



Processamento de imagens além do hype

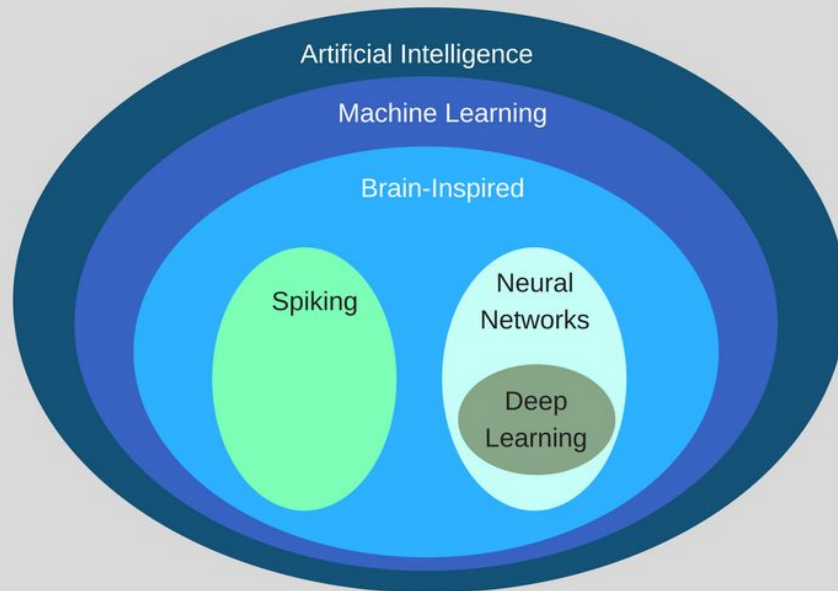
Por que Deep Learning pode não ser sua melhor opção



