

# Processamento e Análise de Imagens

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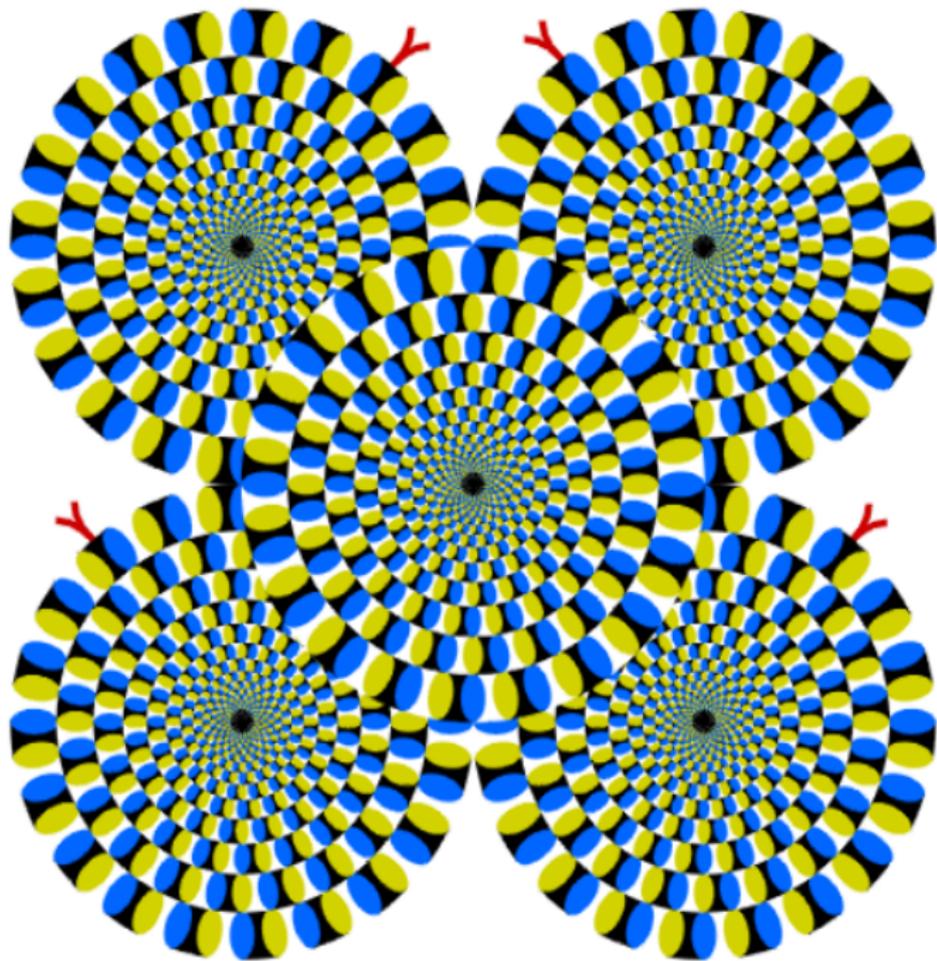


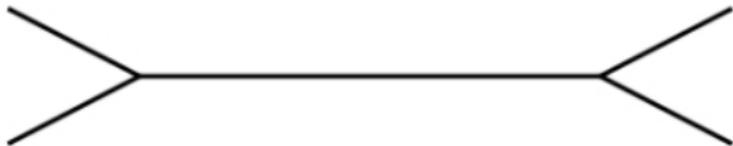
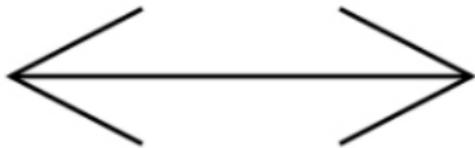


