

Visão Computacional e Biotecnologia: Fundamentos, Problemas e Oportunidades

Prof. Dr. Hemerson Pistori

**INOVISAO – Pesquisa, Desenvolvimento e Inovação em
Visão Computacional**

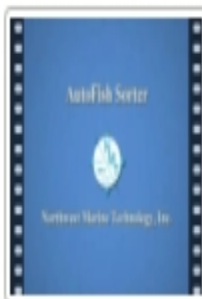
**Universidade Católica Dom Bosco – UCDB
Campo Grande, MS Brasil**



Sumário

- Visão computacional através de exemplos
- Etapas de um sistema de Visão Computacional
- Projetos em andamento no mestrado em
Biotecnologia da UCDB
- Tópicos no estado da arte
- Conclusões

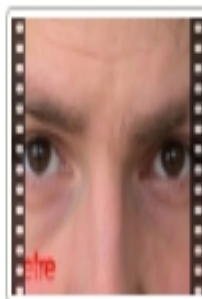
Visão Computacional - Exemplos



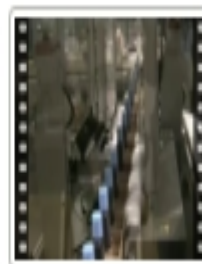
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mp4



direcao_do_olhar.
mp4



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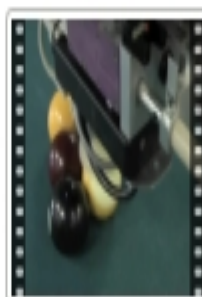
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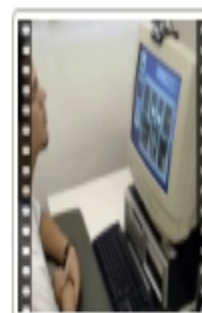
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seguranca.mp4



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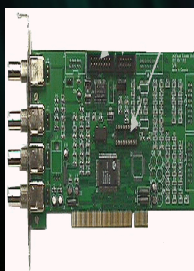
Etapas – Visão Computacional

- Captura, armazenamento, transmissão, calibração, etc
- Melhoramento, detecção de bordas, estereoscopia, etc
- Segmentação
- Extração, seleção e redução de atributos
- Rastreamento
- Reconhecimento
- Experimentos e ajustes de parâmetros (*transversal*)

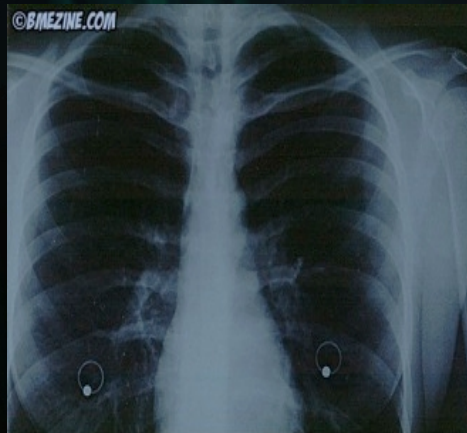
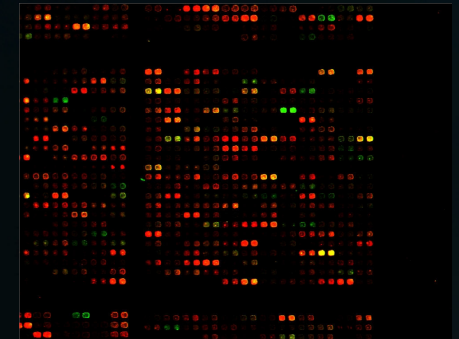
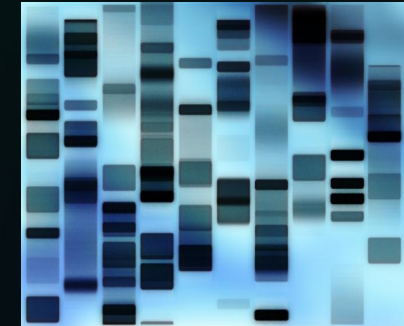
Captura, armazenamento, transmissão, ...



Câmera digi



Captura, armazenamento, transmissão, ...



Electronic Distortion Correction

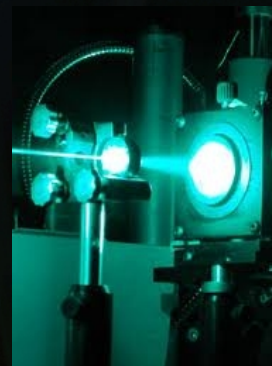


Taken with DSLR216, 187 HFOV Lens

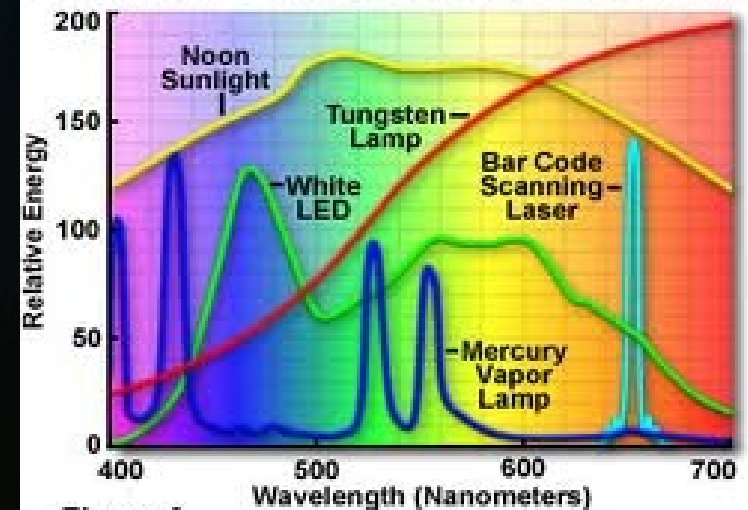


De-warped with electronic distortion correction

Captura, armazenamento, transmissão, ...



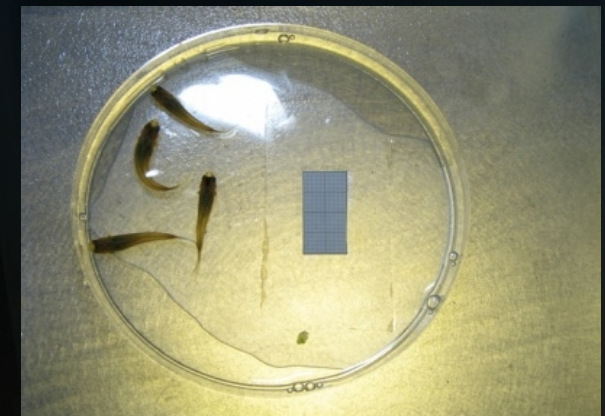
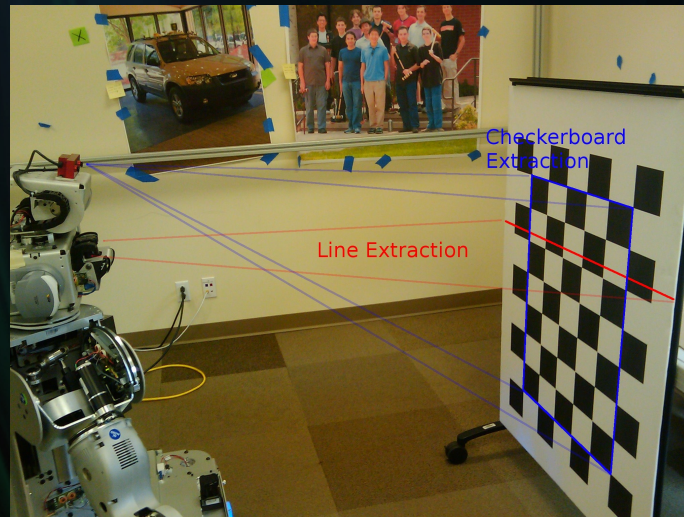
Spectra From Common Sources of Visible Light