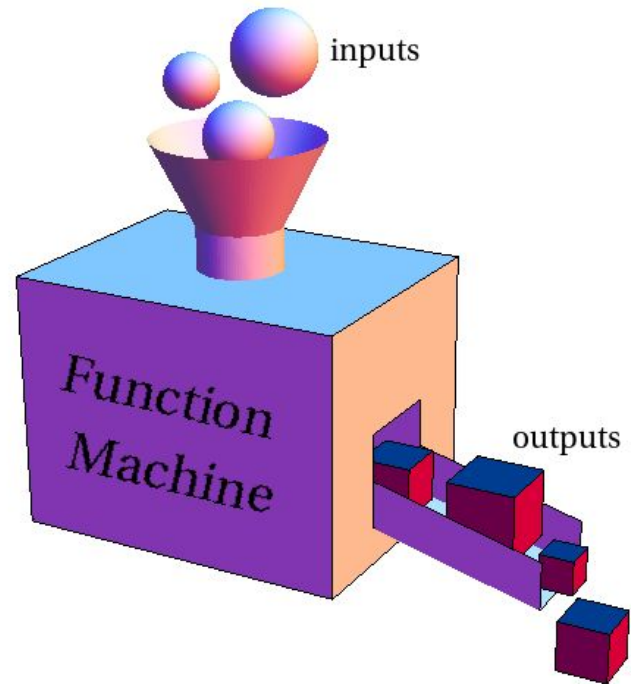
Marcos Felipe Trevisan - Desenvolvedor



Contexto



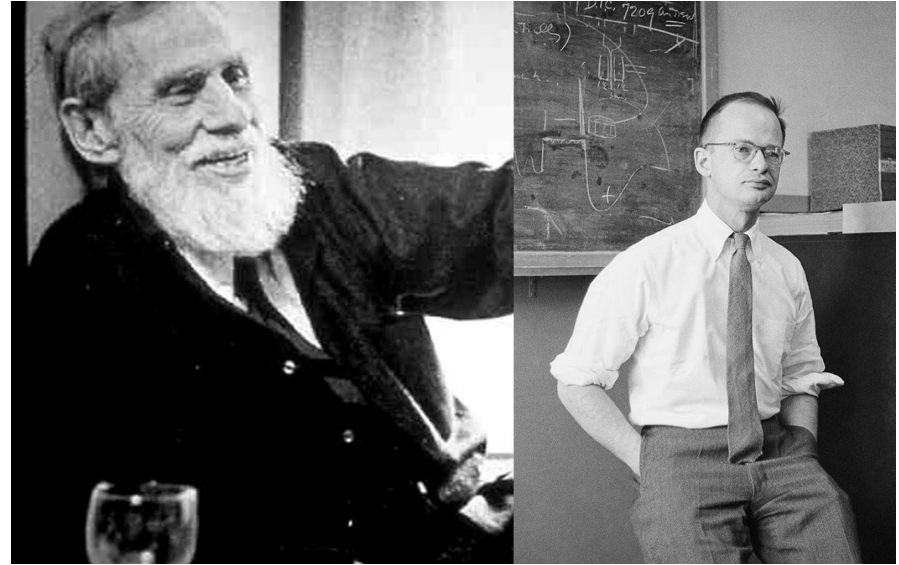
Machine Learning



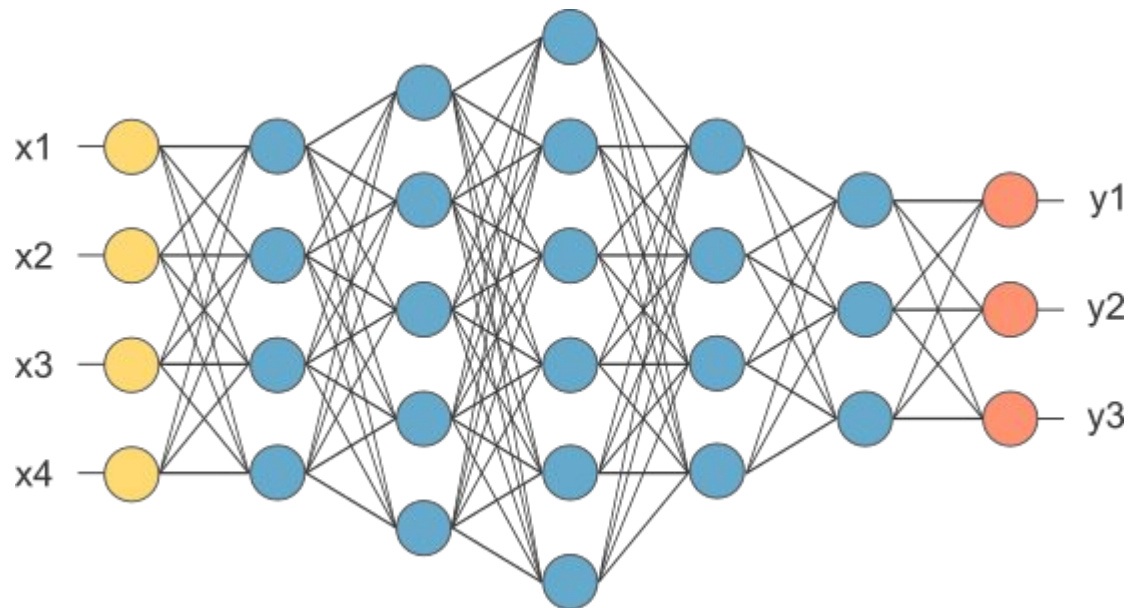
Breve história do Deep Learning

1943 - Redes neurais

- Walter Pitts e Warren McCulloch
- Inspirado nos neurônios biológicos

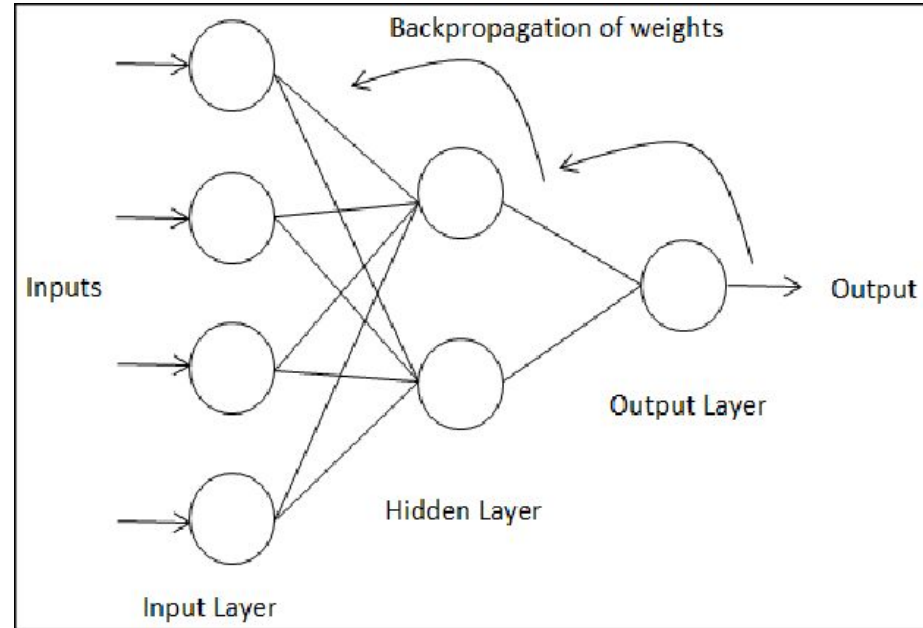


1943 - Redes neurais

