

Tópicos em Visão Computacional e Reconhecimento de Padrões

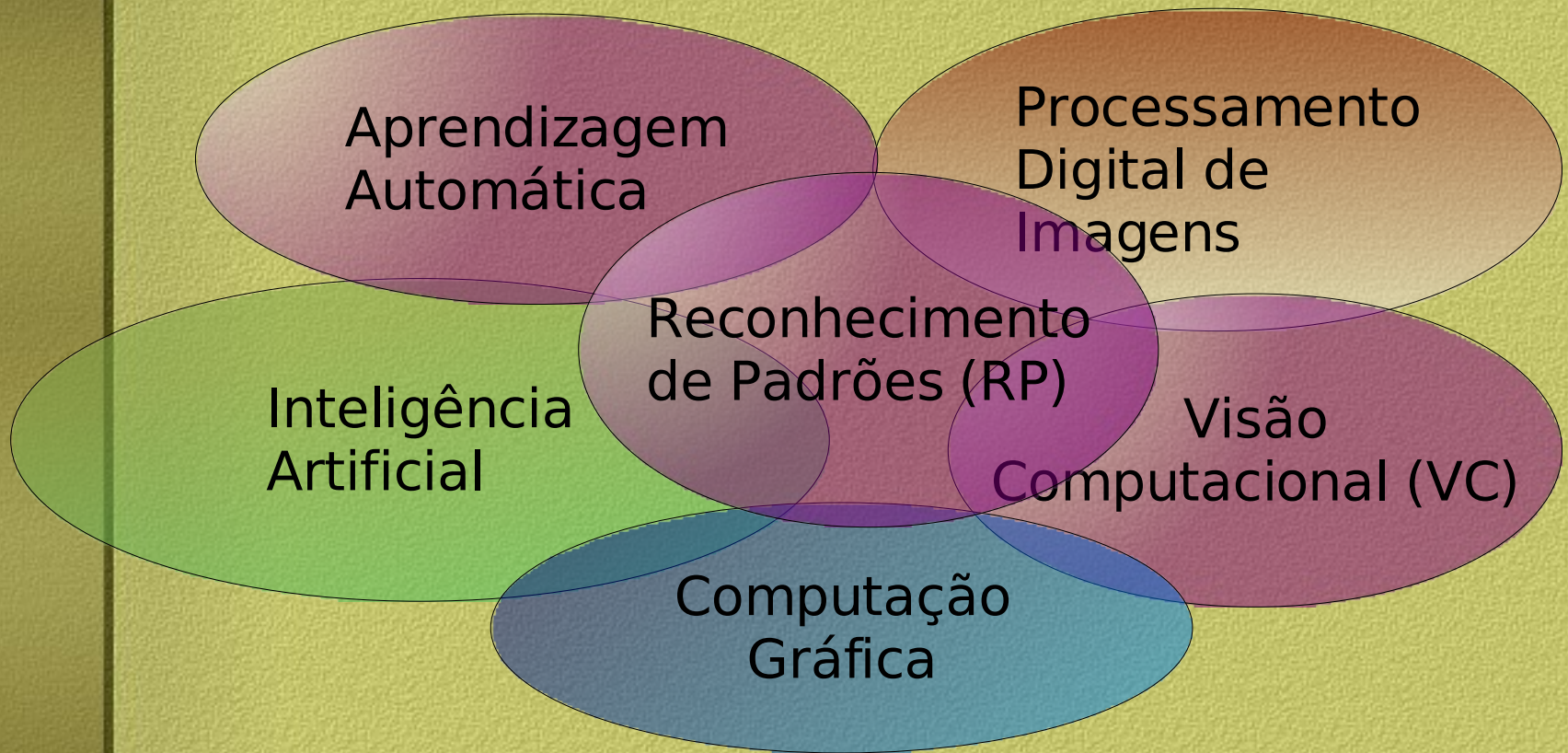
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Universidade Católica Dom Bosco - UCDB

Sumário

- Visão geral e áreas correlatas
- Aplicações (desenvolvidas pelo GPEC)
- Arquitetura de de um sistema de visão computacional
- Tópicos em Visão Computacional
- Tópicos em Reconhecimento de Padrões
- Demonstração
- Conclusão

Visão Geral



RP: Identificação ou classificação de “objetos” ou “coisas”
(Faces, expressões, voz, sons, bases, comportamento, textos, etc)

VC: Interpretação e reação a partir de imagens
(Filmes, fotos, imagens de satélite, raio-x, tomografia, etc)

Classificação de Couro Bovino

www.gpec.ucdb.br/dtcouro



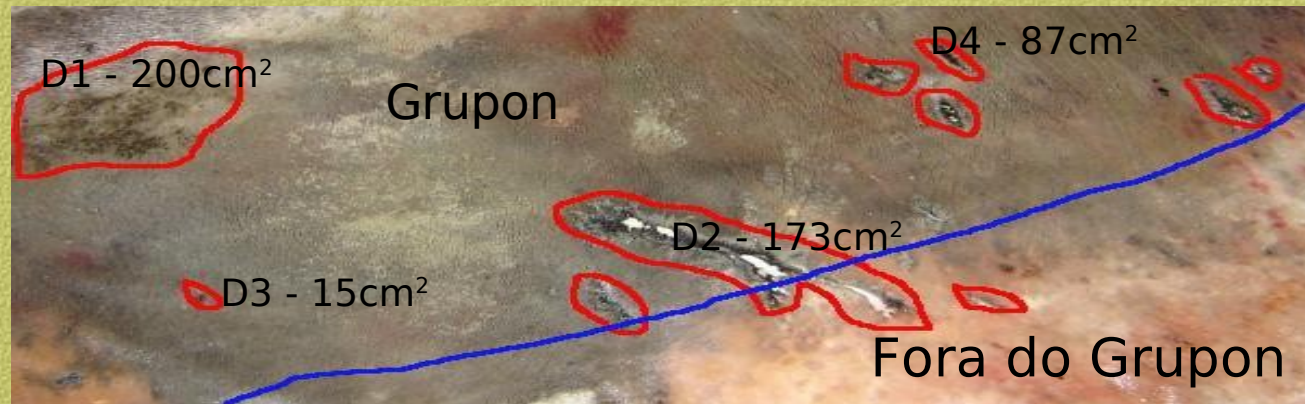
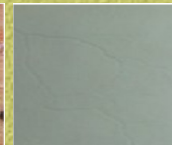
fazenda