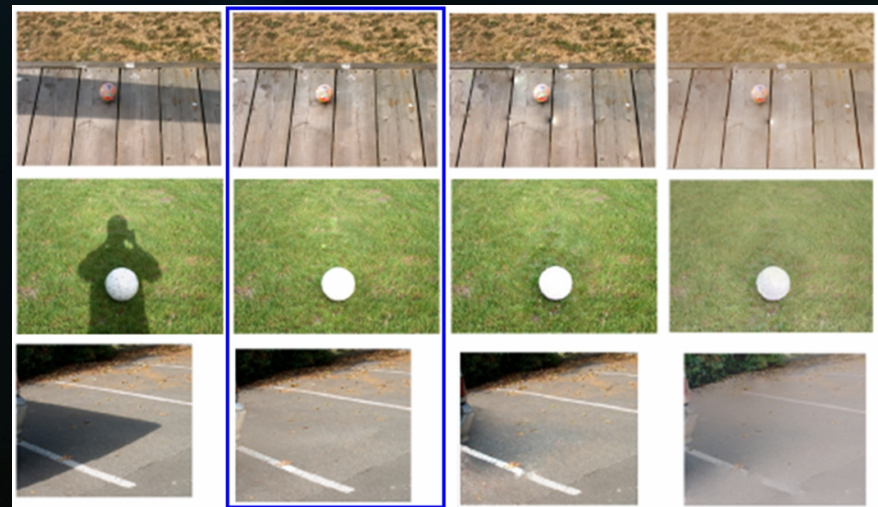
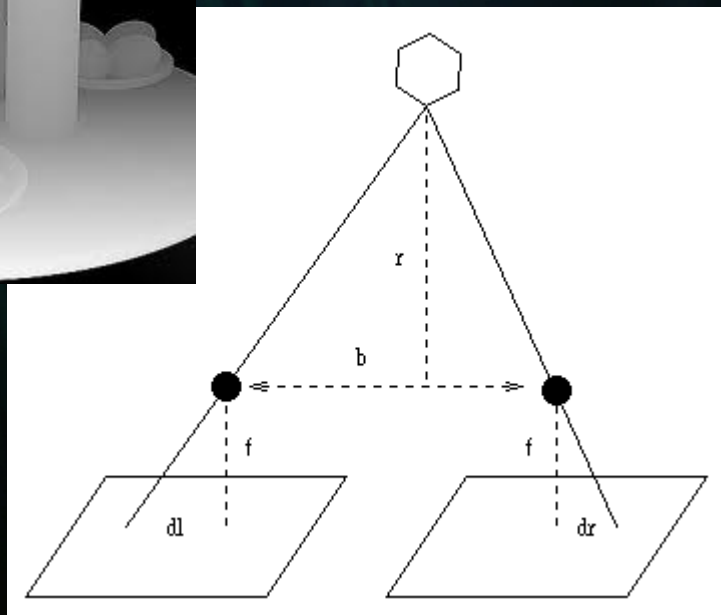
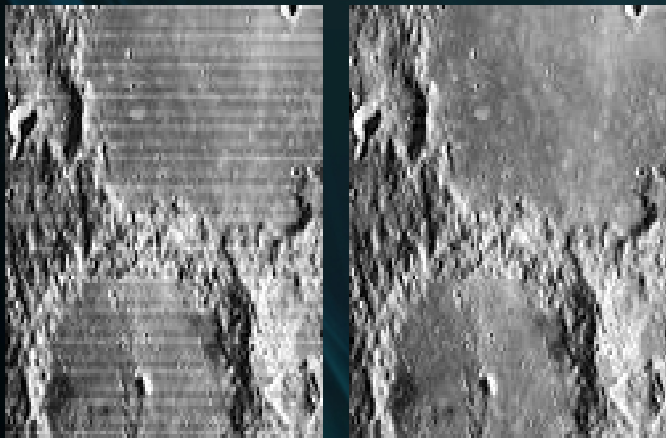
Armazenamento, transmissão, calibração, ...



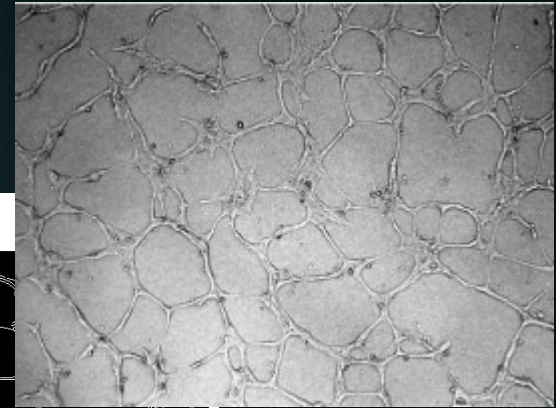
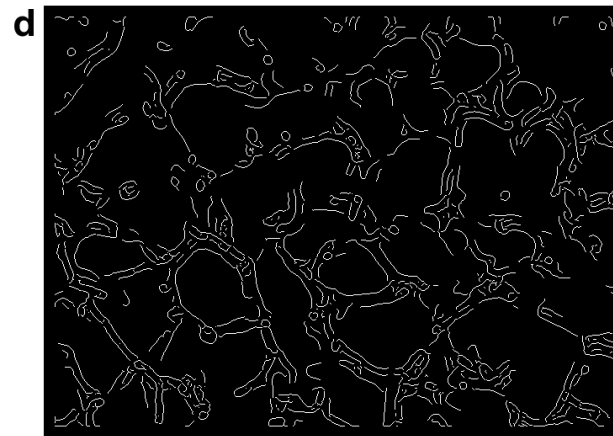
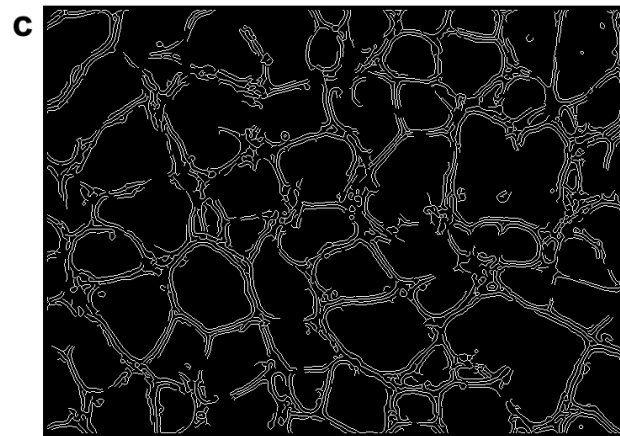
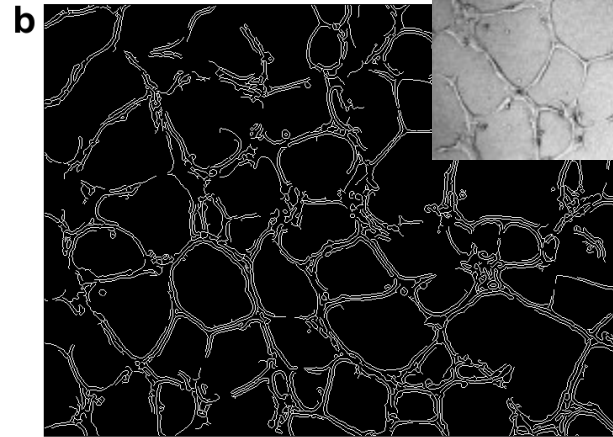
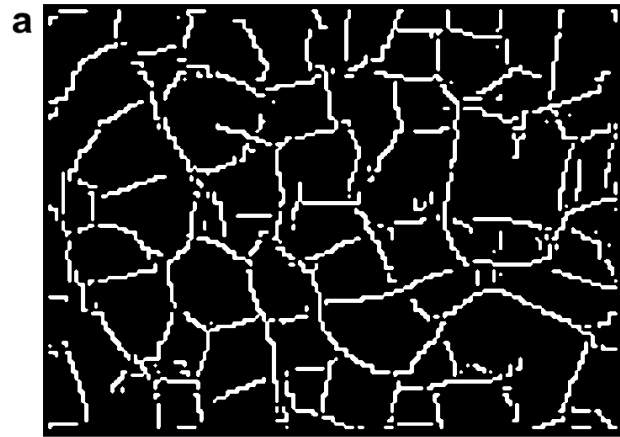
Jpg, gif, tiff, mov, avi, mpeg, ...