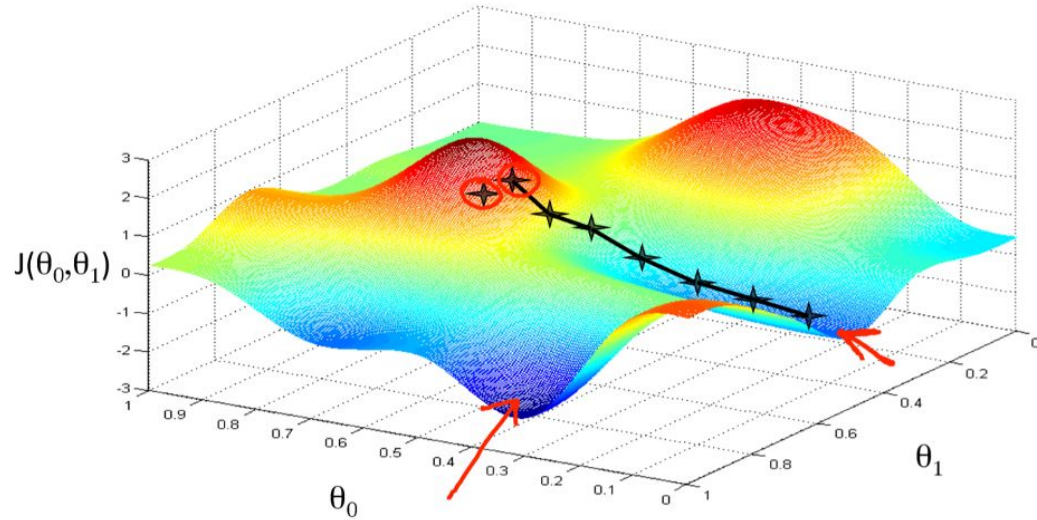


1960 - Backpropagation

- Henry J. Kelley
- Descida de gradiente



1960 - Backpropagation



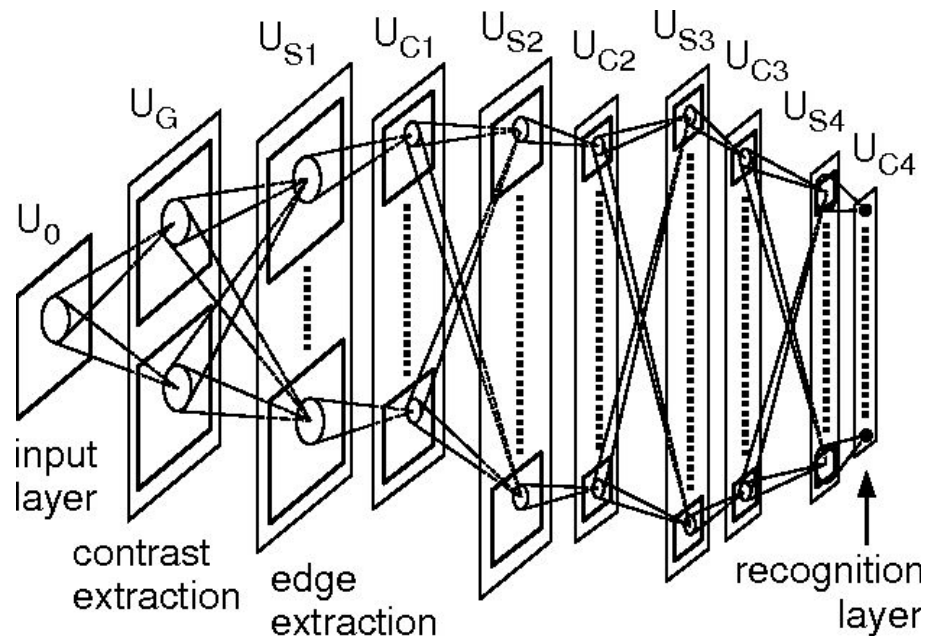


1970's - Primeiro Inverno (AI Winter)

- Limitações de processamento, memória, e outros recursos tecnológicos
- Substituição por sistemas especialistas

1979 - Neocognitron

- Kunihiro Fukushima
- Reconhecimento de caracteres





1985-90 - Segundo Inverno (AI Winter)