frigorífico

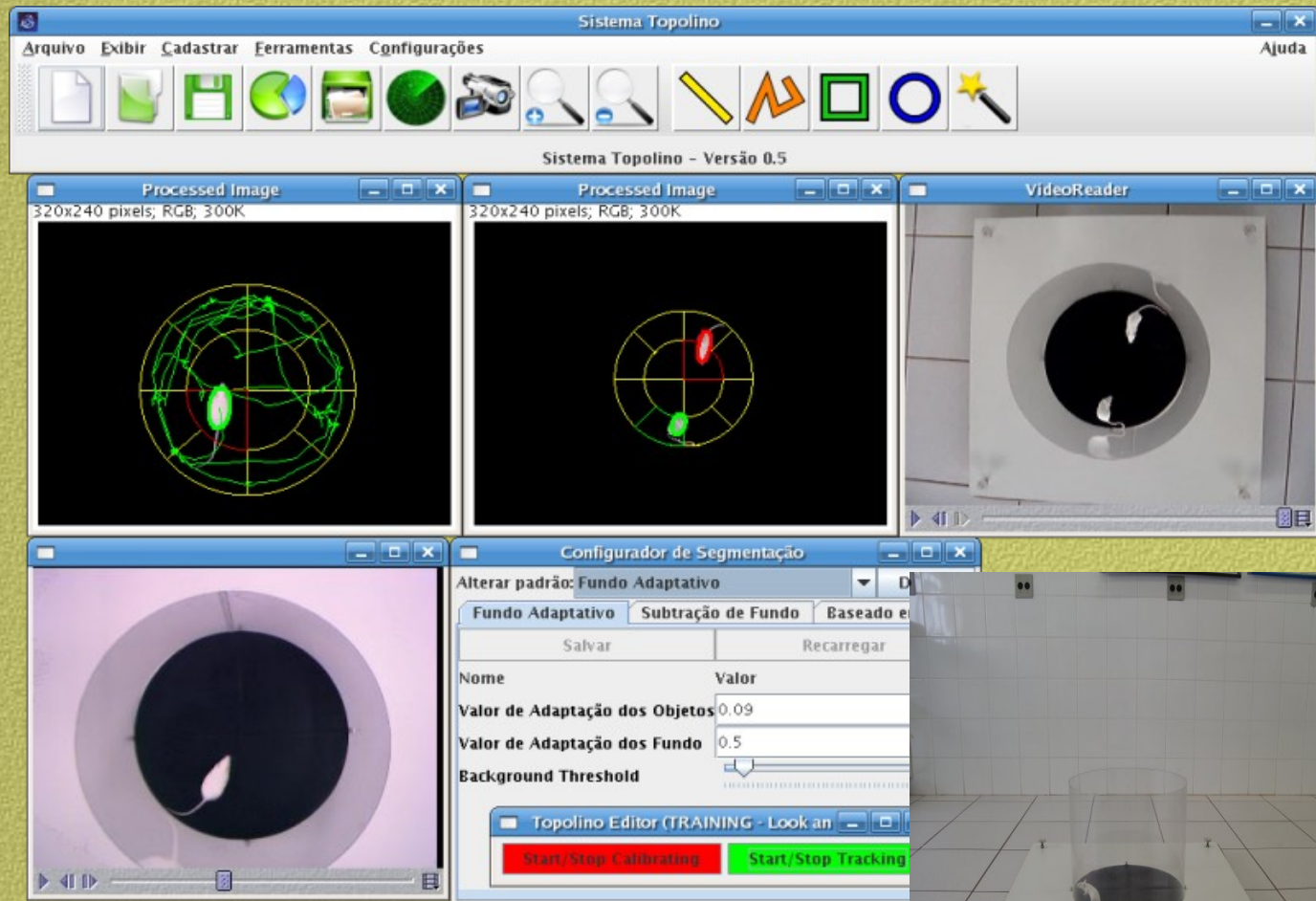


curtume



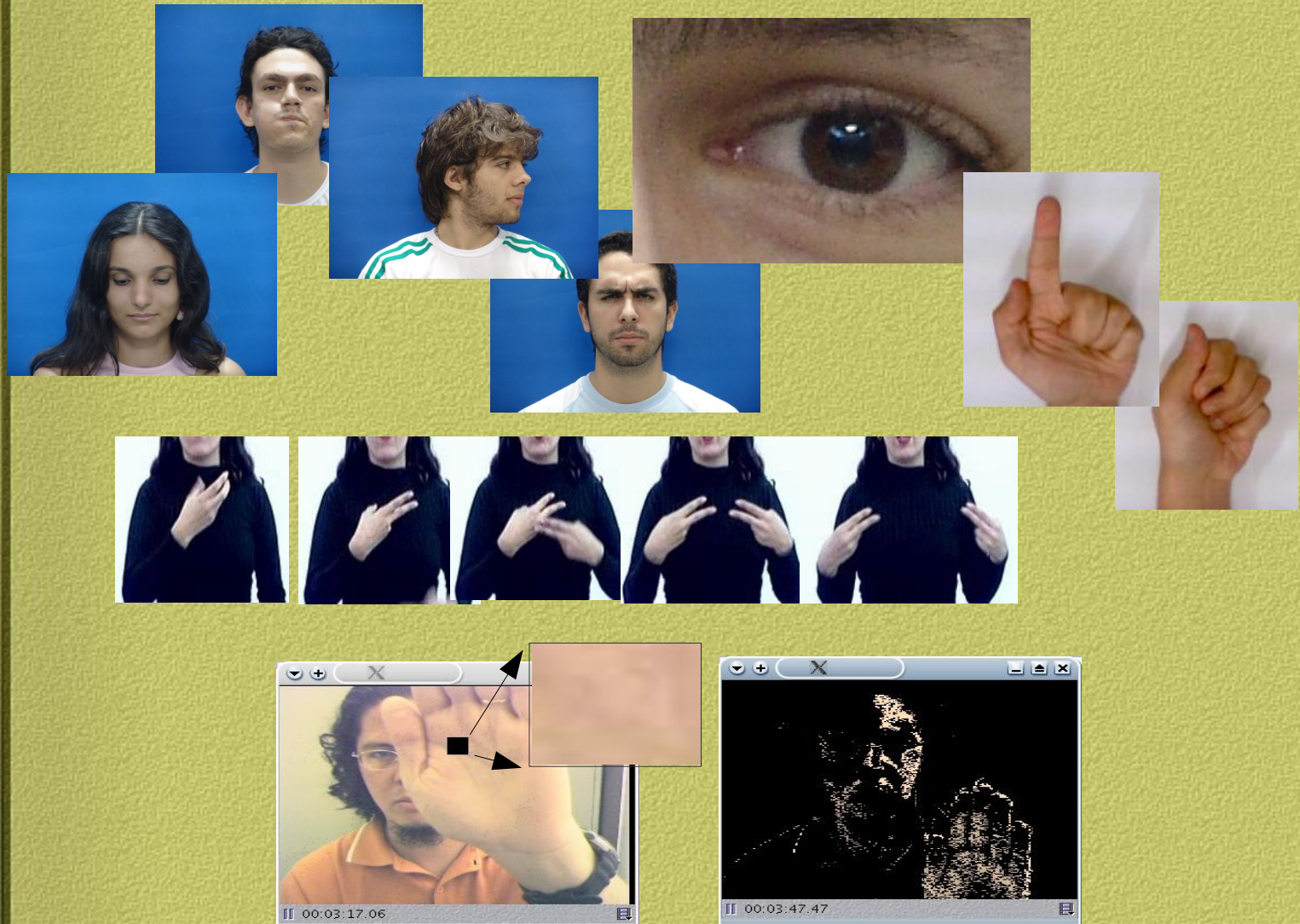
Identificação de Comportamento Animal

www.gpec.ucdb.br/topolino

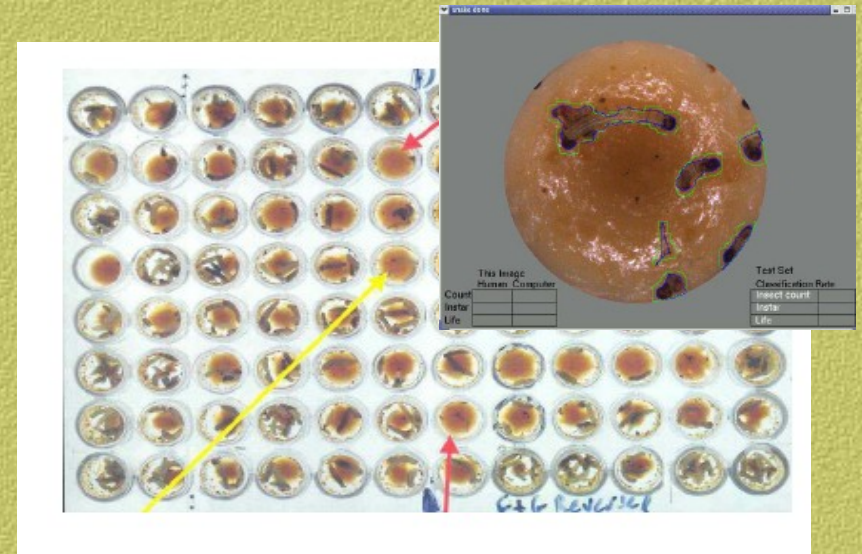


Interação Homem-Máquina

www.gpec.ucdb.br/sigus



Monitoramento de Bioensaios

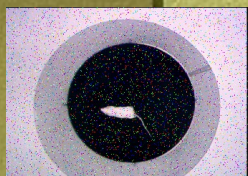


Patten et Alli (UNR e Verdia Inc.)



<http://www.vims.edu/pfiesteria/>

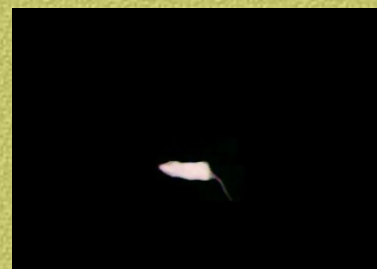
Arquitetura de Sistema de VC



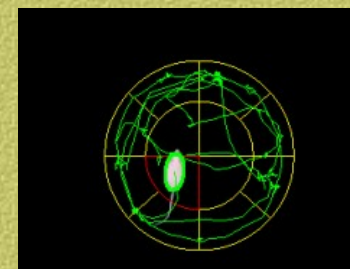
Captura



Pré-processamento



Segmentação



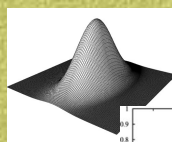
Rastreamento



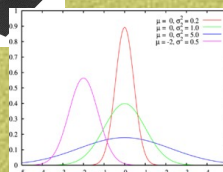
[0.2 0.1 40 30 0.2]

Vertical

Classificação



F.2 > 3.6

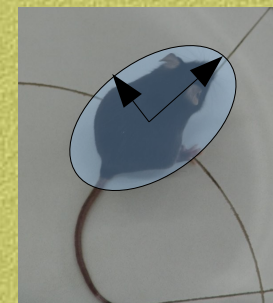


Aprendizagem

F.2

$$\argmax_{\mu, \Sigma} \prod_{i=1}^n p(x_i | \omega_j)$$

Seleção Atrib.