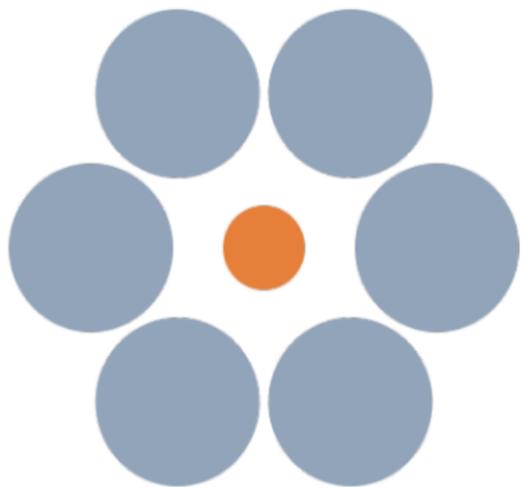


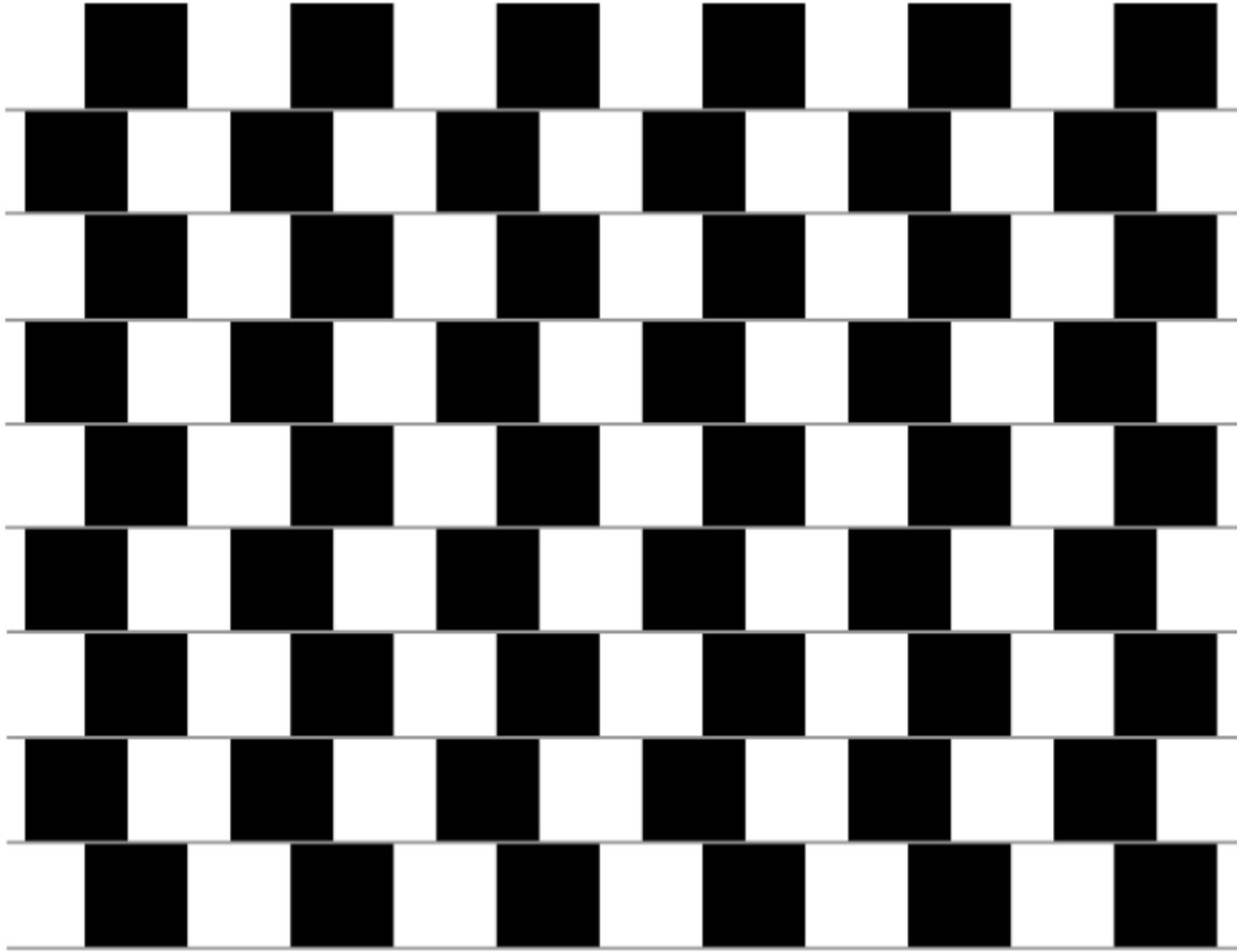


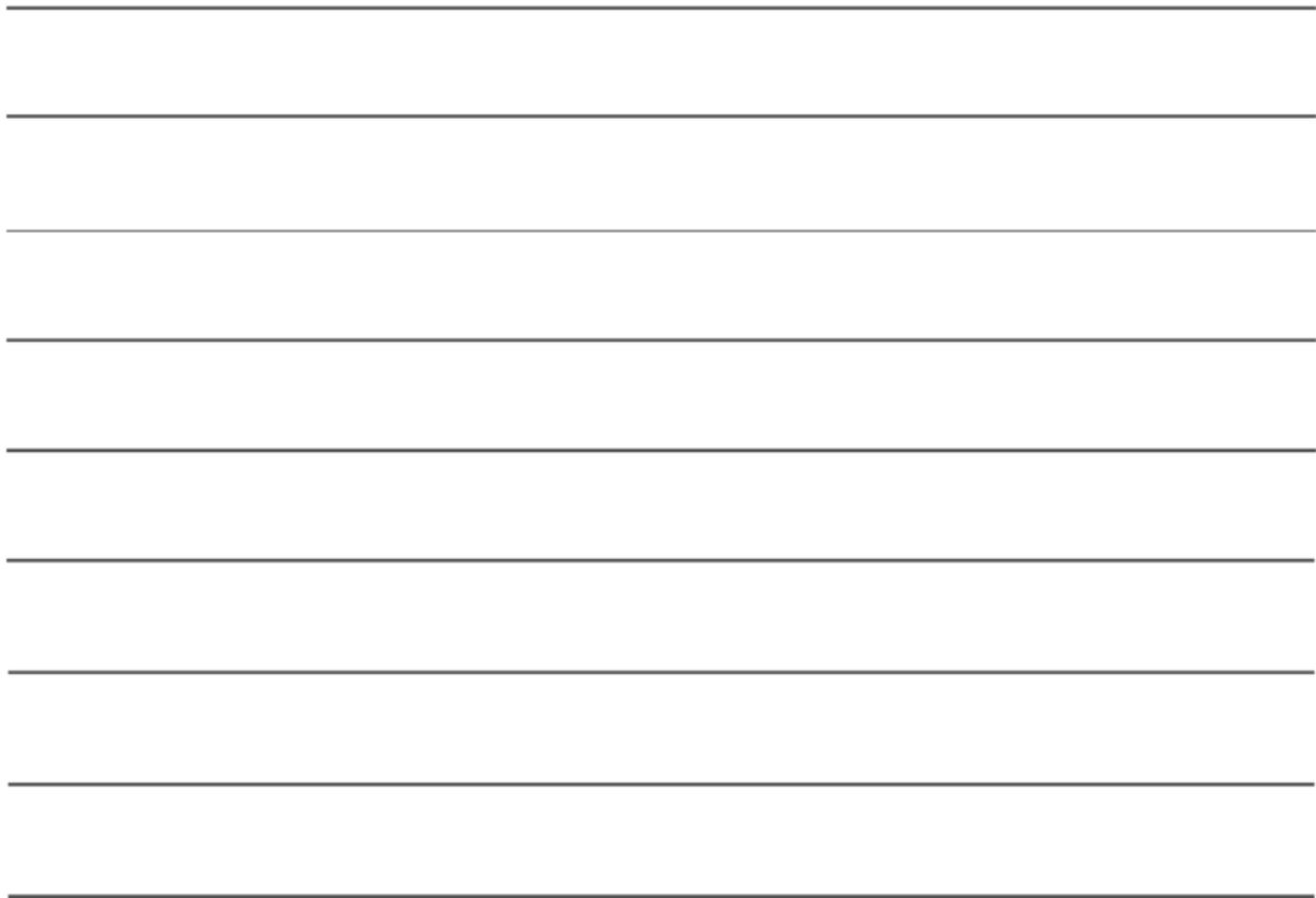