- Popularização dos Desktops
- DARPA (Defense Advanced Research Projects Agency) deixa de investir



1995-2000 - Novas ferramentas

- SVM (Support Vector Machines)
- LSTM (Long Short-Term Memory)

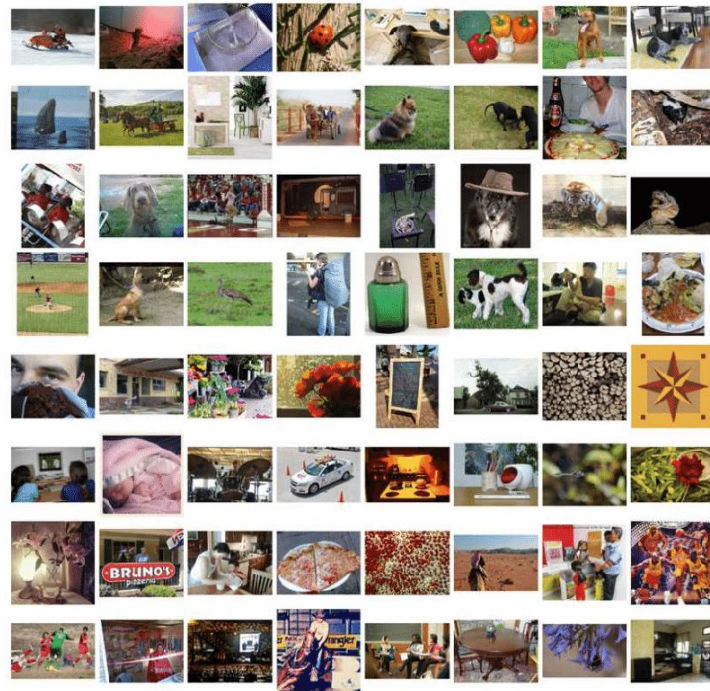


2000 - Melhores recursos

- Melhorias em memória e processamento
- Placas de vídeo (GPU)
- Redes mais profundas
- Problema da dissipação de gradiente

