

压缩比 (compression ratio)

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$$compression\ ratio = \frac{B_0}{B_1}$$

$B_0$  – number of bits before compression

$B_1$  – number of bits after compression

average number of bits      平均比特数

字母S的信息源的熵

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$$\eta = H(S) = \sum_{i=1}^n p_i \log_2 \frac{1}{p_i}$$

$$= - \sum_{i=1}^n p_i \log_2 p_i$$

霍夫曼编码标准步骤

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1. 按照概率从大到小的顺序，从上到下排列， $s_i$  概率
2. 取最小的两项，合并，加到下一列中，参加排序
3. 标出箭头
4. 上（1）下（0）
5. 画出树状图，左0，右1
6. Z字形扫描，从概率最大的开始安排
7. 写出哈夫曼01表示

# JPEG Encoder

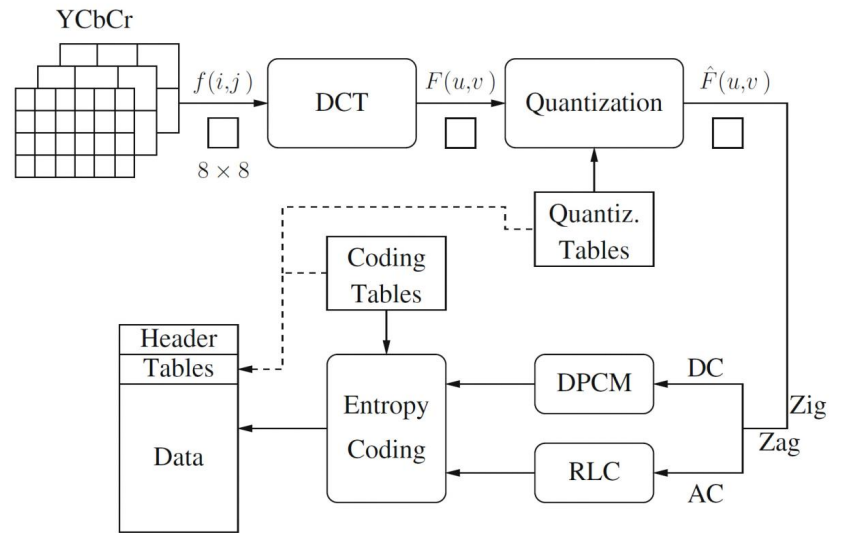
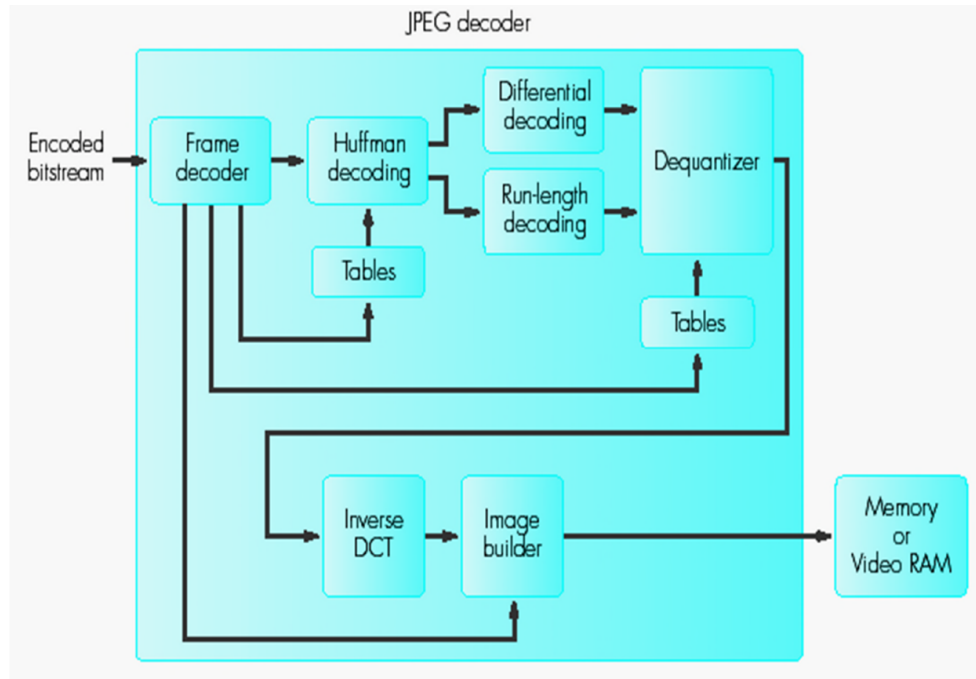


Fig. 9.1: Block diagram for JPEG encoder.



传统DCT算法

$$S_{uv} = \alpha(u)\alpha(v) \sum_{i=0}^{N-1} \sum_{j=0}^{N-1} s_{ij} \cos \frac{(2i+1)u\pi}{2N} \cos \frac{(2j+1)v\pi}{2N} \quad u, v = 0, \dots, N-1$$

$$\alpha(k) = \begin{cases} \sqrt{\frac{1}{N}} & \text{for } k = 0 \\ \sqrt{\frac{2}{N}} & \text{for } k = 1, 2, \dots, N-1 \end{cases}$$