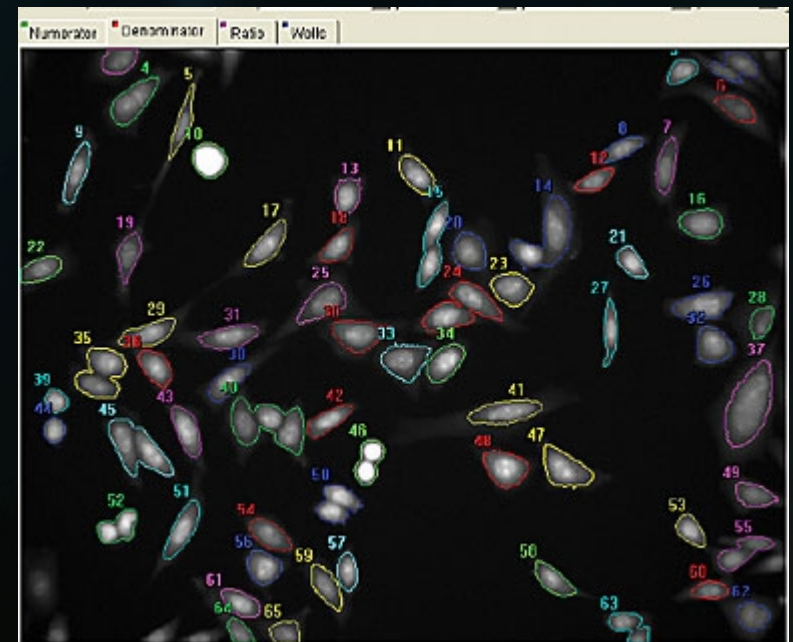
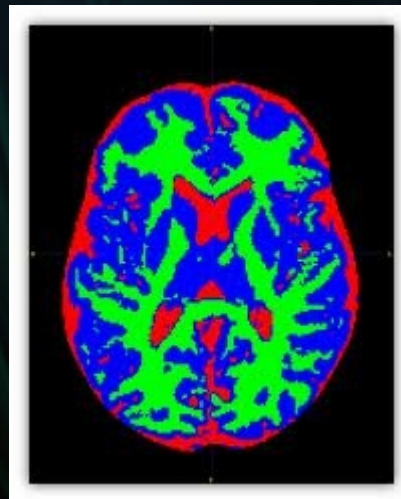
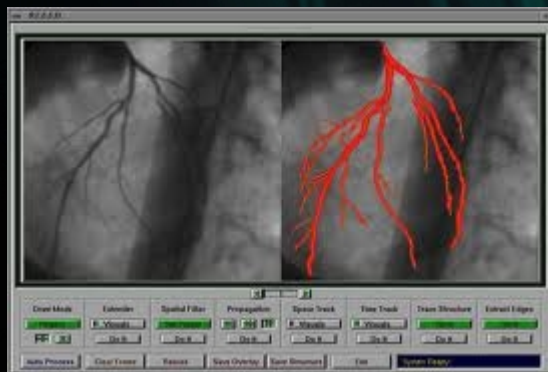
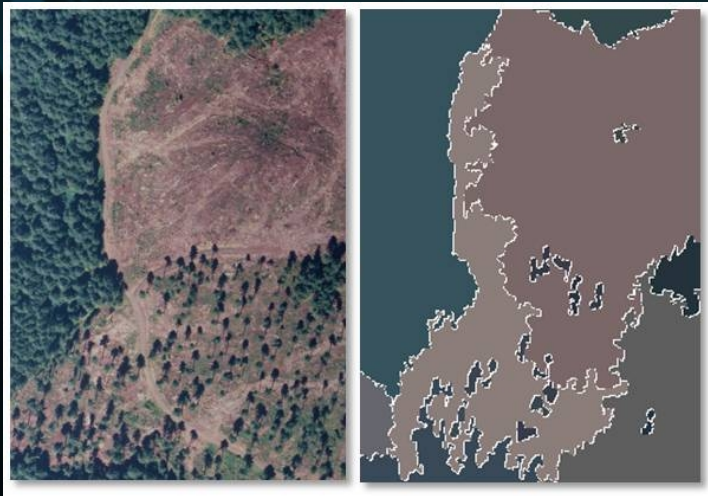
Melhoramento, bordas, estereoscopia, sombras, etc



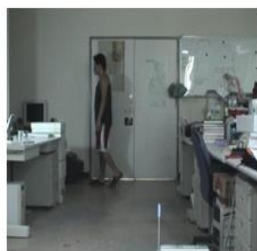
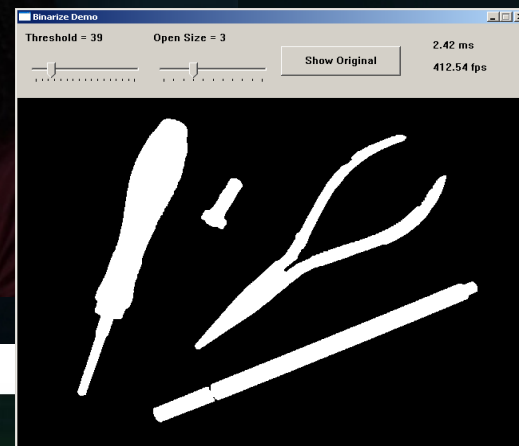
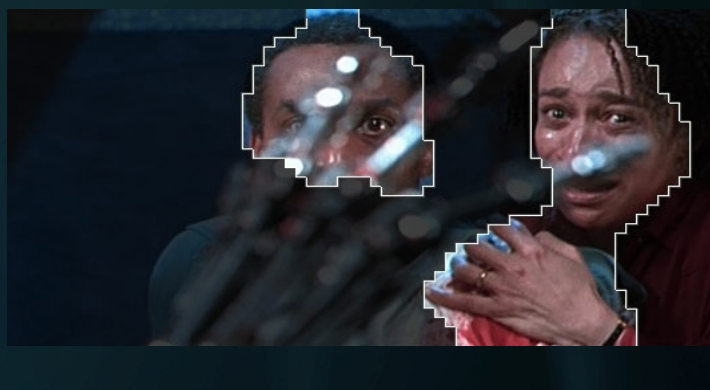
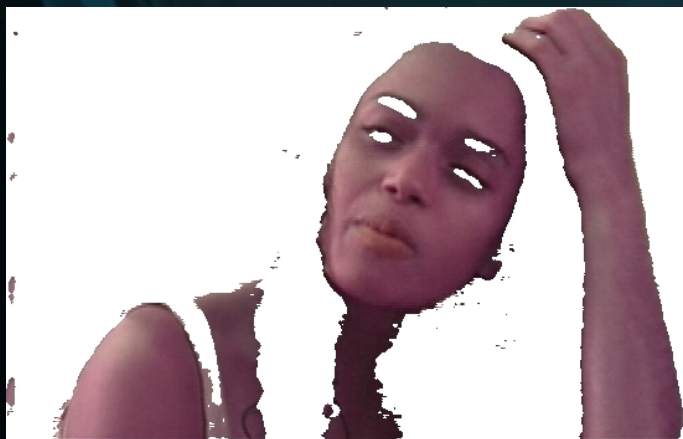
Melhoramento, bordas, estereoscopia, sombras, etc