2009 - ImageNet

- Gratuita
- 14 milhões de imagens
- Imagens rotuladas



2012 - The Cat Experiment



2015 - Google Deep Dream

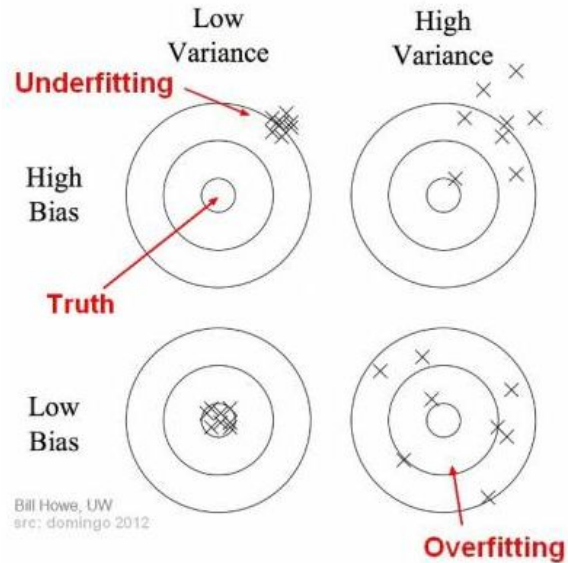


2016 - Alpha Go

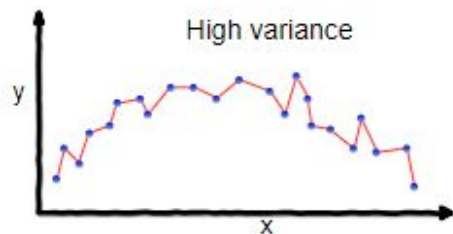


Problemas

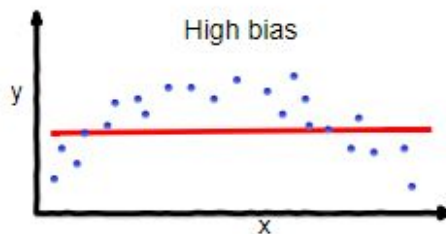
Tradeoff entre viés e variância



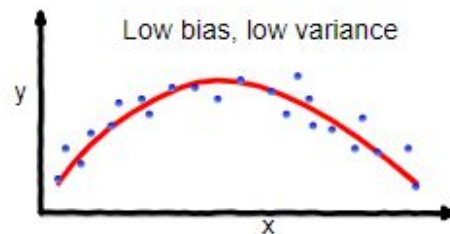
Tradeoff entre viés e variância



overfitting

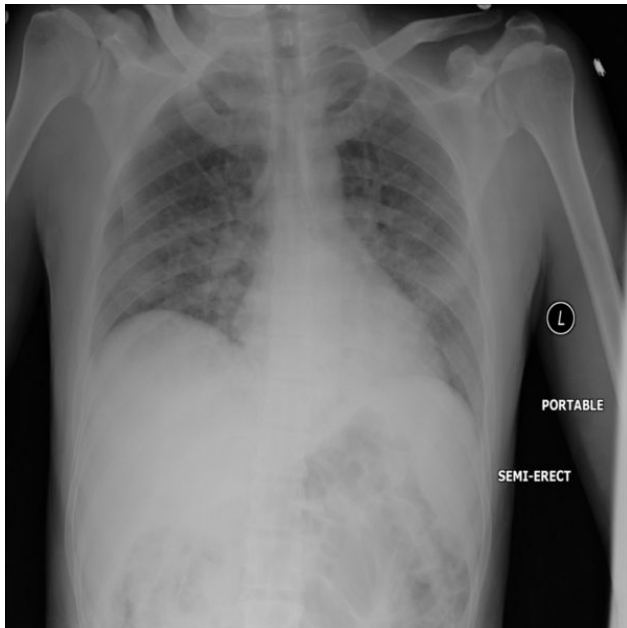