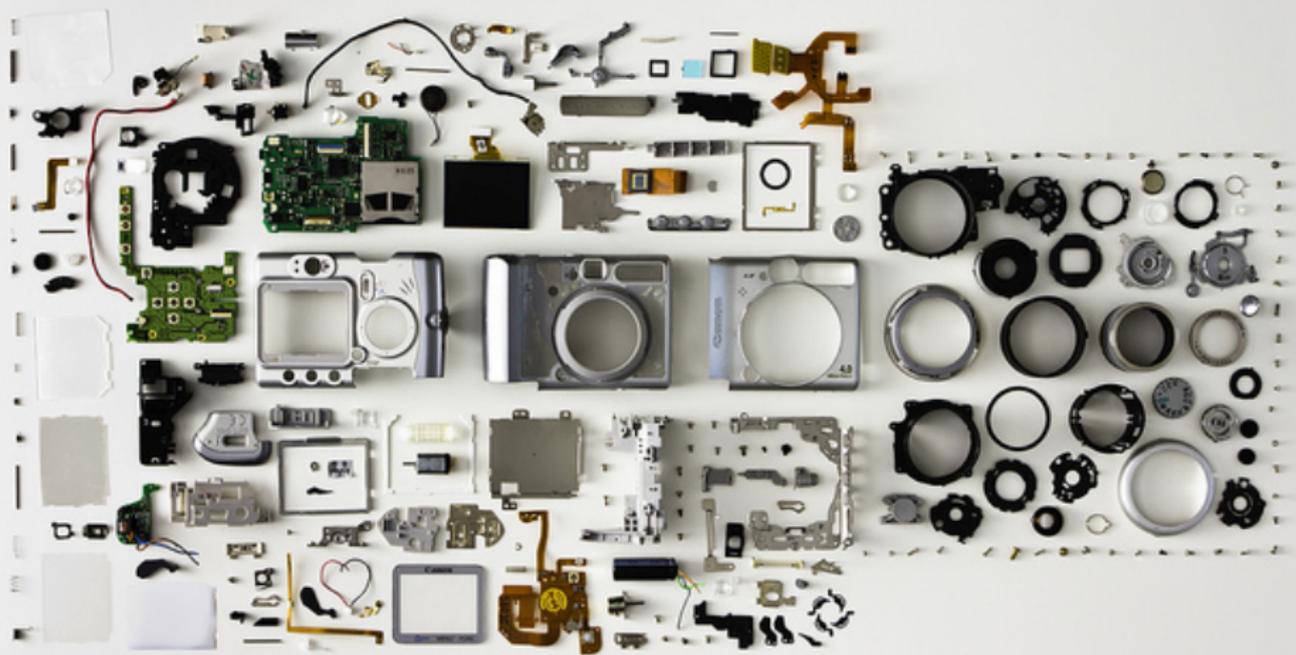










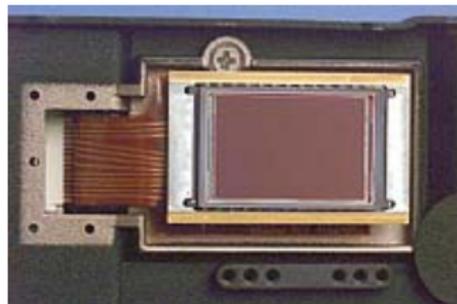
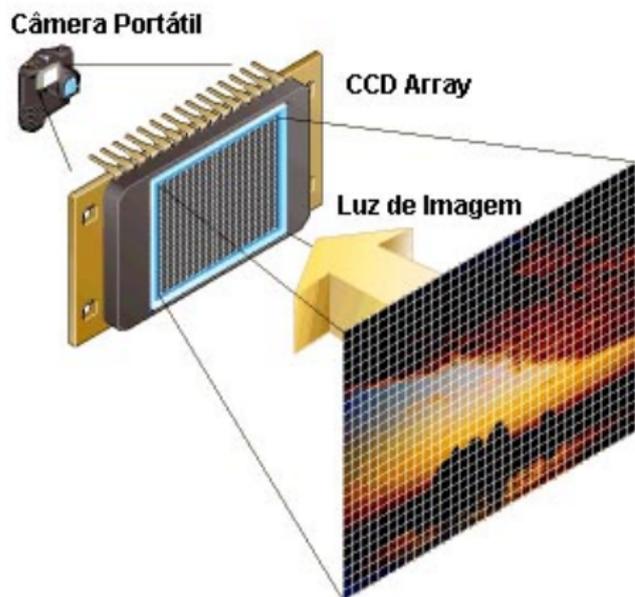