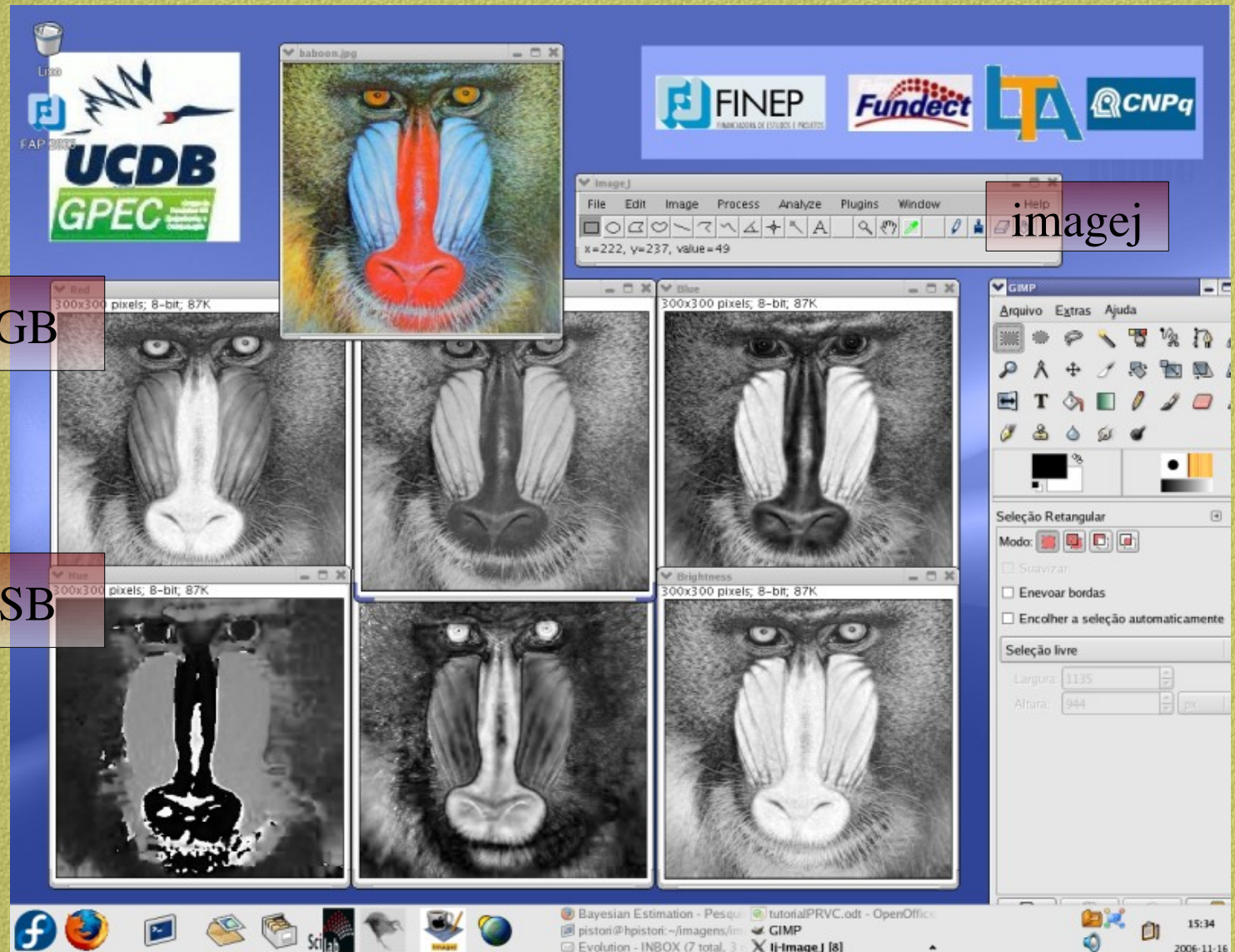


Extração Atrib.

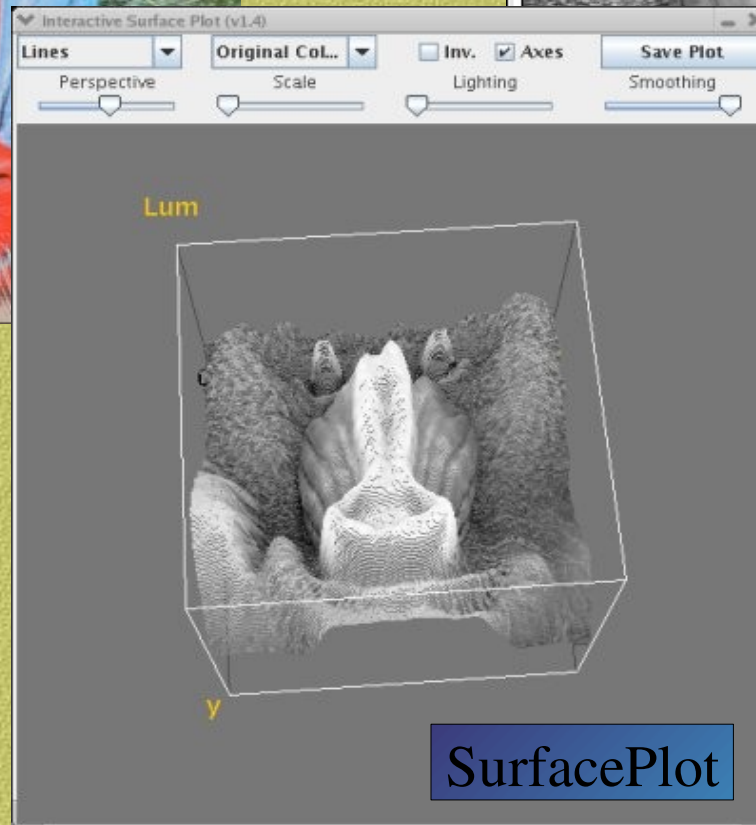
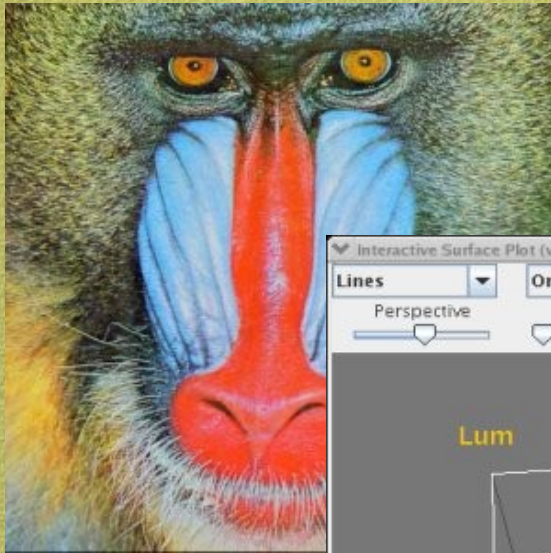
Tópicos em Visão Computacional

- Espaços de Cores e Histogramas
- Pré-processamento
- Segmentação
- Atributos de Textura
- Atributos de Forma
- Vetores de Atributos e Espaço Vetorial