underfitting

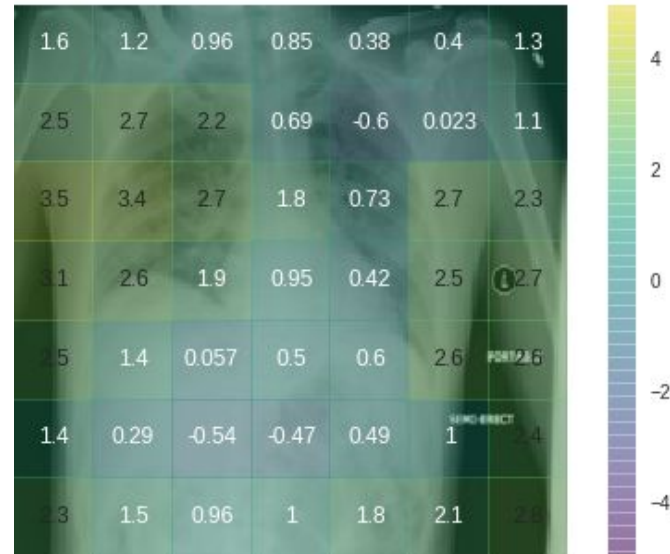


Good balance

Caso: Pneumonia em radiografias



$P(\text{Pneumonia})=0.057$



Ataque de um pixel



Cup(16.48%)
Soup Bowl(16.74%)



Bassinet(16.59%)
Paper Towel(16.21%)



Teapot(24.99%)
Joystick(37.39%)

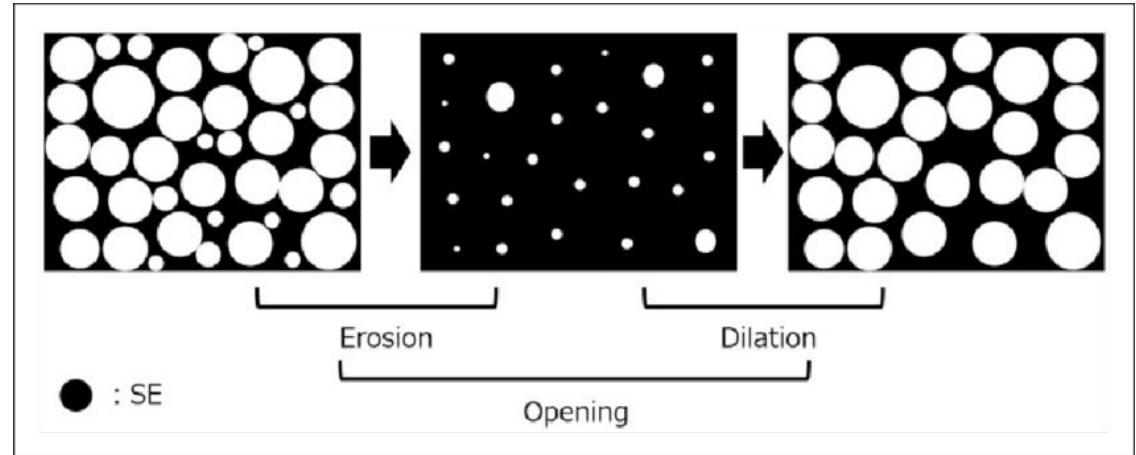


Hamster(35.79%)
Nipple(42.36%)

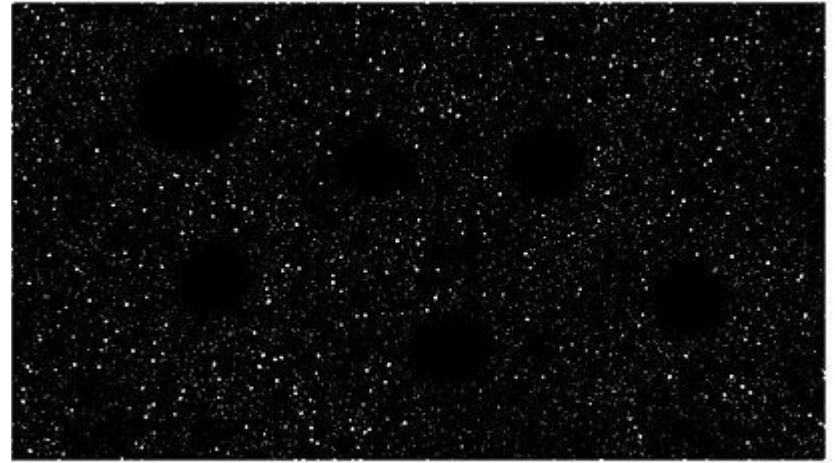
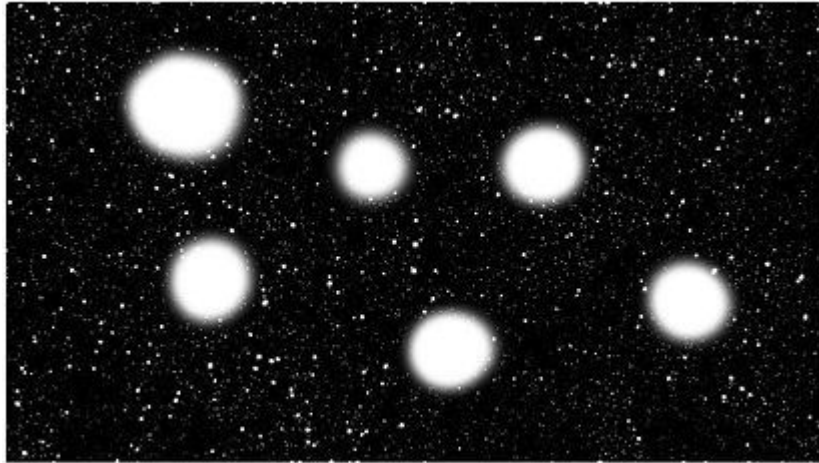
Ferramentas básicas