# Imagem

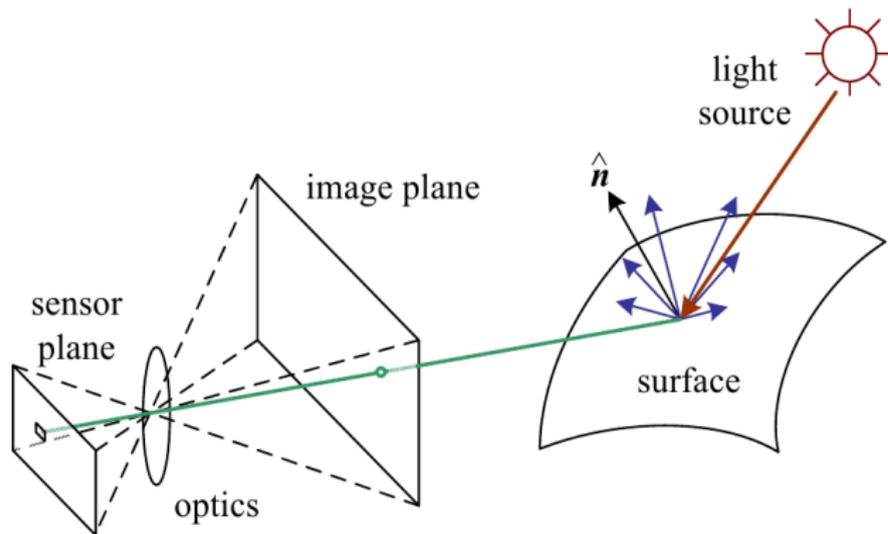
- Função bidimensional (2-d) de intensidade de luz  $f(x, y)$ :
  - $x$  e  $y$  são as coordenadas espaciais
  - $f$  no ponto  $(x, y)$  representa a intensidade ou cor naquela coordenada
  - na prática, são definidas em regiões retangulares
- Contínua no espaço
- Contínua em amplitude



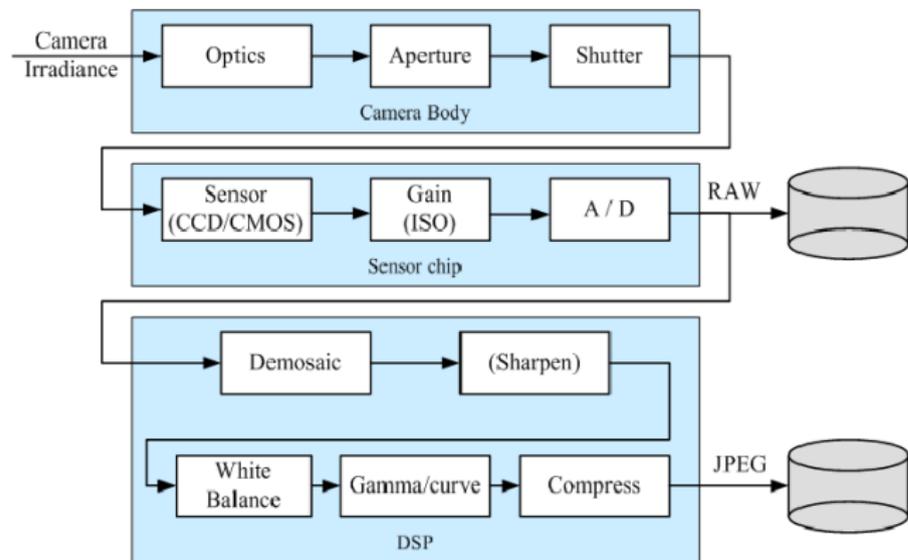
# Aquisição



# Formação da imagem

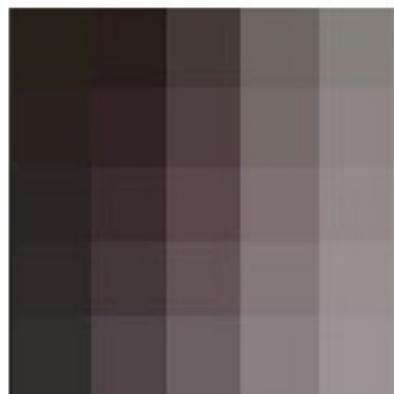
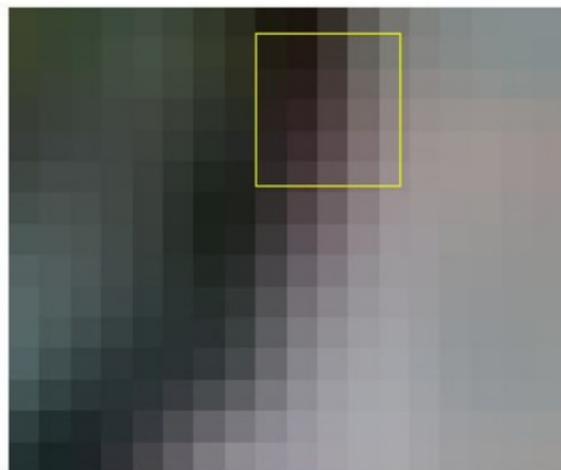
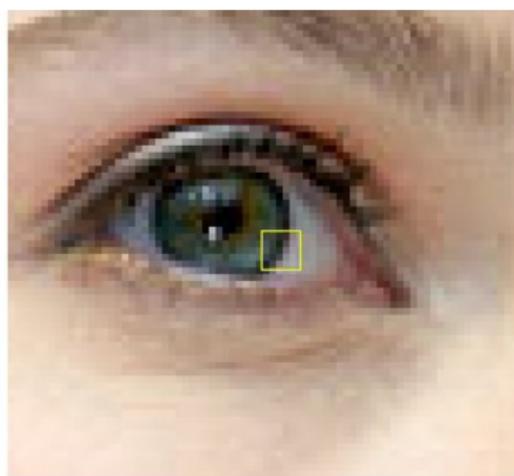
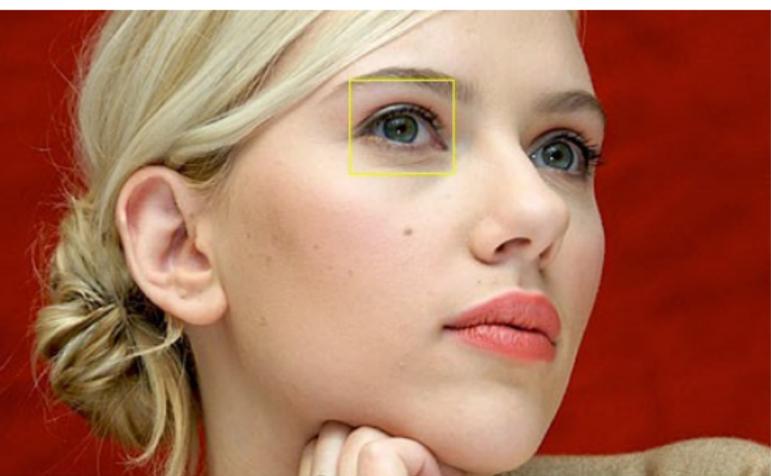