Segmentação



Segmentação



Extração, seleção e redução de atributos



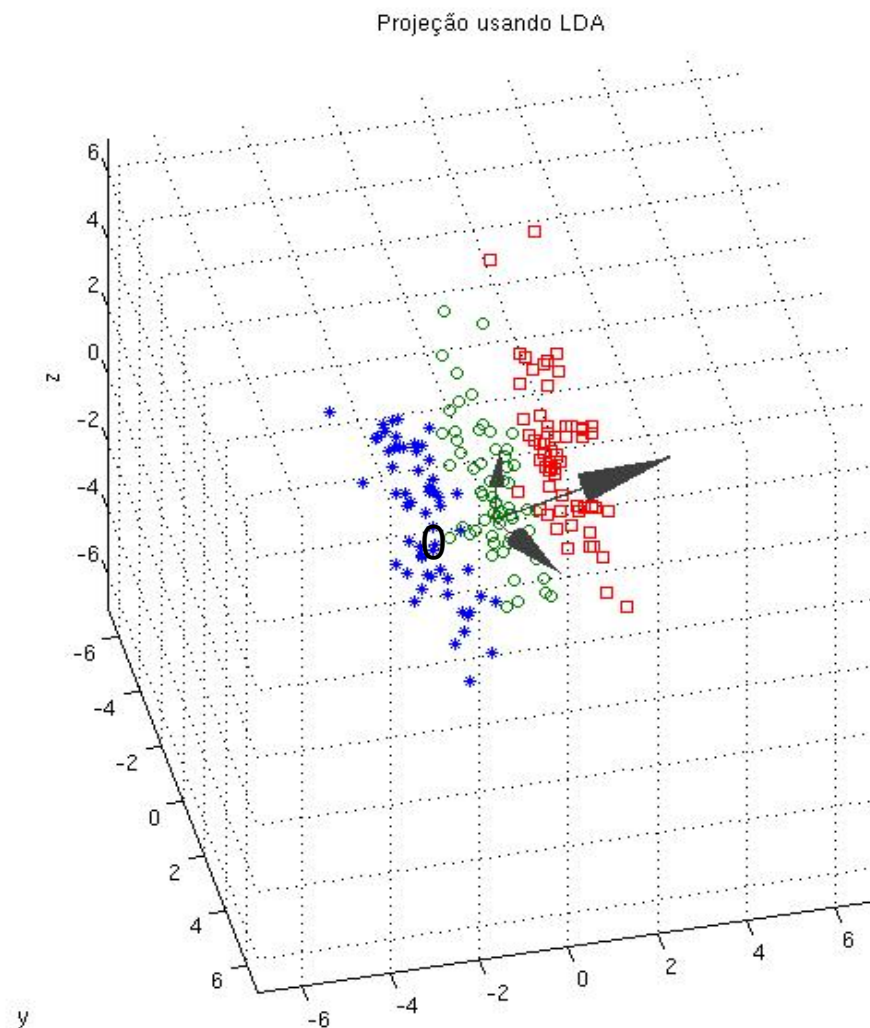
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~ 9 bilhões de bytes ~ 9 gigabytes



Extração, seleção e redução de atributos

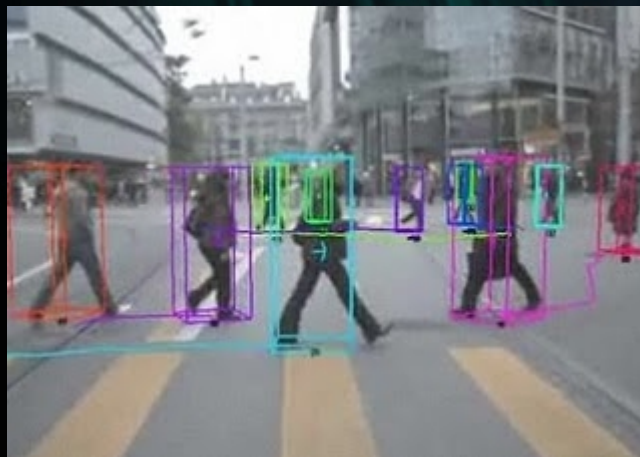
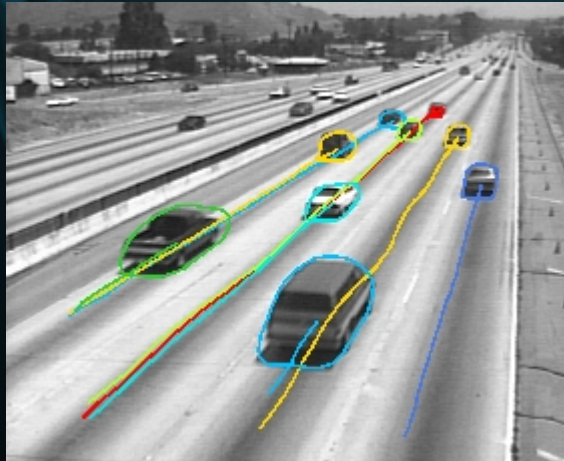
Atributo de Forma 1