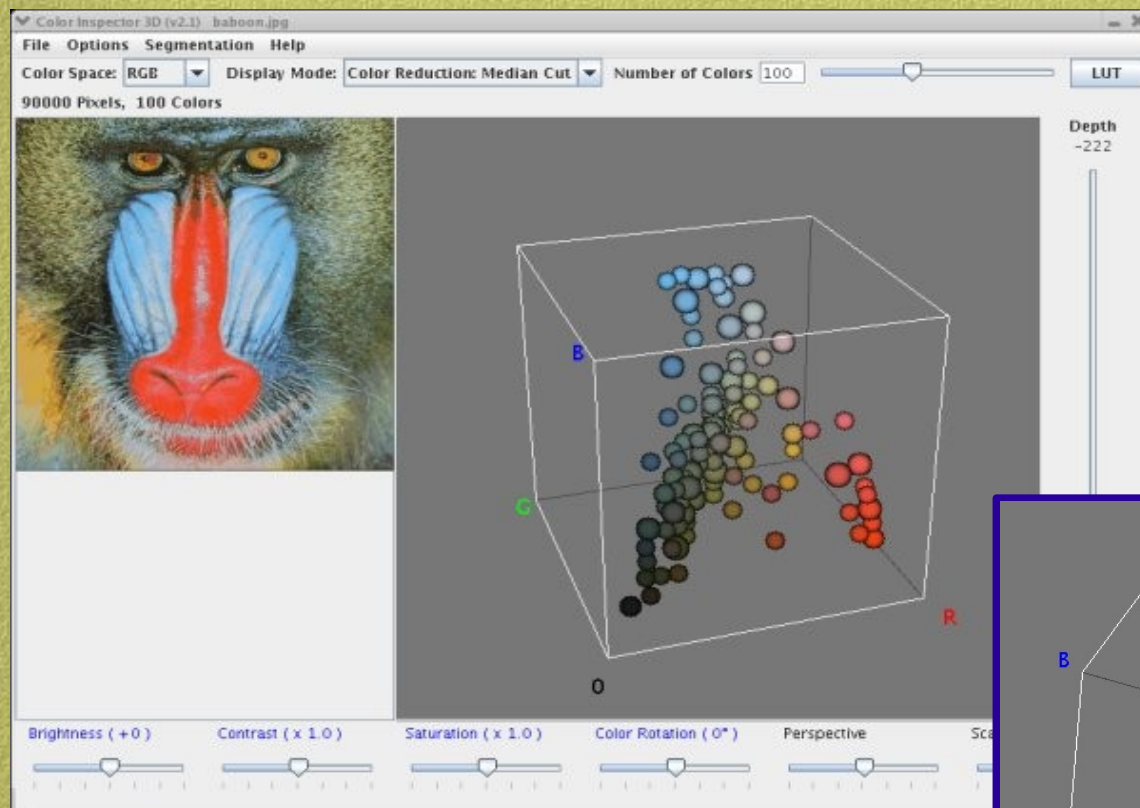
Imagens Coloridas



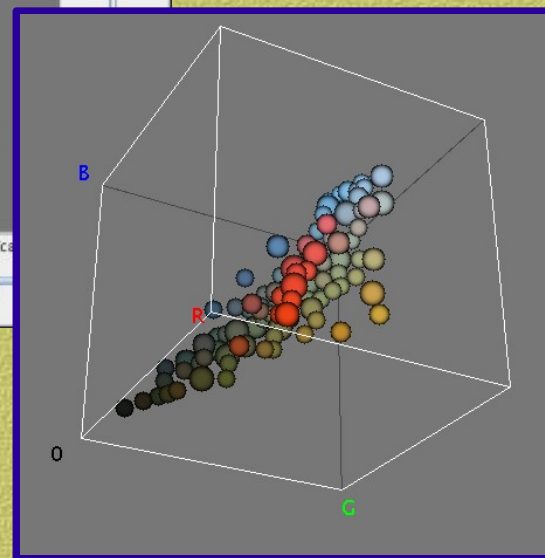
Imagens e Funções Bidimensionais



Histogramas

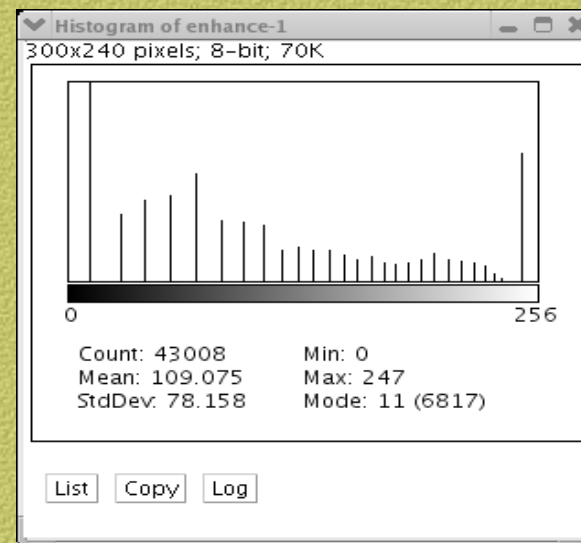
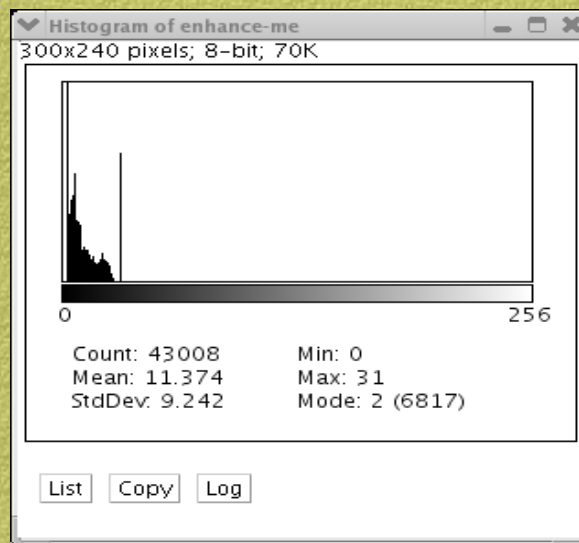


Color Inspector 3D

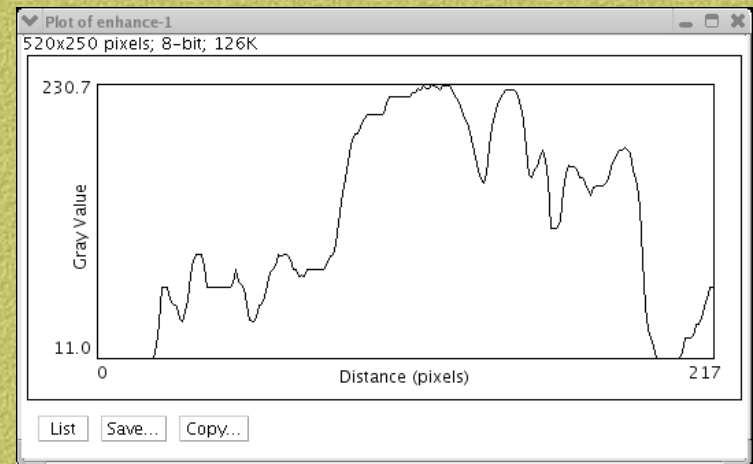
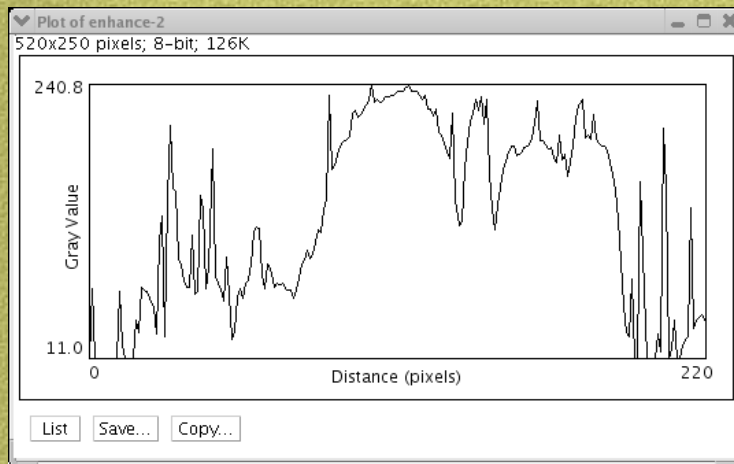
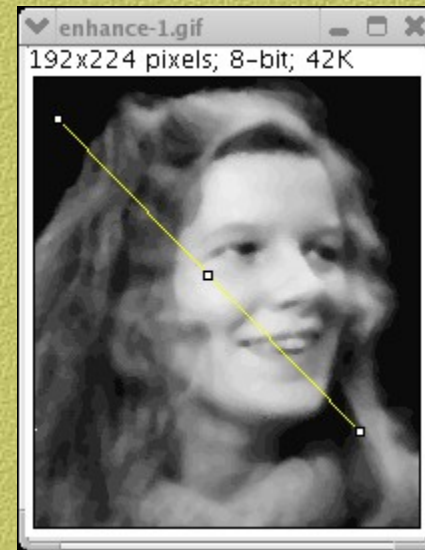
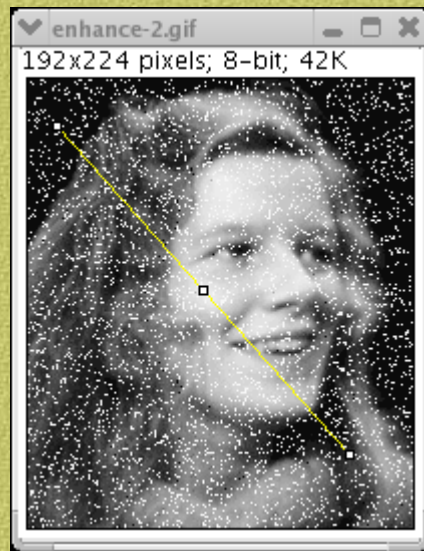