# Pipeline de geração de imagem digital

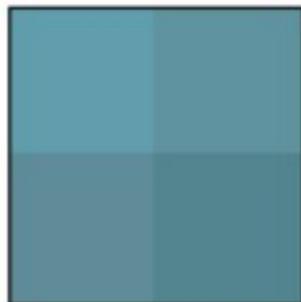


# Imagem Digital

- Ao adquirir a imagem a função contínua é **amostrada** e sua amplitude **quantizada**.
- Como resultado, a **imagem digital** é a representação da imagem contínua por um *array 2-d de amostras discretas*.
- Cada elemento da matriz é chamado de **pixel**.



2 x 2



5 x 5



10 x 10



20 x 20



50 x 50

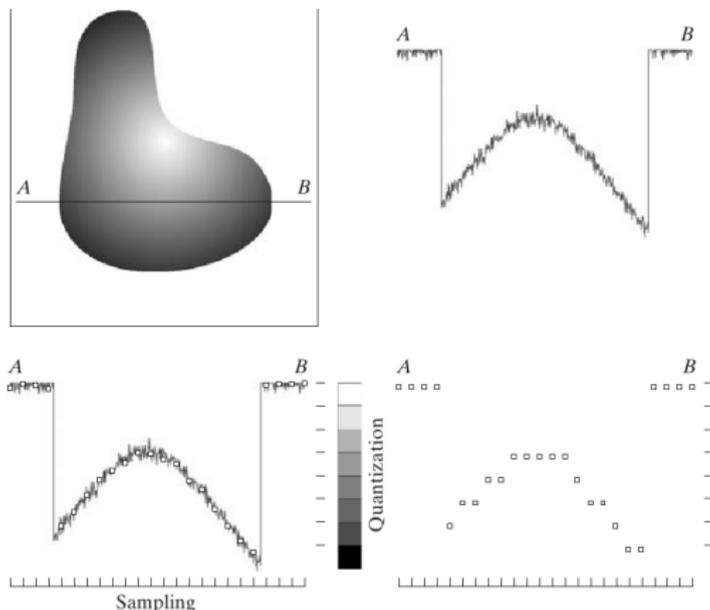


100 x 100

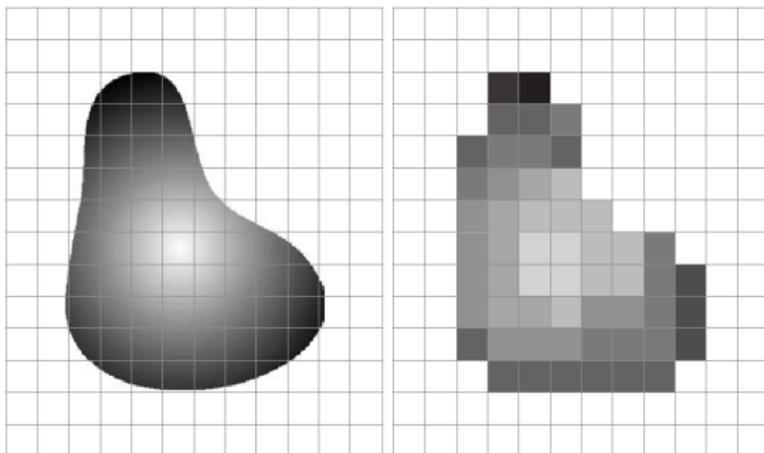


# Número de cores: quantização

- Após amostrar a imagem o sensor ainda precisa converter cada observação “real” em uma observação discreta, definida pelo número de bits usados para armazená-lo.



# Número de cores: quantização





## Componentes de cor



Vermelho (R)



Verde (G)



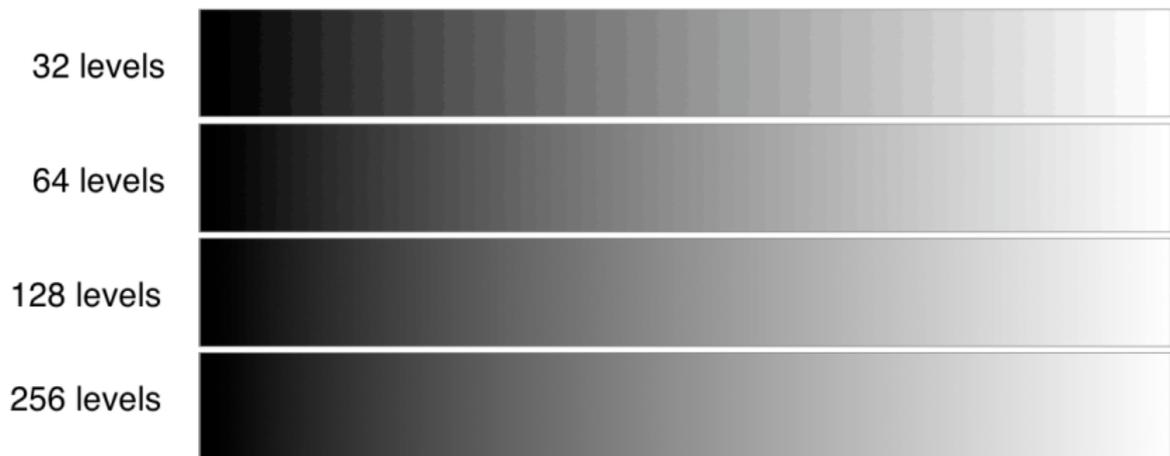
Azul (B)