Atributo de Textura 1

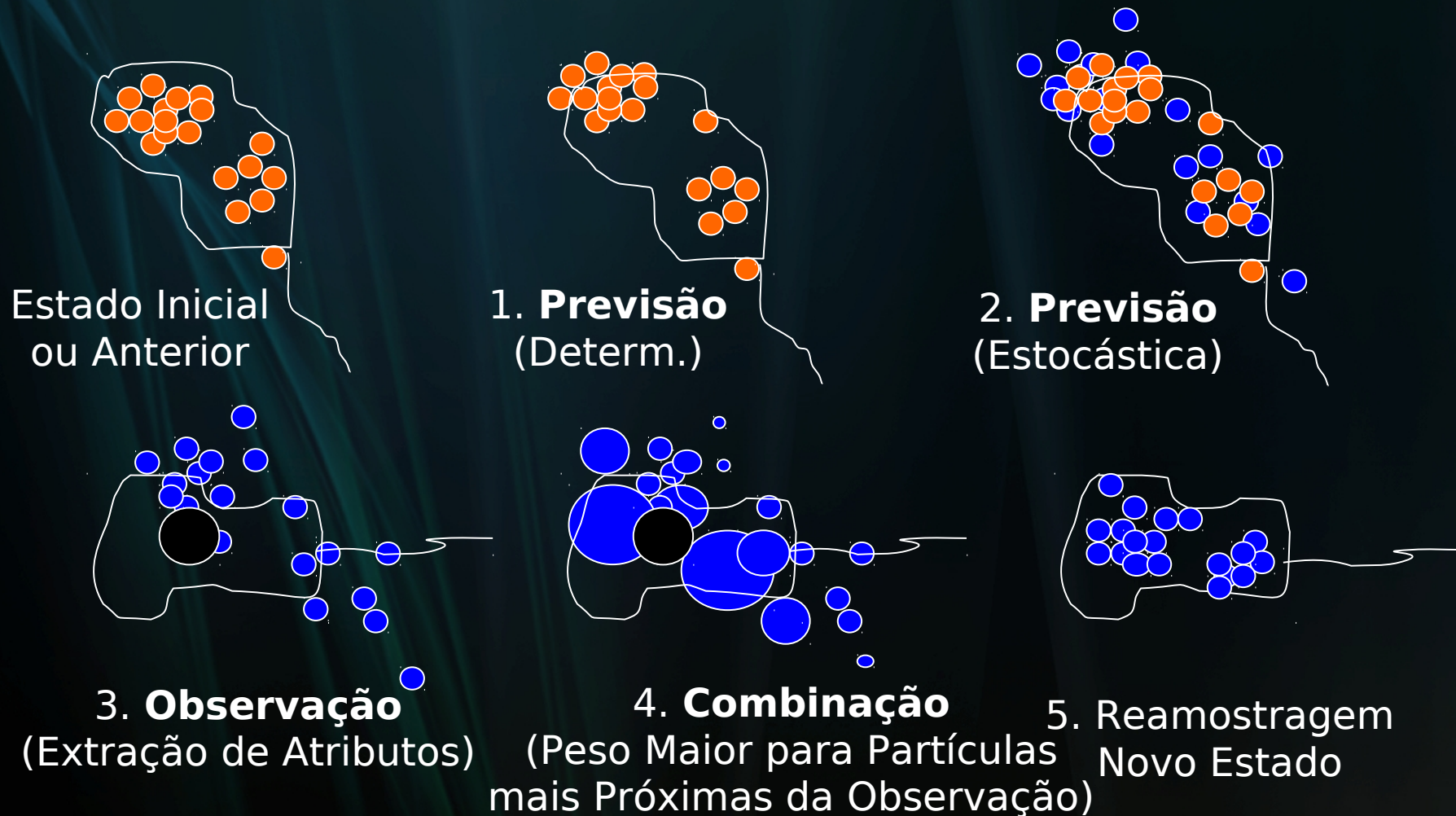


Atributo de Textura 2

Rastreamento



Rastreamento – Filtros Preditivos



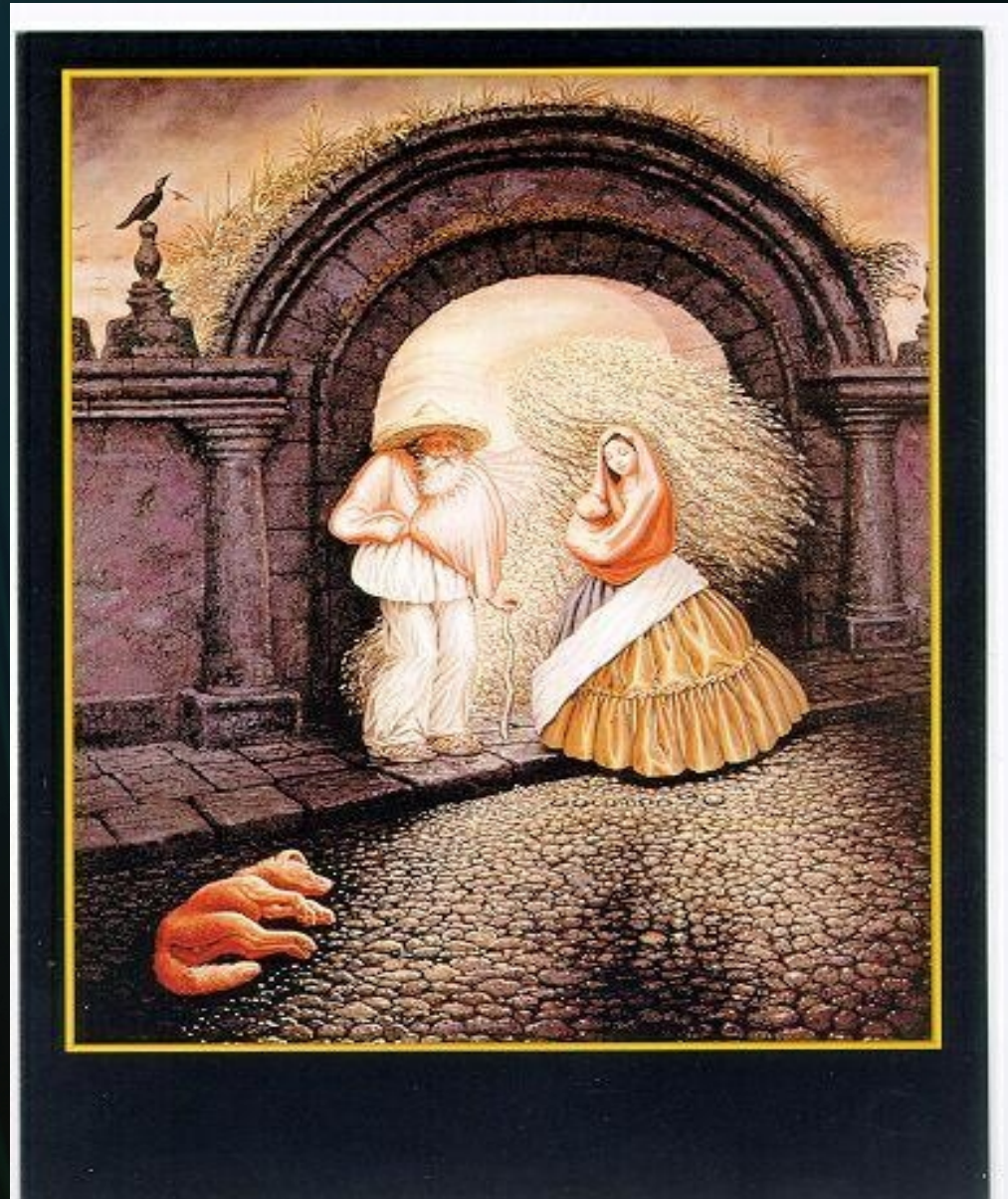
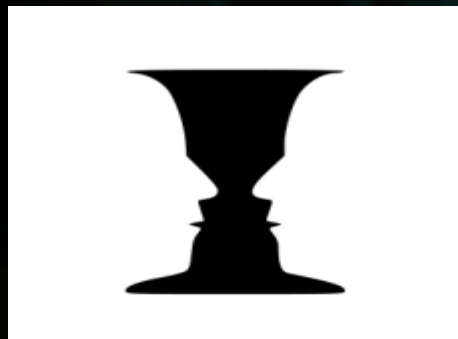
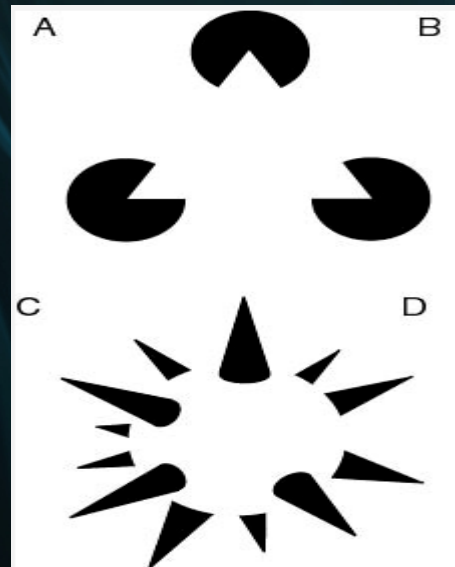
Rastreamento – Fluxo Óptico



