# Compressor de Imagens Utilizando Wavelets, QV e Codificador Aritmético

Universidade Federal Do Rio De Janeiro

Programa de Engenharia Elétrica

Compressão de Imagens

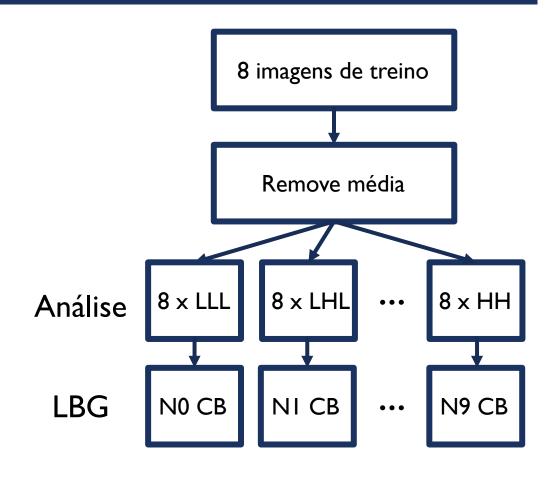
Victor Raposo Ravaglia De Oliveira

### Visão Geral

- Treinamento
- Avaliação
- Codificação
- Decodificação

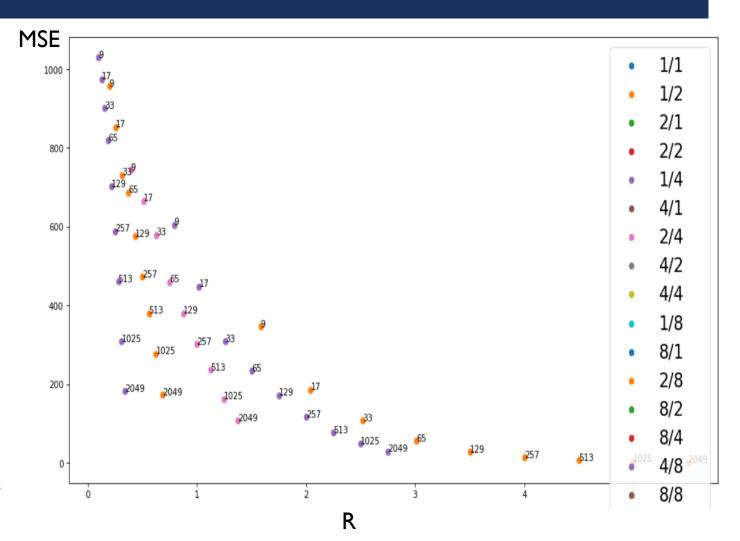
#### Treinamento

- Para cada imagem do conjunto de treinamento:
  - Remover a média
  - Separar em sub-bandas (análise)
  - Agrupar sub-bandas de mesmo nível e frequência
- LBG com método de Divisão para a inicialização dos vetores
- Cada subbanda tem sua própria configuração de tamanho de codebook e bloco



### Avaliação

- Para cada imagem do conjunto de treinamento:
  - Para cada sub-banda:
    - Avaliar desempenho de cada codebook: MSE e R
- R teórico ou prático
- Guardar o desempenho médio de cada codebook para cada sub-banda
- Guardar histograma de cada codebook
- Apenas necessário calcular uma vez



# Codificação, decisão do codebook

- Para cada sub-banda:
  - Selecionar o melhor codebook com o Lagrangiano para a imagem de teste:
    - $J = MSE + \lambda R$
  - Duas possibilidades:
    - R teórico ou R após a codificação do conjunto de treino
  - Codebook com menor J é utilizado para a sub-banda