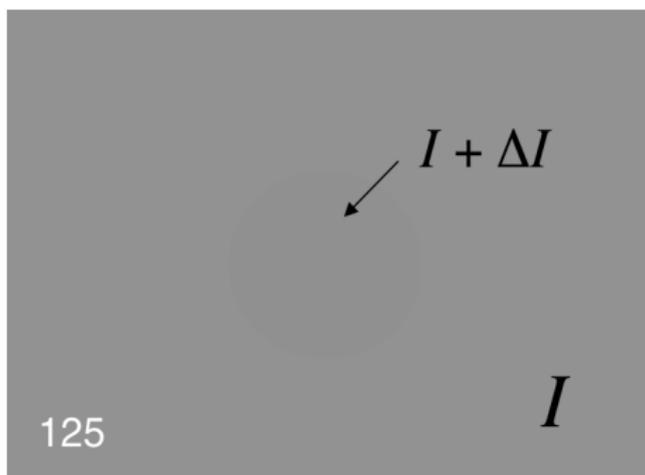
24 bits (8 + 8 + 8)

## Níveis de cinza

Ao visualizar em sequência os níveis de cinza utilizando quantização diferente, é possível ver falsos contornos gerados:



## Níveis de cinza: discernimento de brilho



- O limiar de visibilidade foi determinado experimentalmente por Weber:

$$\Delta I / I \approx K_{\text{Weber}} \approx 1.2\%,$$

chamada: fração de Weber ou lei de Weber.

# Número de cores: quantização



Imagem binária (0-1)

# Número de cores: quantização



(Domicio Pinheiro / Agência Estado)

Imagem binária (0-1)



## Componentes de cor



Vermelho (R)



Verde (G)



Azul (B)

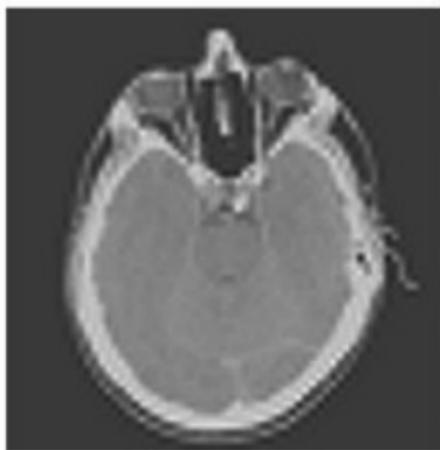
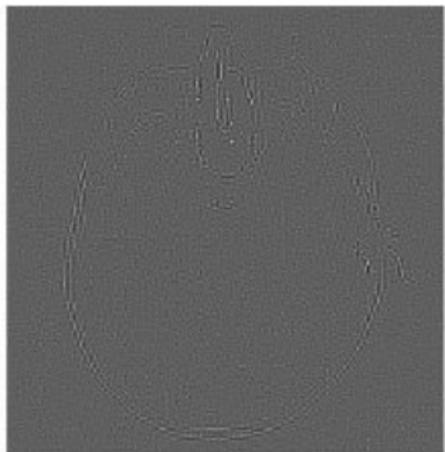


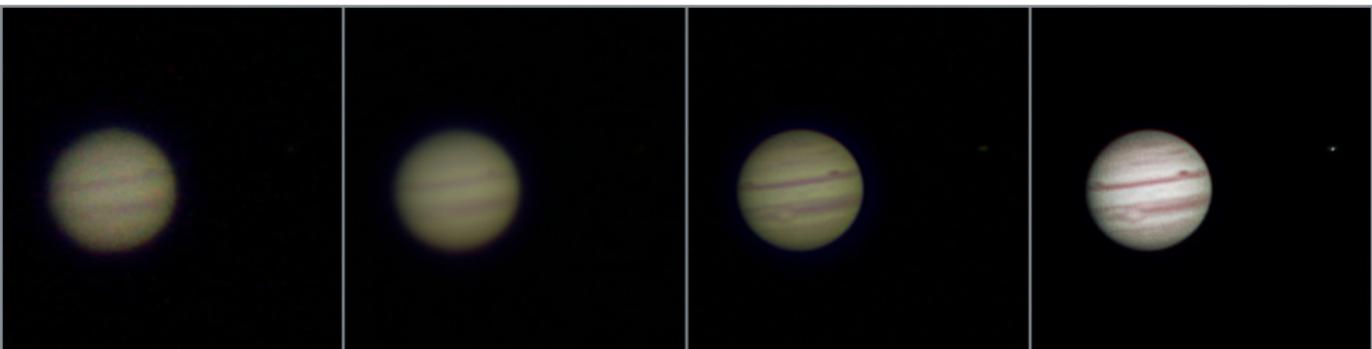
24 bits (8 + 8 + 8)

