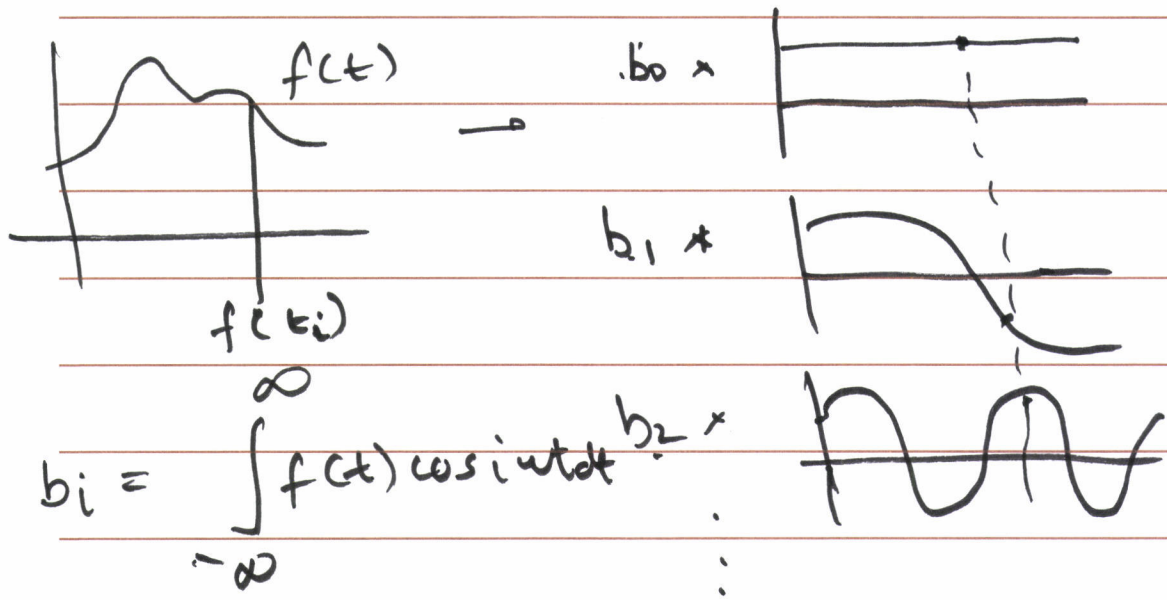
coordinates



Eigen faces

$$f(x) = \sum b_i (\text{basis function}_i)$$

$$f(t) = b_0 \cos 0\omega t + b_1 \cos \omega t + b_2 \cos 2\omega t \ldots$$



$$b_i = \int_{-\infty}^{\infty} f(t) \cos i\omega t \, dt$$

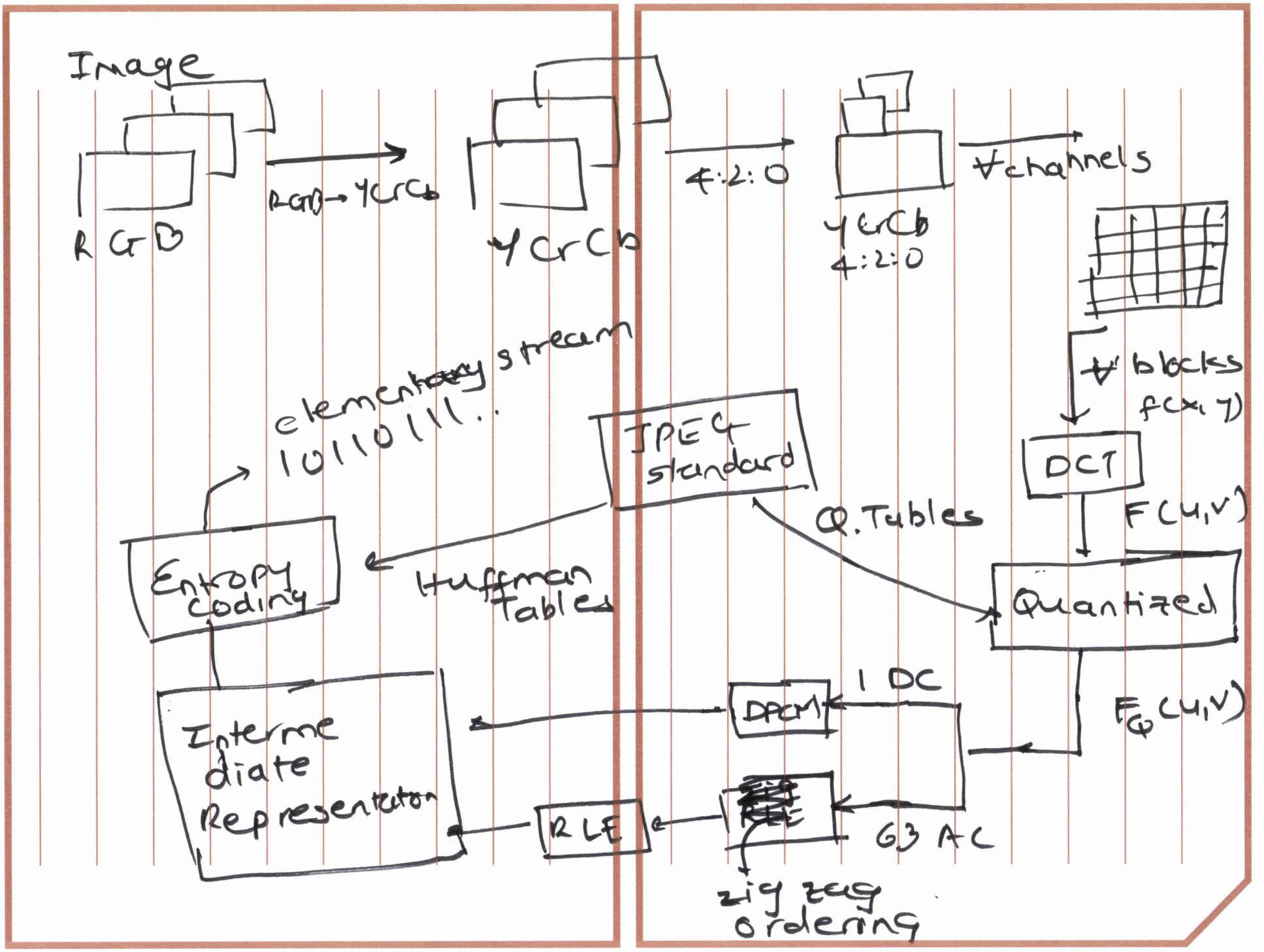


Image
R G B
RGB → YCrCb
YCrCb
4:2:0
YCrCb
4:2:0
∀ channels
∀ blocks
f(x, y)
DCT
F(u,v)
Quantized
$F_Q(u,v)$
Q. Tables
JPEG standard
Huffman Tables
Entropy coding
elementary stream
10110111..
Interme diate Representation
DPCM
1 DC
RLE
63 AC
zig zag ordering

15 0 -2 -1 -1 -1 0 0 -1 0 ....

previos block
12 .....