Álgebra – Espaços Vetoriais

Pré-Processamento

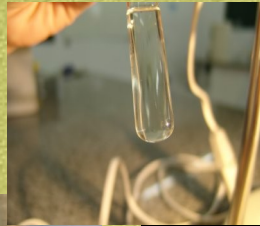


Pré-Processamento



Gradiente – Cálculo Diferencial - Variação

Segmentação



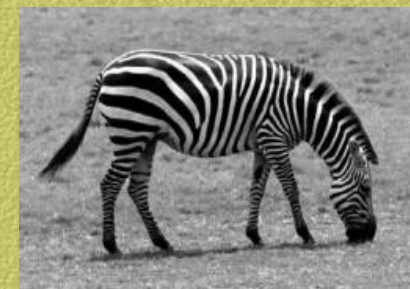
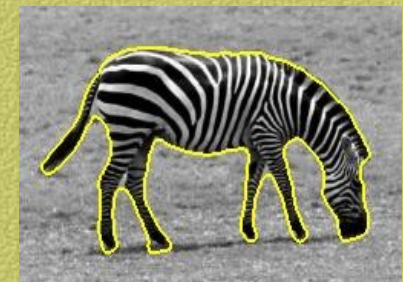
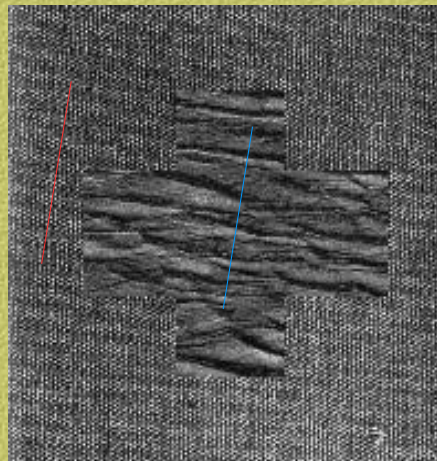
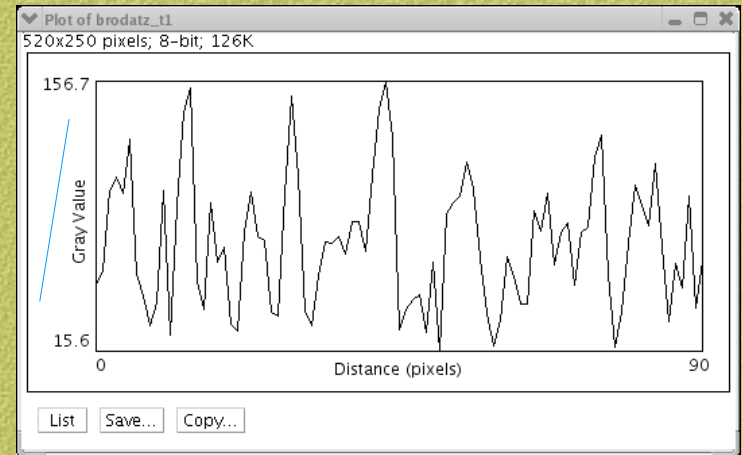
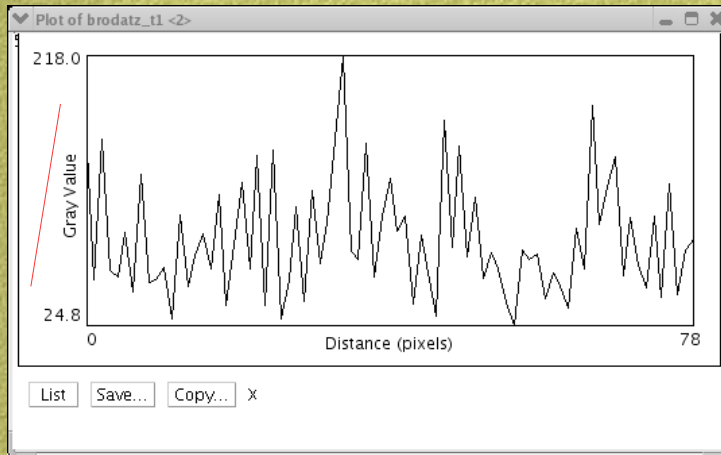
Artemis counting



Wetblue leather defects

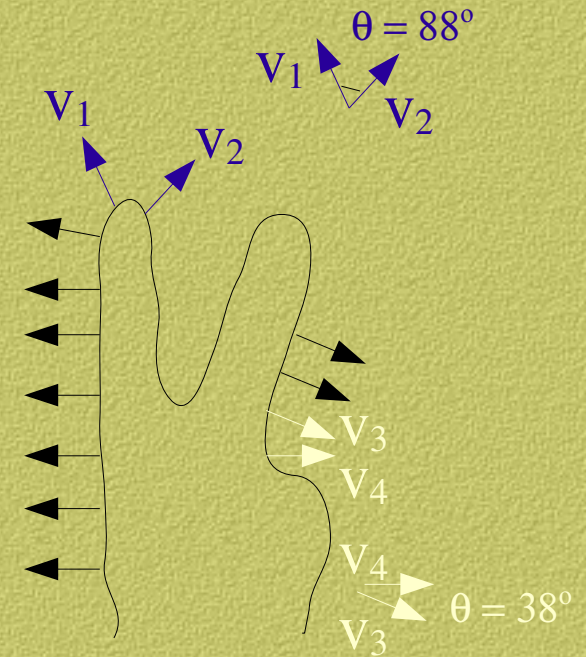
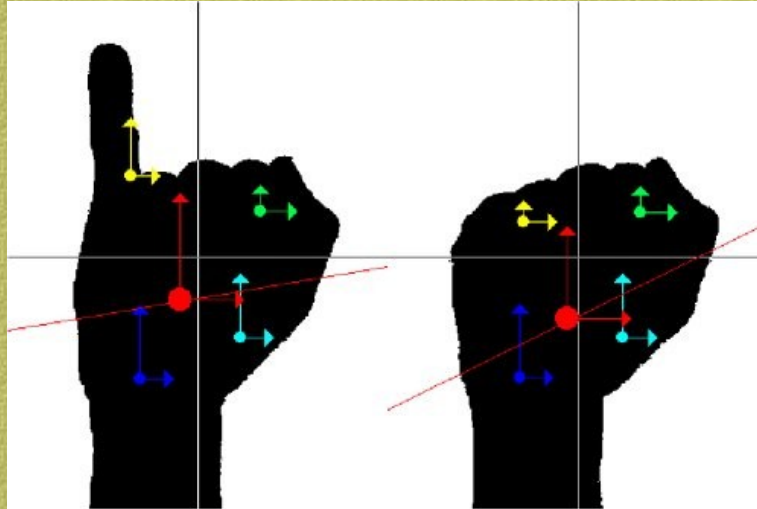


Atributos baseados em Textura

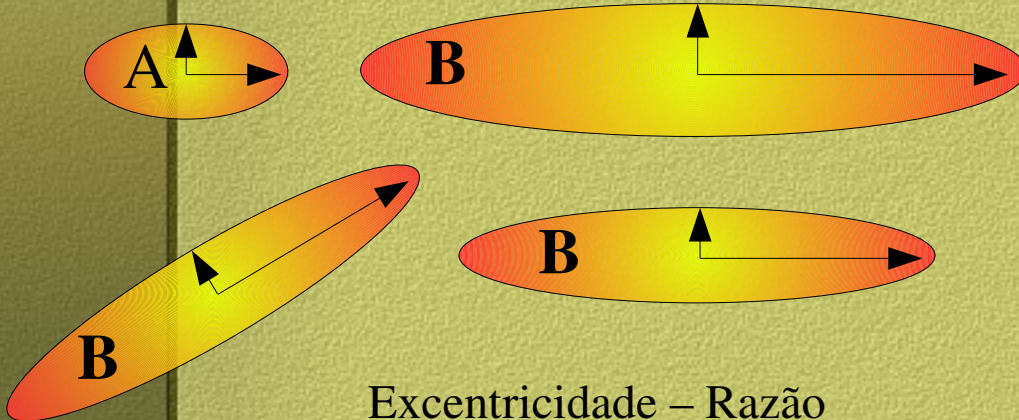
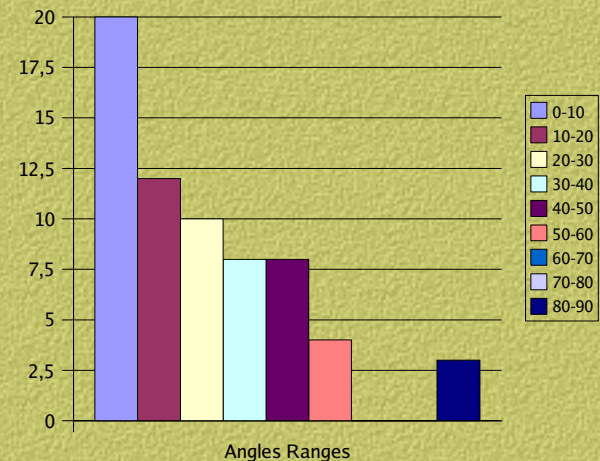


Atributos Baseados em Forma

Image Moments



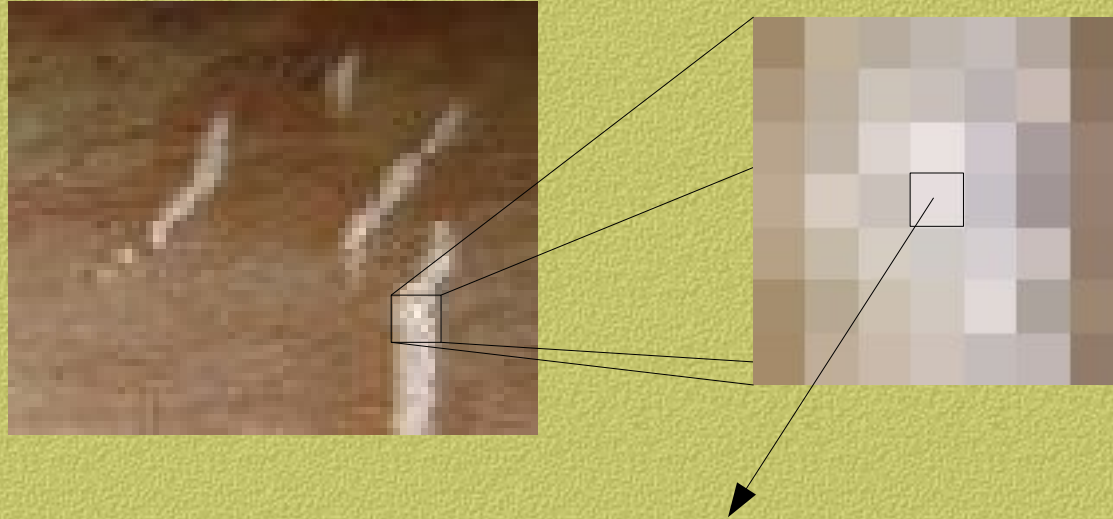
Curvatures Histogram



Excentricidade – Razão

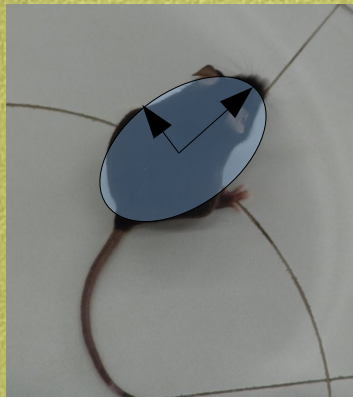
Invariância à Rotação, Translação e Escala

Vetores de Atributos e Espaços Vetoriais



$$x = [230 \quad 221 \quad 222 \quad 353 \quad 4 \quad 90 \quad 0.12 \quad 0.5]'$$

Red Green Blue Hue Sat. Value Freq.45° Freq.90°



$$x = [0.2 \quad 430 \quad 0.4 \quad 0.2 \quad \dots]'$$

Excen. Perimeter Curv.Hist.0-10 Curv.Hist.40-50. ...