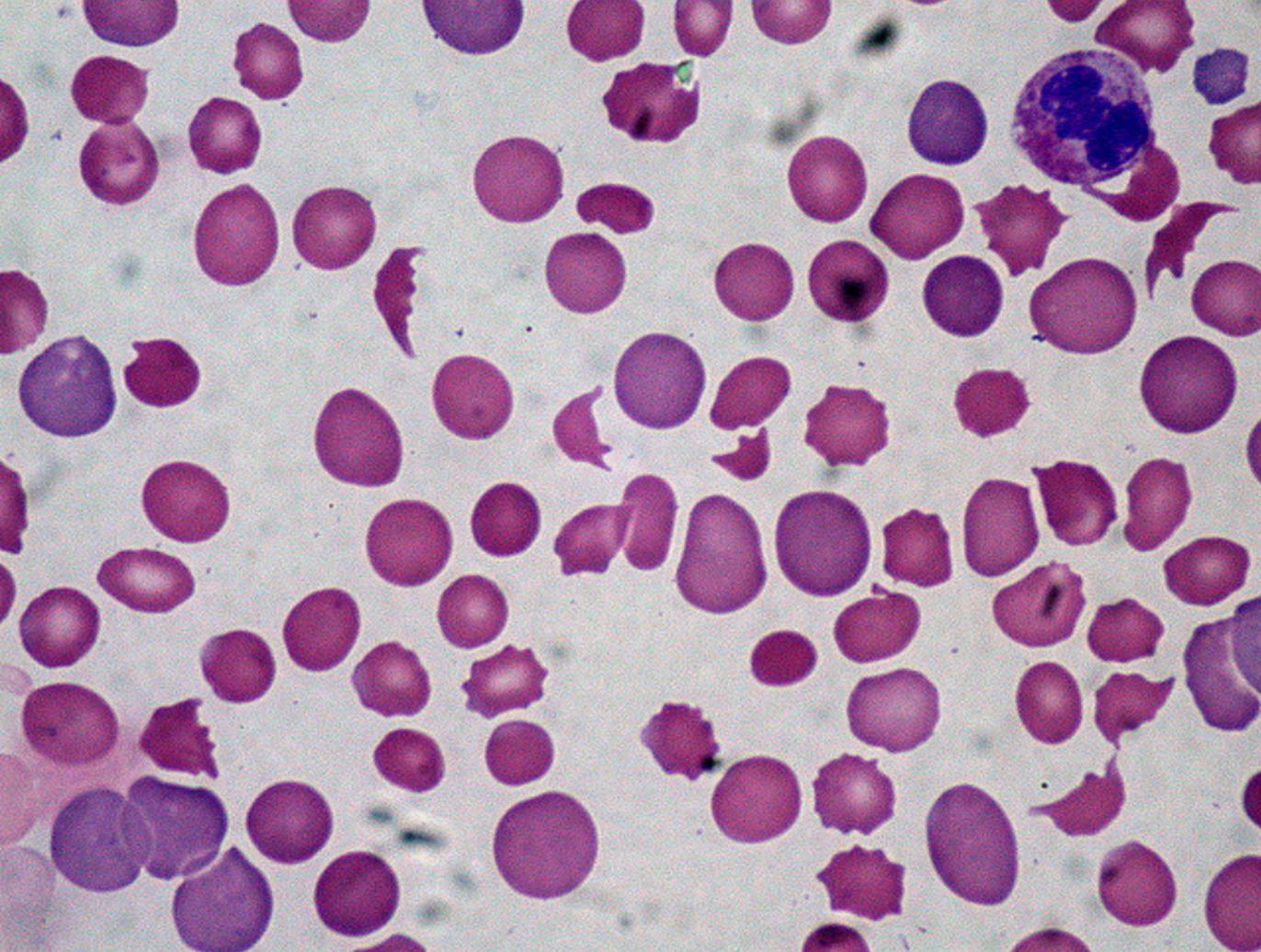




















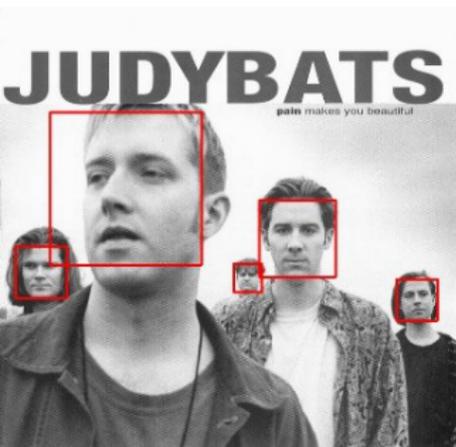


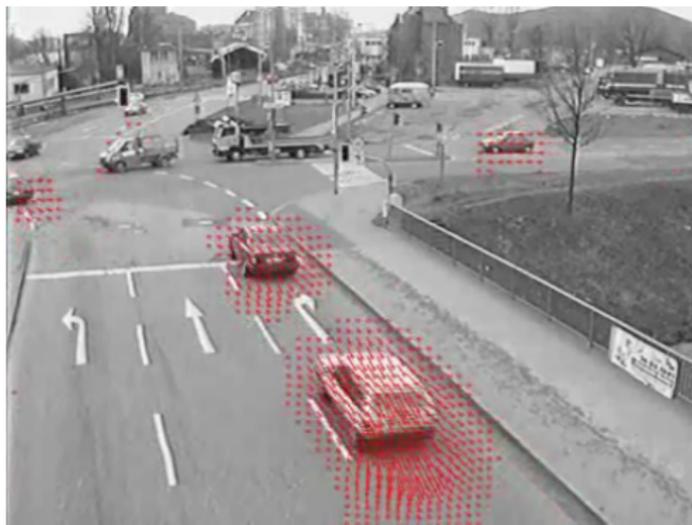
MSD  
MOTOROLA  
SUNOCO

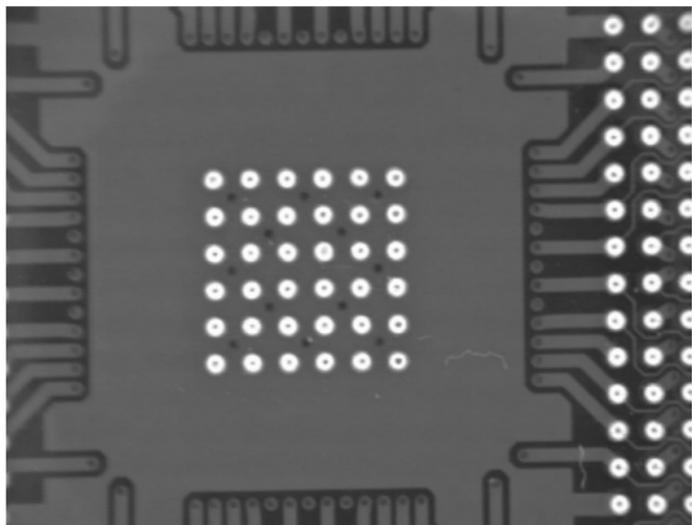
OREGON  
FRATEL

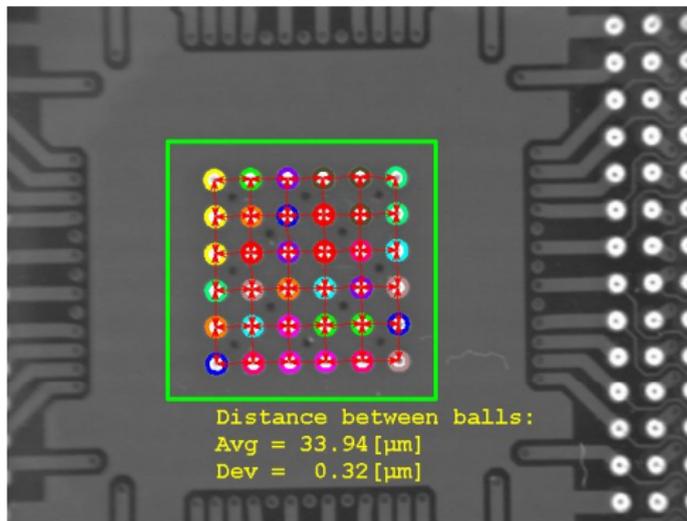
MSD  
MOTOROLA  
SUNOCO

MSD  
MOTOROLA  
SUNOCO

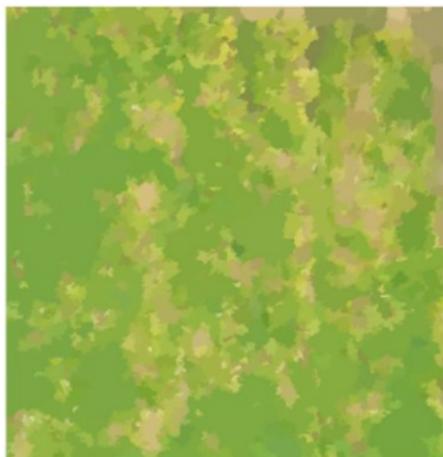




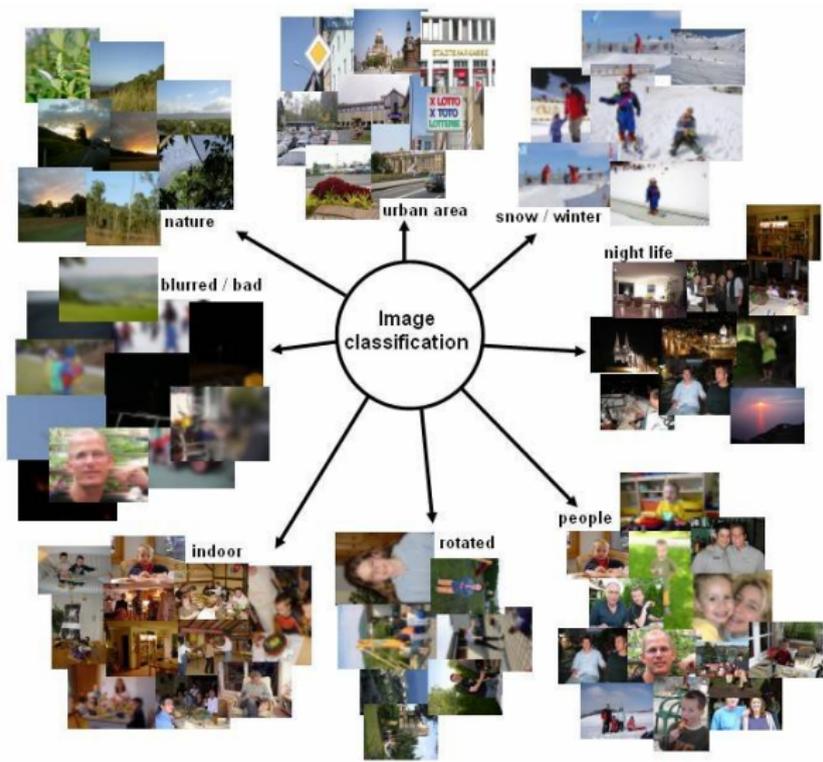


















# ICMC: pesquisadores

## **VICG: Visualização, Imagens e Computação Gráfica**

- Moacir Ponti
- João E.S. Batista Neto
- Maria Cristina Oliveira
- Rosane Minghim

## **Outros pesquisadores**

- Luis Gustavo Nonato (VICG / Processamento Geométrico)
- Afonso Paiva Neto (VICG / Processamento Geométrico)
- Agma Traina (laboratório GBDI)

# Disciplinas da área e correlatas

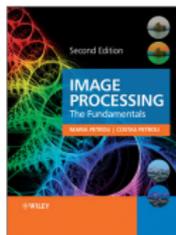
- scc0250 — Computação Gráfica