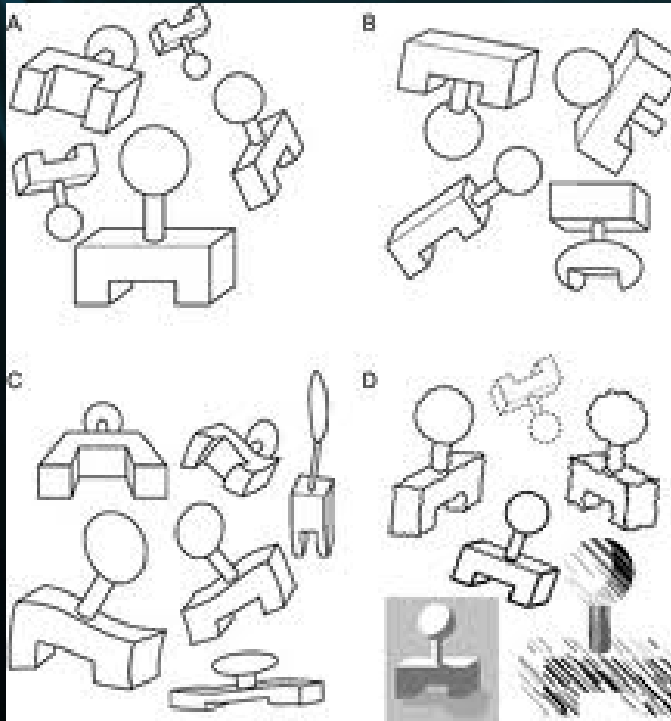
Reconhecimento - Gestalt



Reconhecimento - Gestalt

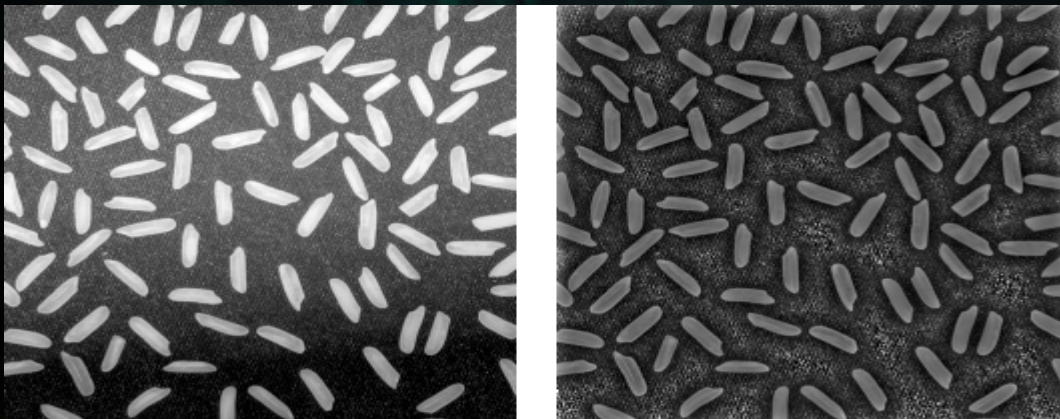


Reconhecimento - Invariância



Invariância à

- Rotação 2D e 3D
- Escala
- Translação
- Cisalhamento (Shear)
- Transformações afim (affine)
- Iluminação
- Deformações gerais
- ...



Reconhecimento – Casamento de Modelos



- **Como se tornar invariante ?**
- **Quais modelos utilizar ?**
- **Que atributos extrair, se for extrair ?**
- **Quais medidas de similaridade ?**

Reconhecimento – Casamento de Modelos

Como se tornar invariante ?

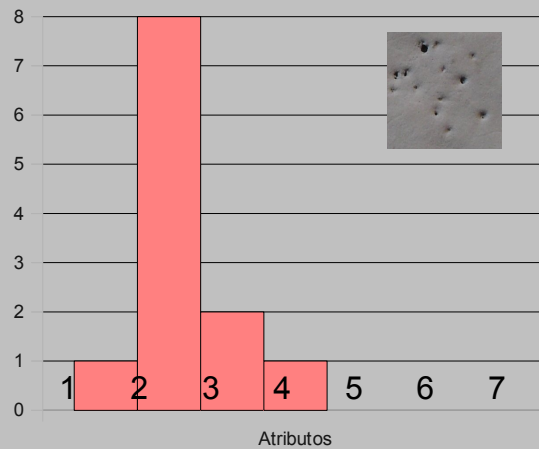
Exemplos Modelos: banco de imagens, vetores de Atributos, modelos Deformáveis, snakes, Hough, Gramáticas, Grafos, modelos 3D, etc

Exemplos Atributos: LBP, Matriz Coocorrências, Wavelets, Histogramas de cores, Distribuições paramétricas, Momentos, Topológicos, K-Curvatura, Histogramas de arestas, etc

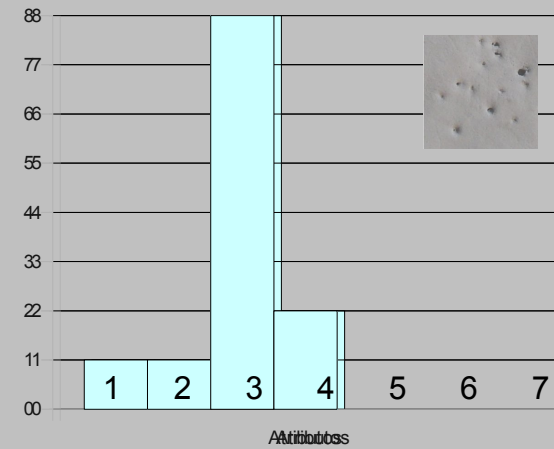
Exemplos Medidas de similaridade: Minkowski, Hamming, Tanimoto, Entropia cruzada, Battacharya, Mahalanobis, Cosine, Canberra, Kullback-Leibler, Jeffrey divergência, Chi quadrado, Kolmogorov-Smirnov, etc