Rastreamento – Filtros Preditivos

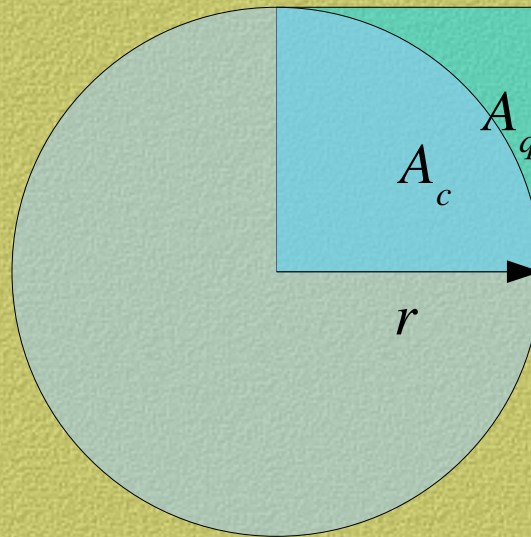


Modelos de Observação + Modelos de Dinâmica
Observação + Previsão

Contínuo X Discreto, Paramétrico X Não-Paramétrico,
Linear X Não Linear

Assuntos Relacionados: Modelos de Markov Ocultos, Campos Aleatórios de Markov, Redes Bayesianas, Filtros de Kalman, Filtros de Partículas, etc

Métodos de Monte-Carlo



$$A_c = \frac{\pi r^2}{4}$$

$$A_q = r^2$$

$$\pi = 4 \frac{A_c}{A_q}$$

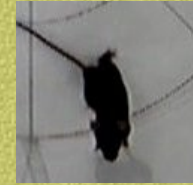
$\frac{\text{Total que atinge quadrado}}{\text{Total que atinge semi-círculo}}$

Exemplo: Calculando Pi - Dardos

Tópicos em Reconhecimento de Padrões

- Abordagem da Aprendizagem Estatística
- Estimação de Máxima Verossimilhança
- Modelos Paramétricos X Não-Paramétricos
- Modelos de Mistura de Gaussianas
- Métodos Iterativos para Estimação de Modelos
- Redução de Dimensionalidade – PCA e FLDA

Aprendizagem Estatística



ω_1 : Carrapatos

ω_2 : Estrias

ω_3 : Mosca

ω_1 : Horiz.

ω_2 : Vert.

Problema de Classificação em 3 Classes

2 Classes

$$p(\omega_j | x) = \frac{p(x | \omega_j) p(\omega_j)}{p(x)}$$

ω_j : Classe j

x : Vetor de atributos

$p(\omega_j | x)$: Prob. a posteriori de ω_j

$p(x | \omega_j)$: Verossimilhança of ω_j

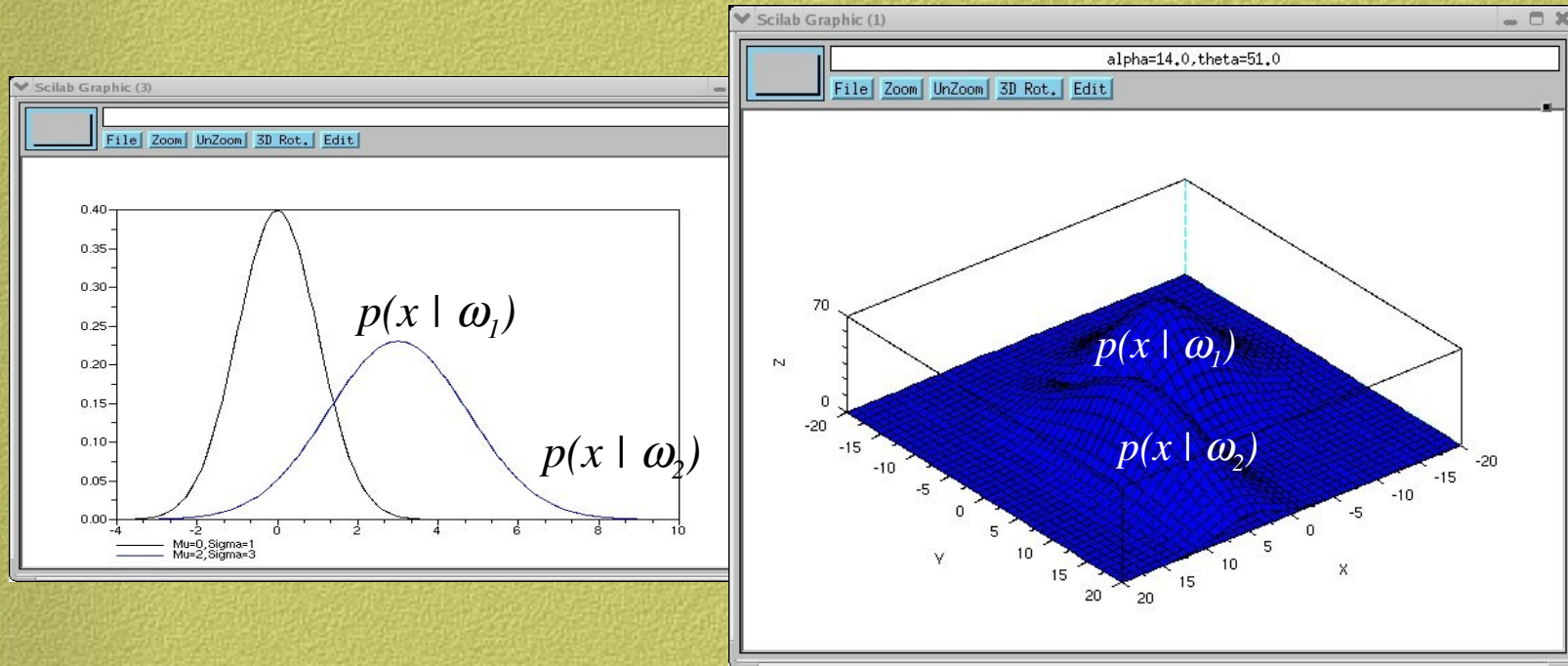
$p(\omega_j)$: Prob. a priori de ω_j

$p(x)$: Prob. de x (evidência)