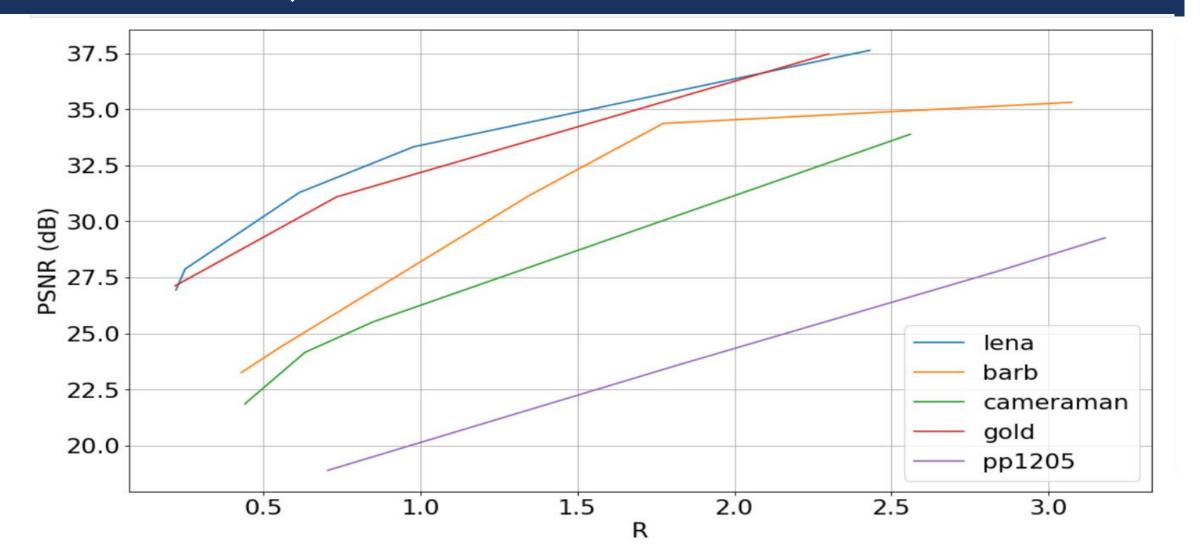
## Codificação, codificador aritmético

- Cabeçalho contendo a média da imagem e o codebook utilizado para cada sub-banda
- Para cada sub-banda um histograma fixo que foi obtido com as taxas do conjunto de treino

## Decodificação

- Leitura do cabeçalho
- Decodificação com o histograma fixo por subbanda
- Síntese
- Soma da média

### Resultados, conjunto de testes



# Testes, reconstrução:

R: 0.52bpp, PSNR: 31.2 dB



R: 0.53bpp, PSNR: 27.43 dB



#### Testes, reconstrução:

#### R: I.22bpp, PSNR: 20.8 dB

this is if a lift of land

$$g = (I - t)a$$

Zaviable not passwided as CDC

W. Cambridge Information from the Coder Common Private

If his clear that the dissociated persons for establishing the image. All porchases it and the hopeoperated over shorter profession of the codes. If Contain  $u_n^p$ ,  $u_n^p$  and  $u^p$ , where we use the catalond image f is observative g and again. If Contains  $f^{(a_1,a_2,a_3)}_{a_1,a_2,a_3}$  and  $f^{(a_1,a_2,a_3)}_{a_2,a_3,a_4}$  for  $f^{(a_1,a_2,a_3)}_{a_1,a_2,a_3}$  for  $f^{(a_1,a_2,a_3)}_{a_2,a_3,a_4}$  for  $f^{(a_1,a_2,a_3)}_{a_1,a_2,a_3,a_4}$ But hoperprises for the hyperparameters for the same (30) by- (323), (323) and (322), (324), steapest-

$$f^{(\alpha_1, \alpha_2, \beta_1, \alpha_2)} = \sup_{\mathbf{x} \in \mathbf{x}} \min_{\mathbf{x} \in \mathcal{X}} \{M(\mathbf{x}, \mathbf{f}|\alpha_1, \alpha_2, \beta_1)\}$$
  
=  $\sup_{\mathbf{x} \in \mathbf{x}} \min_{\mathbf{x} \in \mathcal{X}} \{M(\mathbf{x}|\alpha_2, \alpha_1) + M(\mathbf{f}|\alpha_1, \beta_2)\}$  (27)

and the hypergurerenses are also endoused using the religional Shape of Alverration, that is,

$$A_{i}^{r,d}$$
,  $A_{i}^{r,d}$ ,  $A^{r,d}$  =  $\exp \max_{n_{i},n_{i},n_{i},l} \int_{\mathbb{R}} g\left(\mathbf{x},\mathbf{f}(n_{i},n_{i},l)\right) d\mathbf{x}$ .