DC → DPCM <size><amplitude>
AC → RLE <runlength,size><amplitude>

DC→ <2 7 <3 7
AC →

<1, 2> <-2>
<0, 1> <-1>
<0, 1> <-1>
<0, 1> <-1>
<2, 1> <-1>
~~EOB~~ <0,0>

VLI

	0	1
	-1	1
00 01 10 11		
-3	-2	2 3
000 001 010 011 100 101 110 111		
-7 -6 -5 -4 4 5 6 7		

Huffman <0,0> → 1010
<0,1> → 00
<1,2> → 11011
<2,1> → 11100
<2> → 011

elementary bitstream

0 11 11 11011 01 00 0 000 000
11100 0 1010

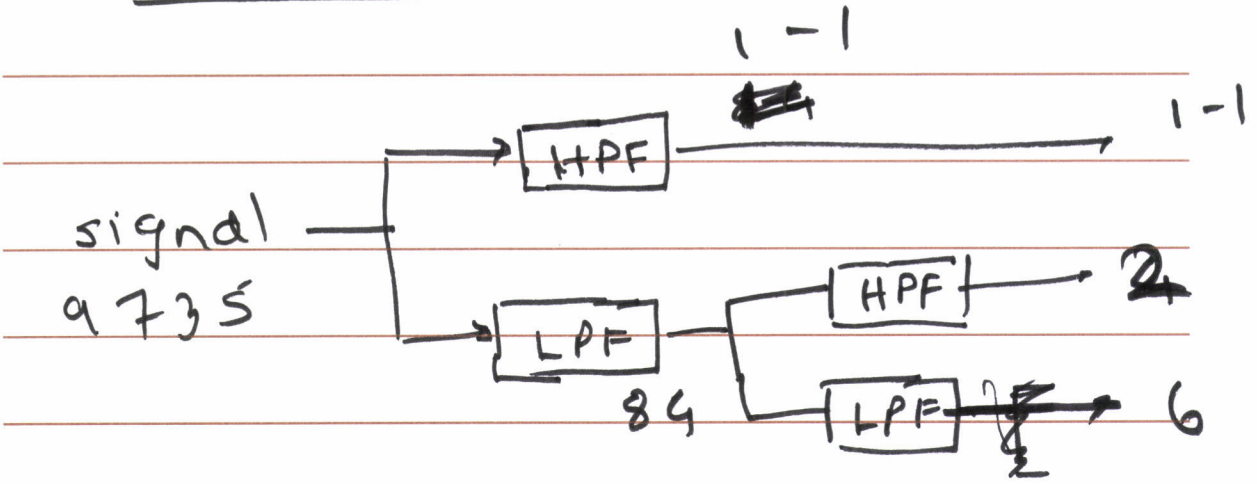
original → 256 bits

compressed → 31 bits

Modes of compression

- Baseline
- Progressive
  - spectral selection
  - successive bit approx.
  - hierarchical

Wavelets



9	7	3	5
8	4	1	-1
6	2	1	-1