Decisão Bayesiana

$$\underset{j}{\operatorname{argmax}} p(\omega_j | x)$$

Aprendizagem de Modelos Gaussianos

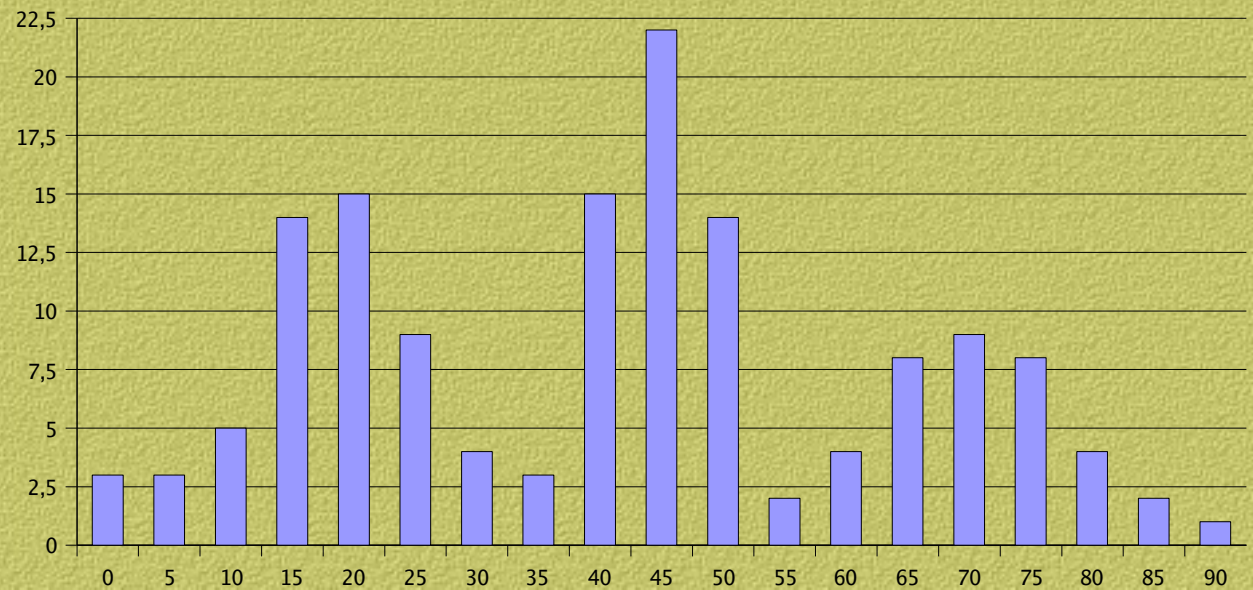
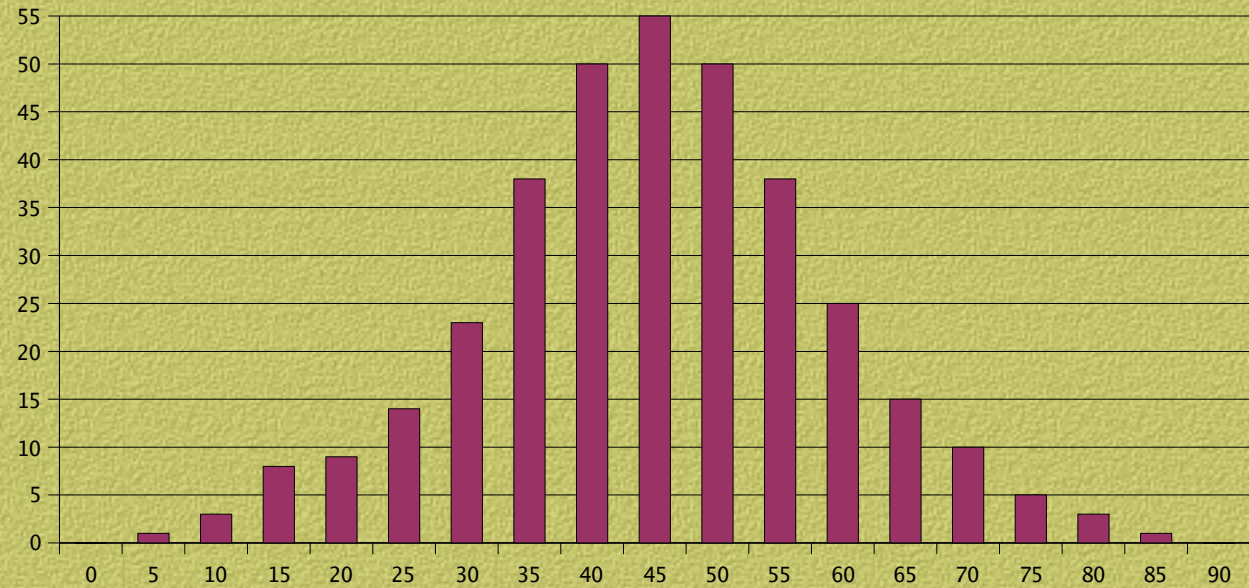


Estimativa de Máxima Verossimilhança

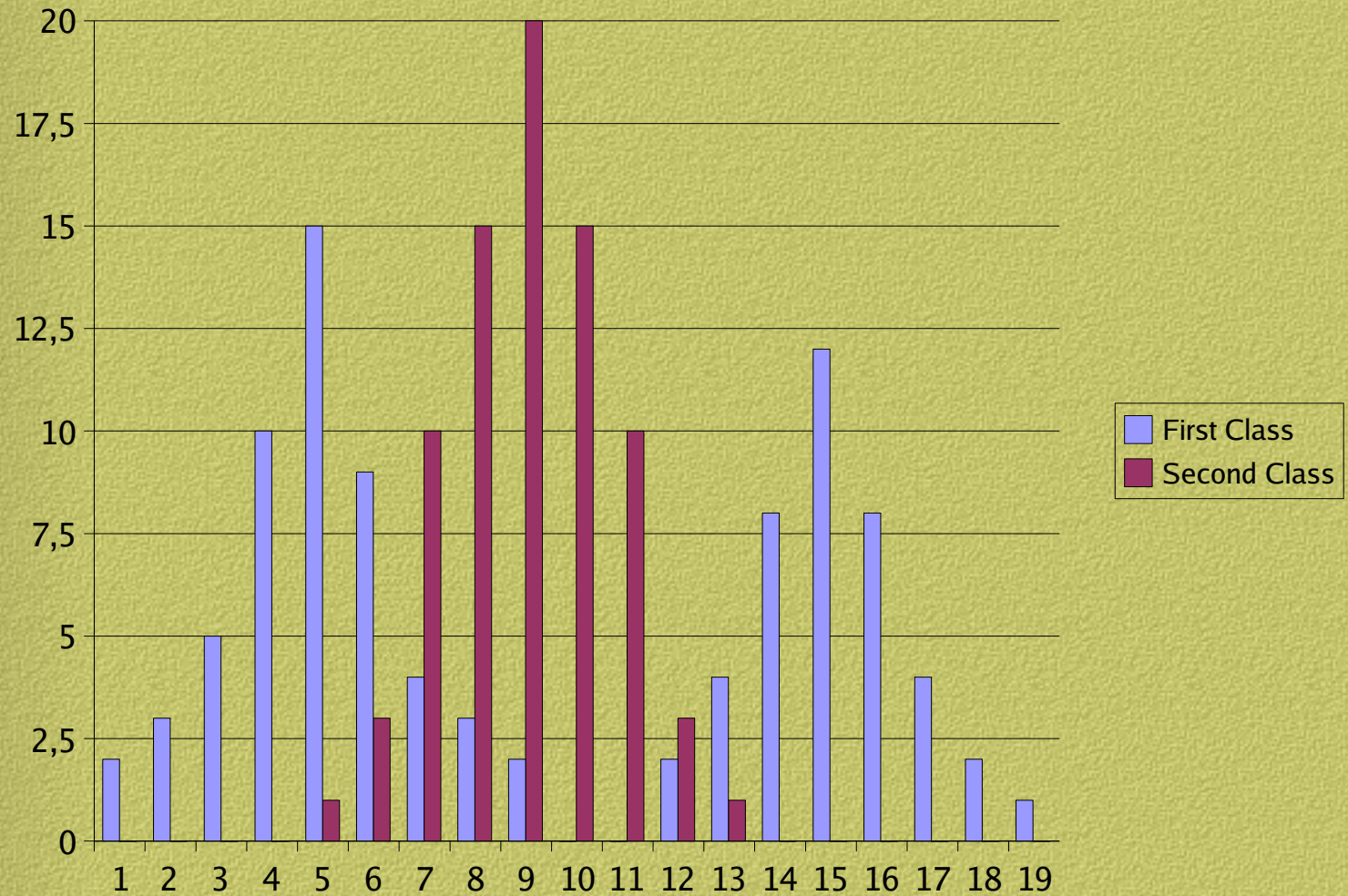
$$\underset{\mu, \Sigma}{\operatorname{argmax}} \prod_{i=1}^n p(x_i | \omega_j)$$

$$p(x | \omega_j) = \frac{1}{(2\pi)^{D/2} |\Sigma|^{1/2}} e^{-\frac{1}{2}(x-\mu)^T \Sigma^{-1}(x-\mu)}$$