T矩阵背下来，用于偷鸡

$$T(i, j) = \begin{cases} \frac{1}{\sqrt{N}}, & \text{if } i = 0 \\ \sqrt{\frac{2}{N}} \cos \frac{(2j+1)i\pi}{2N}, & \text{if } i > 0 \end{cases},$$

$$\begin{aligned} & \text{2D DCT of A} = \\ & \mathbf{TAT}^T \end{aligned}$$

$$\begin{aligned} \mathbf{T} &= \begin{bmatrix} 0.5 & 0.5 & 0.5 & 0.5 \\ \frac{1}{\sqrt{2}} \cos \frac{\pi}{8} & \frac{1}{\sqrt{2}} \cos \frac{3\pi}{8} & \frac{1}{\sqrt{2}} \cos \frac{5\pi}{8} & \frac{1}{\sqrt{2}} \cos \frac{7\pi}{8} \\ \frac{1}{\sqrt{2}} \cos \frac{\pi}{4} & \frac{1}{\sqrt{2}} \cos \frac{3\pi}{4} & \frac{1}{\sqrt{2}} \cos \frac{5\pi}{4} & \frac{1}{\sqrt{2}} \cos \frac{7\pi}{4} \\ \frac{1}{\sqrt{2}} \cos \frac{3\pi}{8} & \frac{1}{\sqrt{2}} \cos \frac{9\pi}{8} & \frac{1}{\sqrt{2}} \cos \frac{15\pi}{8} & \frac{1}{\sqrt{2}} \cos \frac{21\pi}{8} \end{bmatrix} \\ &= \begin{bmatrix} 0.5000 & 0.5000 & 0.5000 & 0.5000 \\ 0.6533 & 0.2706 & -0.2706 & -0.6533 \\ 0.5000 & -0.5000 & -0.5000 & 0.5000 \\ 0.2706 & -0.6533 & 0.6533 & -0.2706 \end{bmatrix} \end{aligned}$$

softmax Loss

z : Normalized probabilities

p : Predicted output Scores

$$p_j = \frac{e^{z_j}}{\sum_k e^{z_k}}$$

激活函数

$$\sigma(x) = \frac{1}{1+e^{-x}}$$

Vanilla RNN

$$h_t = f_W(h_{t-1}, x_t)$$



$$h_t = \tanh(W_{hh}h_{t-1} + W_{xh}x_t)$$

$$y_t = W_{hy}h_t$$

LSTM必背公式

$$\begin{pmatrix} i \\ f \\ o \\ g \end{pmatrix} = \begin{pmatrix} \sigma \\ \sigma \\ \sigma \\ \tanh \end{pmatrix} W \begin{pmatrix} h_{t-1} \\ x_t \end{pmatrix}$$

门控多四项，sig三tanh一行。

遗忘乘旧忆，输入加新常。

输出乘激活，隐隐藏心房。

长期记忆

$$c_t = \underset{\text{遗忘}}{f} \underset{\text{之前长期记忆}}{\odot} c_{t-1} + \underset{\text{输入}}{i} \underset{\text{门}}{\odot} \underset{\text{逐个元素乘法}}{g}$$

短期记忆

$$h_t = \underset{\text{输出门}}{o} \underset{\text{长期记忆}}{\odot} \tanh(c_t)$$

i fog理解

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i: Input gate, whether to write to cell

f: Forget gate, Whether to erase cell

o: Output gate, How much to reveal cell

g: Gate gate (?), How much to write to cell

i 越大，写入长期记忆越多

f 越大，忘掉的就越少，保留就越多

o 越大，显示的就越多

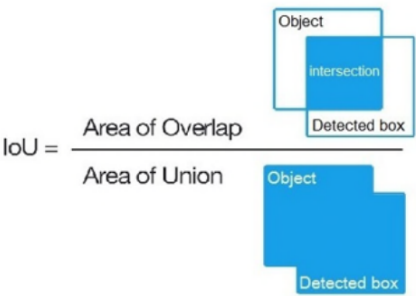
g 越大，写入就越多

性能指标

平均精度 mean Average Precision (mAP) (AP)

$$mAP = \frac{1}{N} \sum_{i=1}^N AP_i$$

交并比 Intersection over Union (IoU)



真阳性 True Positive (TP)

假阳性 False Positive (FP)

假阴性 False Negatives (FN)

只要检测出来了，不管IoU，都是positive，大于IoU的才是True，小于IoU阈值的是False  
没检测出来，就是Negatives，第二个框都没有，IoU就是0, 所以是False

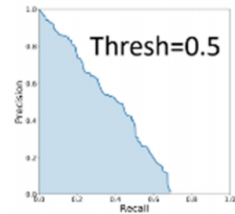
召回：真实存在，检测出来多少

召回  $Recall = \frac{TP}{TP + FN} = \frac{TP}{\# \text{ ground truths}}$

精度：所有检测出来的，真实的多少

精度  $Precision = \frac{TP}{TP + FP} = \frac{TP}{\# \text{ predictions}}$

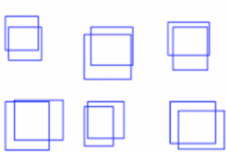
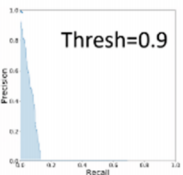
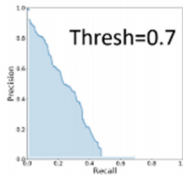
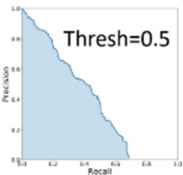
AP50 or AP0.5



精度召回曲线下的面积

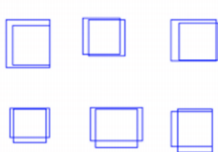
AP0.50: 0.55: 0.95

$$mAP_{COCO} = \frac{mAP_{0.50} + mAP_{0.55} + \dots + mAP_{0.95}}{10}$$

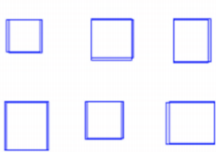


IoU = 0.5

Loose



IoU = 0.7



IoU = 0.9

Tight