Reconhecimento – Casamento de Modelos

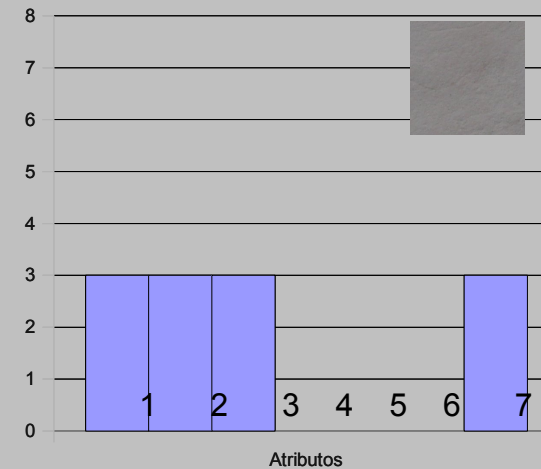
Amostra A



Exemplo Classe B

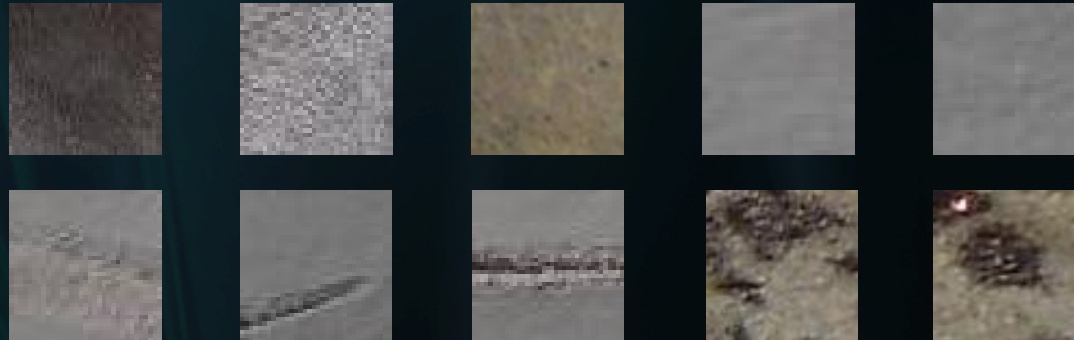
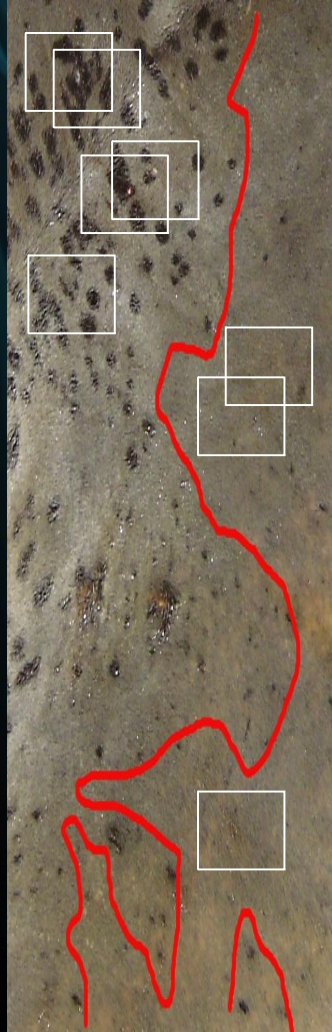


Exemplo Classe C



A qual classe a amostra A pertence, B ou C ?

Reconhecimento – Aprendizagem de Máquina



Amostra 1: Sem defeito – Nelore – Em pé
Amostra 2: Sem defeito – Simental – Limpo
Amostra 3: Risco Aberto – Wetblue
Amostra 4: Risco Aberto – Nelore – Em pé
Amostra 5: Dermatófilo – Wetblue

...

Amostra 3052: ...