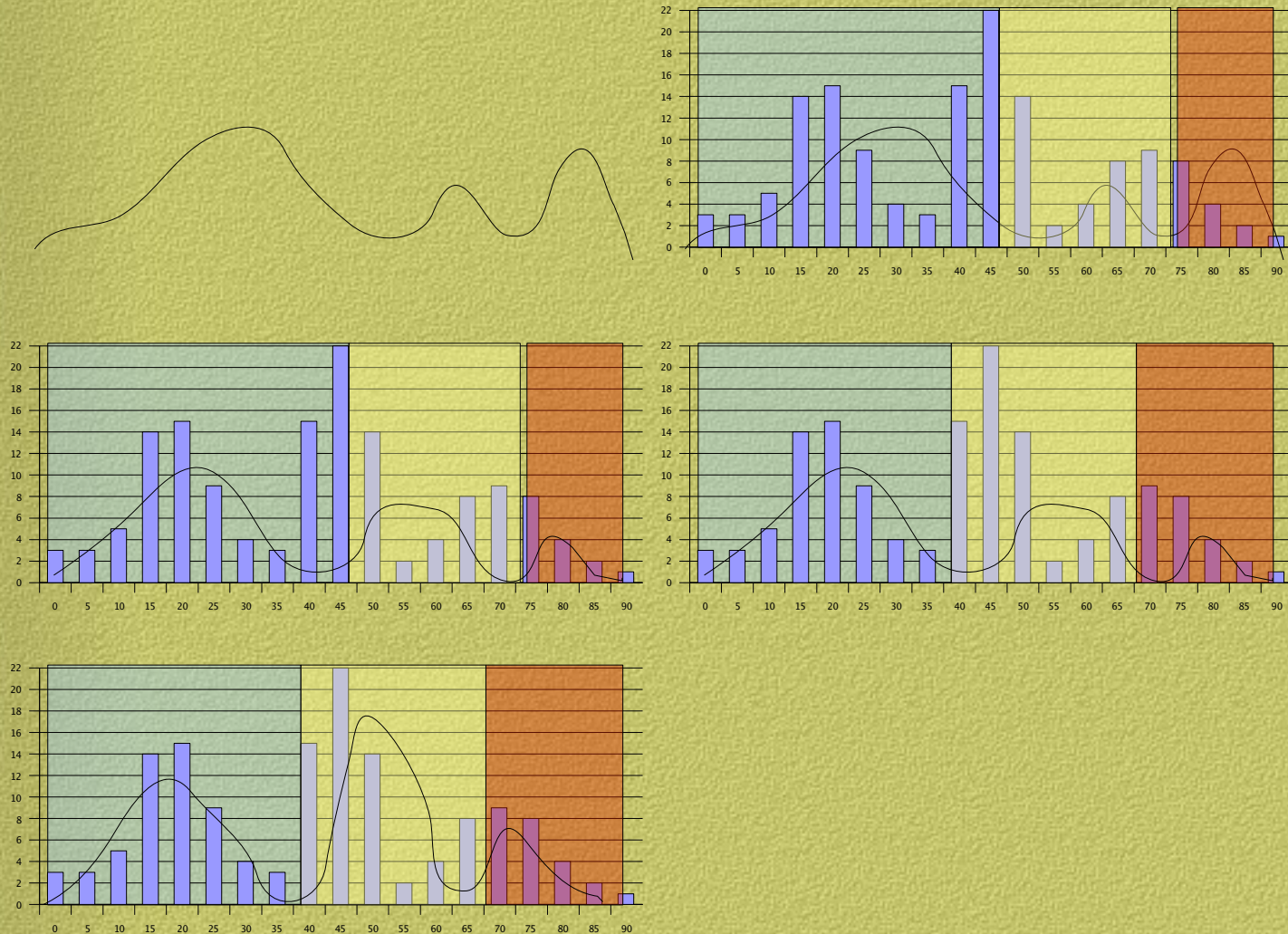
Modelos Paramétricos X Não Paramétricos



Mistura de Modelos Gaussianos

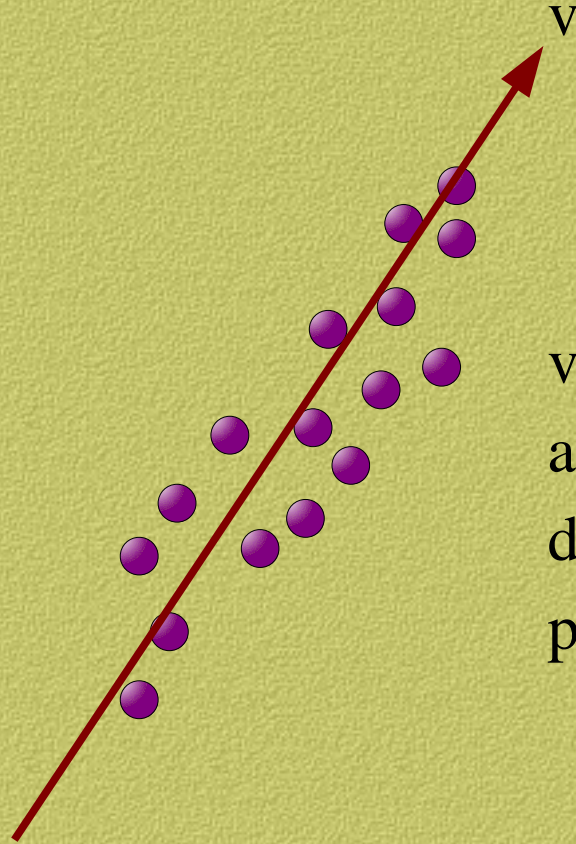


Métodos Iterativos de Estimação



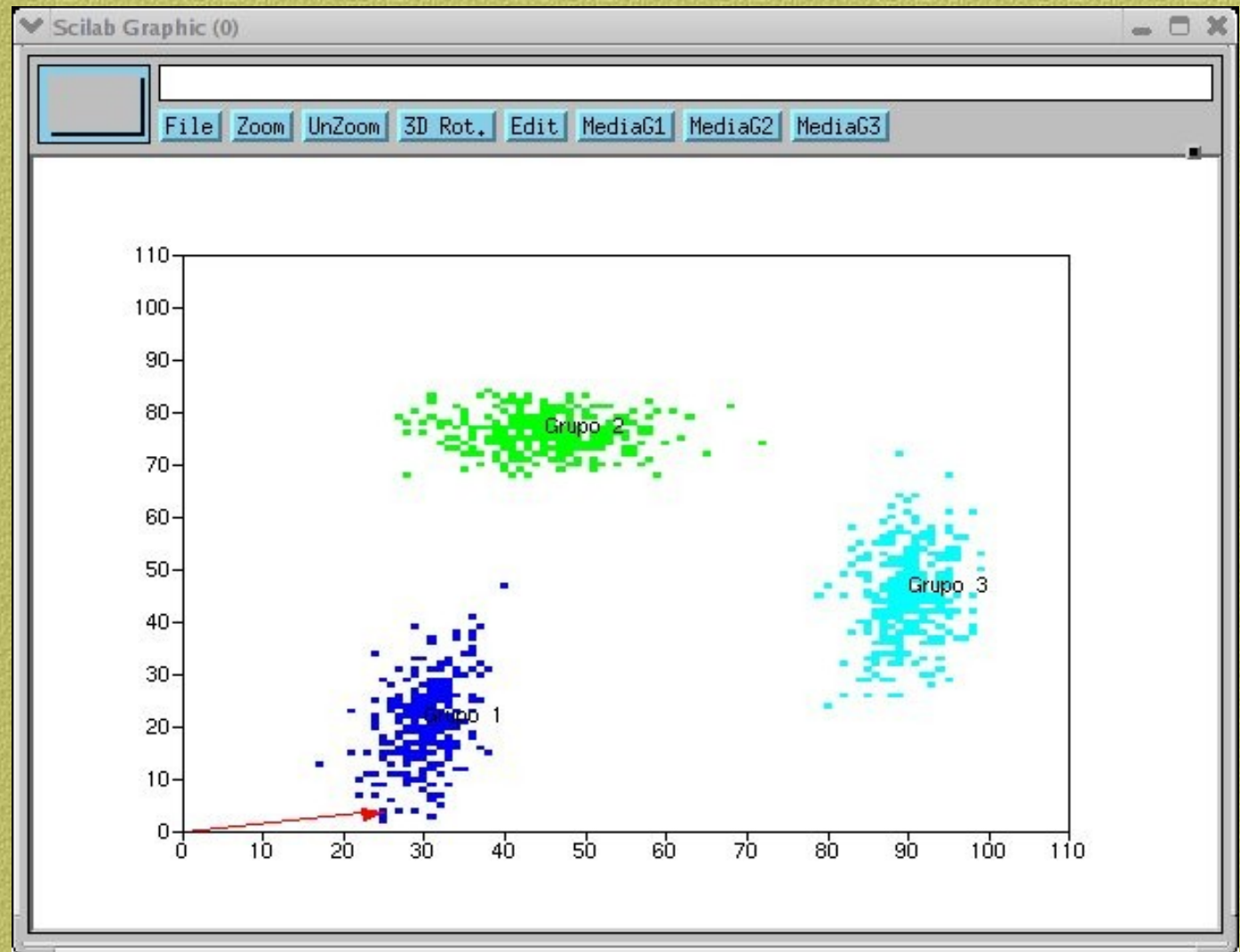
E.M. - Expectation-Maximization

Redução de Dimensão - PCA

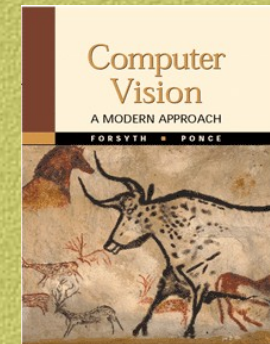
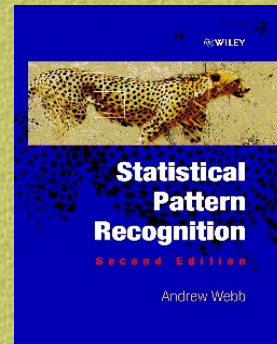


v é um autovetor associado
ao maior autovalor da matriz
de variância e covariância dos
pontos

Redução de Dimensão - FLDA



Informações Adicionais



www2.acad.ucdb.br/pistori

Dr. Hemerson Pistori - Mozilla Firefox

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Prof. Dr. Hemerson Pistori

[GPEC - UCDB \(location in GoogleEarth\)](#)
[Salesians Institutions for Higher Education - IUS](#)

Resume

Hemerson Pistori received his doctorate in 2003 from the [University of São Paulo, USP](#), at the Computer Engineering Department, and his M.Sc. degree in Computer Science from [State University of Campinas, UNICAMP](#), in 1998. Currently, he is working as a professor of Discrete Mathematics and of Computer Vision at [Dom Bosco Catholic University, UCDB](#). He is also a member of the [UCDB Scientific Committee](#) and of the [Colabora's](#) editorial board. Recently, he joined the IUS Engineering Group, an international board of [Salesians Institutes of Higher Education](#), as the UCDB's representative. Since February of 2004, he leads the [Research Group in Engineering and Computing, GPEC](#). His current research interests include statistical learning, stochastic modeling, adaptive devices, dissimilarity measures, predictive filters, graphical models and

<http://www.sdb.org/>

International Journal for Computational Vision and Biomechanics

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VIP IMAGE