- scc0251 — Processamento de Imagens
- scc0252 — Visualização Computacional

# Bibliografia I

-  GONZALEZ, R.C.; WOODS, R.E. **Processamento Digital de Imagens**, 3.ed  
Pearson, 2010.

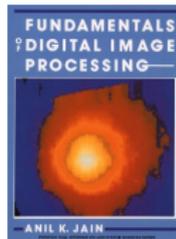


-  PETROU, M. **Image Processing: the fundamentals**, 2.ed  
Wiley, 2010.



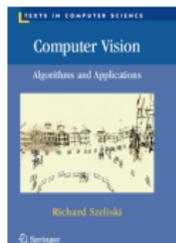
# Bibliografia II

-  JAIN, A.K. **The fundamentals of Digital Image Processing**  
Prentice-Hall, 1988.



-  SZELISKI, R. **Computer Vision: algorithms and applications**  
Springer, 2011.

[http://szeliski.org/Book/drafts/SzeliskiBook\\_20100903\\_draft.pdf](http://szeliski.org/Book/drafts/SzeliskiBook_20100903_draft.pdf)



# Bibliografia III

-  OpenCV (Open Source Computer Vision)  
<http://docs.opencv.org>.
-  GNU Octave  
<http://www.gnu.org/software/octave/>
-  R (GNU S)  
<http://www.r-project.org>