Aplicações - Biotecnologia



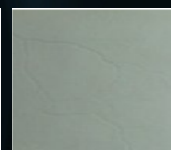
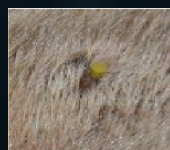
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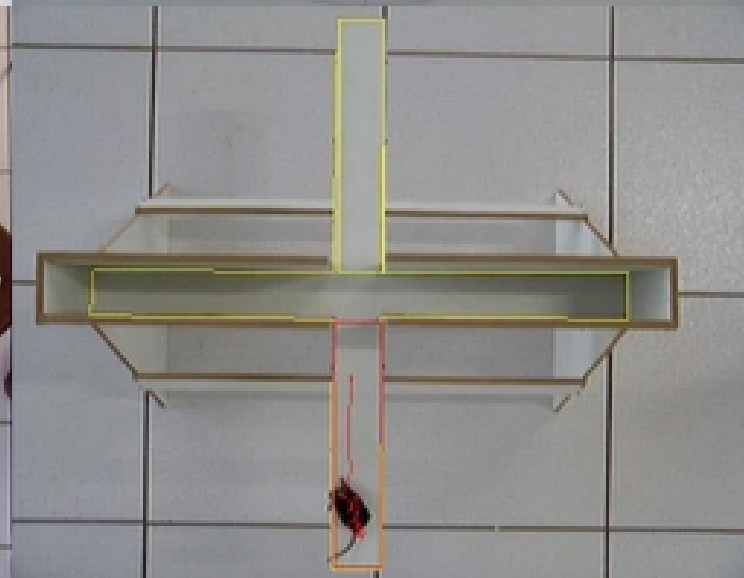
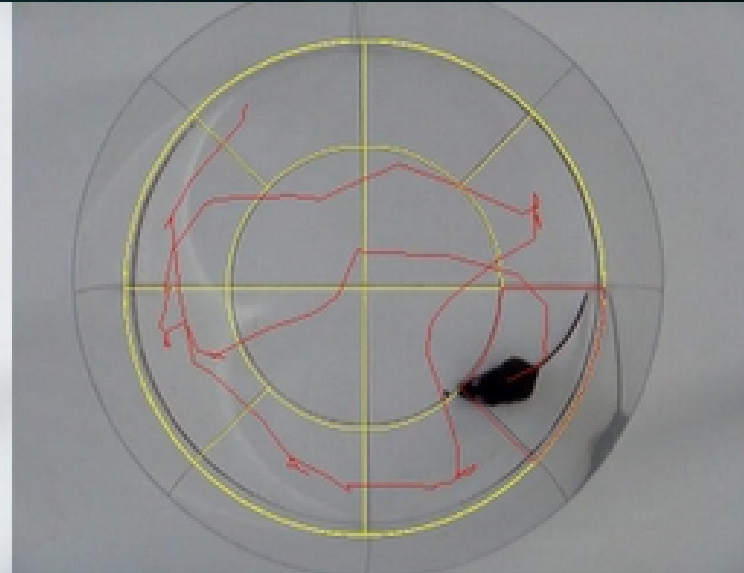
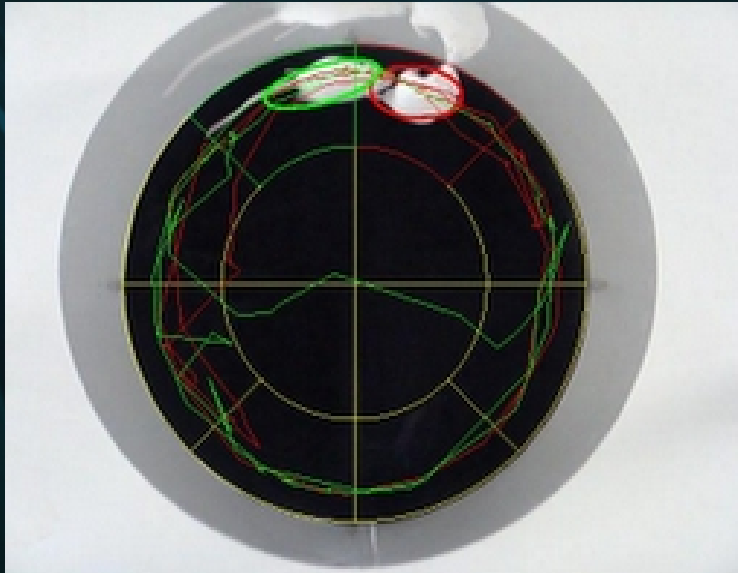
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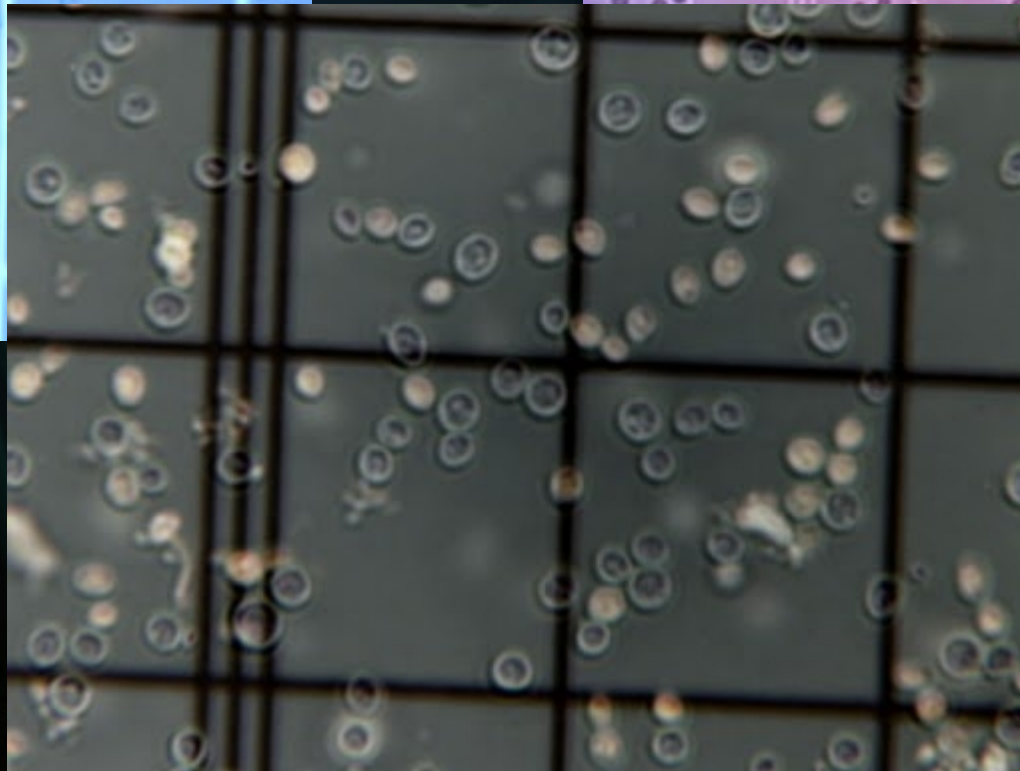
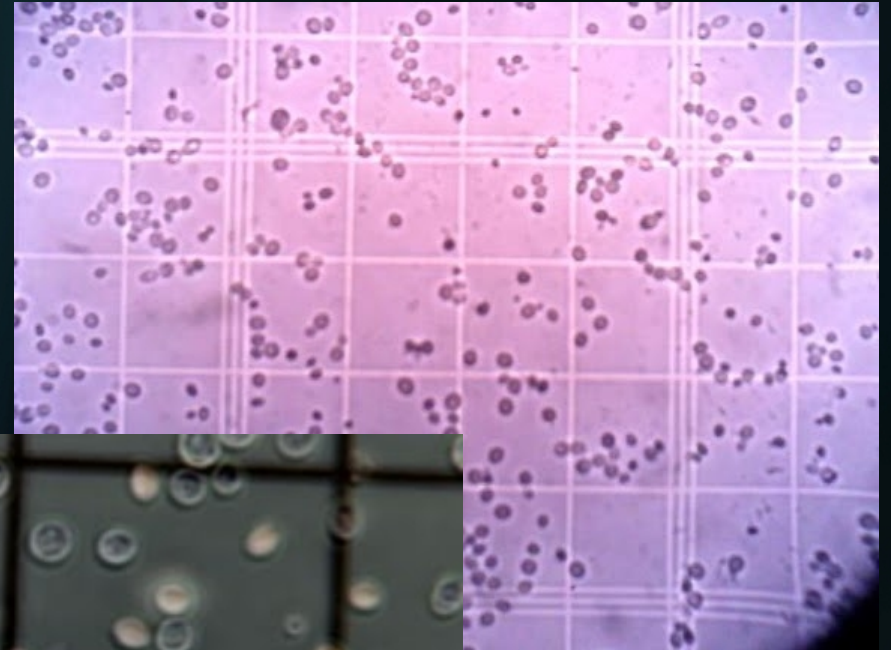
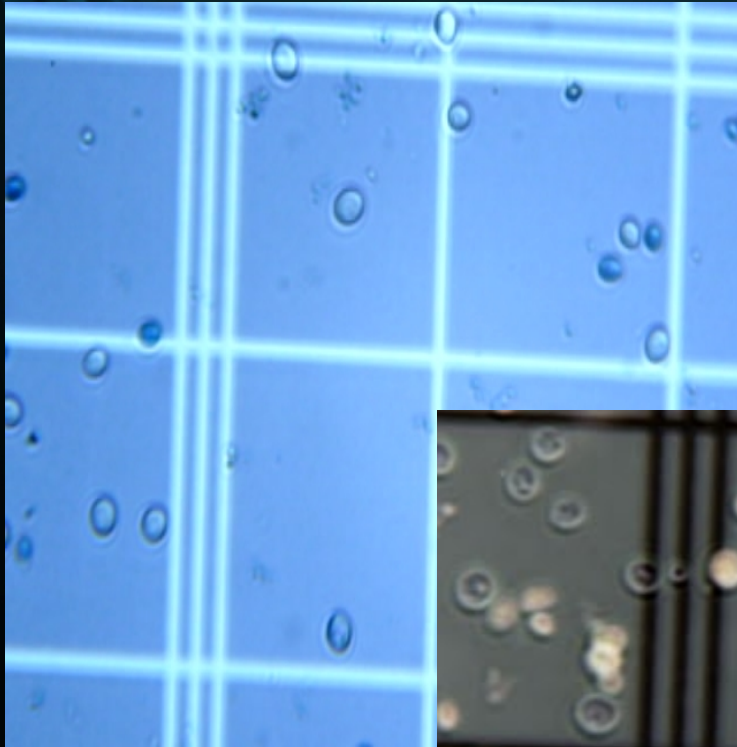
curtume



Aplicações - Biotecnologia



Aplicações - Biotecnologia



Aplicações - Biotecnologia



Conclusões

- Visão computacional é uma importante ferramenta para a área de Biotecnologia
- Custos dos dispositivos cada vez mais baixos
- Grande interface com reconhecimento de padrões, aprendizagem automática, inteligência artificial, etc.

Muchas Gracias...

Site INOVISAO: www.gpec.ucdb.br/inovisao

Site Pistori: www.gpec.ucdb.br/pistori