Disc alone that to obtain a contract and and are we only need to Inter Algorithm 1 or Algorithm I using the original image as the colonia of the first and the colonia of the co Application of the last

A symmetrial version of \$2.00, \$2.00 and \$5.00 is accessed by the broader, and described, respectively, by report, we and to the They are alord as price independence in guiding the extensions of Her Reproductionness in the decision Most specifically, they are and redstring the following departures for only to properties (\$25-464) as

$$\begin{split} p(n_1) &\approx n_1^{2(n_1^{-1/2})-1} \exp\left\{-k \left\{ m_1^{-1/2} \right\} n_2/(n_1^{-1/2}) \right\} & (20) \\ p(n_1) &\approx n_2^{2(n_1^{-1/2})-1} \exp\left\{-k \left\{ m_1^{-1/2} \right\} n_2/(n_2^{-1/2}) \right\} & (30) \end{split}$$

Trafferency again the Summerfried Statement approach to the recommendation problem and using the general describings at (20) - 121, we perfect the retreation of the hypergeneracity. and the reconstruction occup the 6 flowing two street

1). Solveness 
$$n_{\rm crit} \cos \beta \log n_{\rm H} n$$
 Appendix, 15-Ap

The communication of this algorithm is constituted by including. The abstraction of the parameter conjugators step where \$2.7 in has it corresponds to the CM algorithms, where the compliant cond tentral of CC is signified to the process described in Agfrom note that interpretation of intelligence consistency overcommunities of ... preselve It is used in real characters can be interest than the interest over the interest than the interest th thirt the outconversations steel in the narm, for the Nice and gustima.

Using stays it and I above the following algorithm is proposed. for the accordance as execution of the layer parameters and the springe associating gamonia biopograpions.

as forting 
$$\alpha_i^k$$
,  $\alpha_i^k$  and  $\beta^k$  by substituting  $\alpha_i^{k+1}$ ,  $\alpha_i^{k+1}$  and  $\beta^{k+1}$  in the right

tond with at 
$$(M_s)$$
 -  $(M_s)$  -  $(M_s)$  .   
a) Compare  $f^{(r,m),(r)}$  and  $f^{(r,m),(r)}$  (rem.  $(M_s)$ ) .  $(M_s)$  and  $(M_s)$  .  $(M_s)$  .  $(M_s)$ 

$$F_{ij}^{(i)} = x_{ij}^{(i)} + y_{ij}^{(i)} + y_{i$$

This proof of the connectigation of this physicides is agree house. on the last than it is an EM organisms, two (344);

Assuming that  $p \gg p-2$  and  $q \gg q-2$ , we can wron

$$\frac{1}{4} = \mu_{c} \frac{1}{4\pi m^{2}} + (1 - \mu_{c}) \frac{1}{4\pi m^{2}}, \quad (14)$$

$$\frac{1}{\alpha_{i}^{2}} = \mu_{i} \frac{1}{\alpha_{i}^{2} \alpha_{i}^{2}} + \left(1 - \mu_{i}\right) \frac{1}{\alpha_{i}^{2} \beta_{i}} \label{eq:eq:energy_problem}$$

$$\frac{1}{\beta^2} = \nu \frac{1}{a^{1/2}} + (1 - \nu) \frac{1}{\beta^{1/2}}$$
(36)

$$= \frac{M(\alpha e^{-\delta})}{M(\alpha e^{-\delta})} \qquad (37)$$

$$= \frac{M(\alpha e^{-\delta})}{M(\alpha e^{-\delta})}$$

R: 0.88bpp, PSNR: 25.59 dB