Morfologia matemática

- Erosão
- Dilatação
- Abertura
- Fechamento



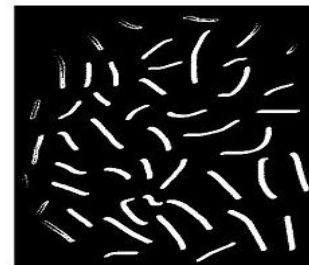
Transformação Top Hat



Transformação Top Hat



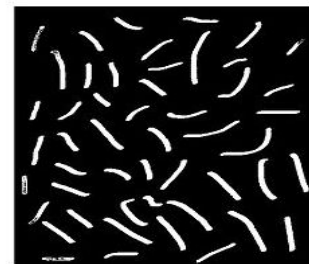
Nonuniform lighting condition input image



Threshold a nonuniform lighting input image

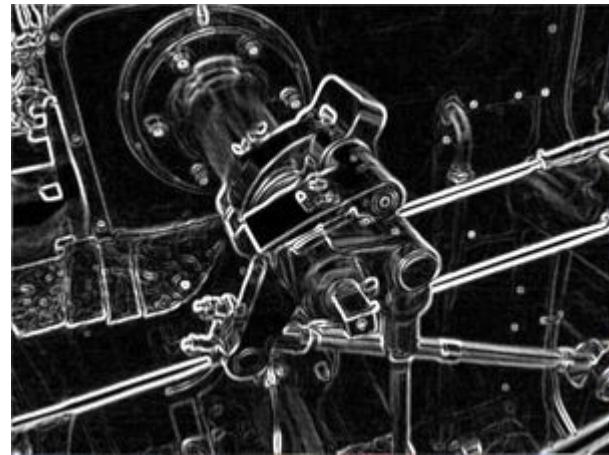
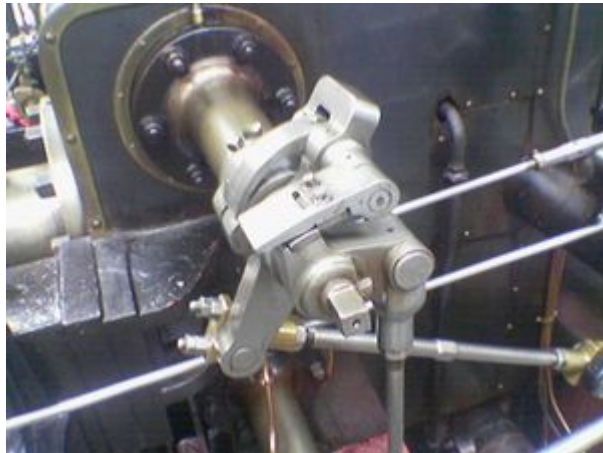


Top-hat transform applied to input image



Threshold image after top-hat transform applied

Detecção de borda - Filtro Sobel



Detecção de Borda - Watershed

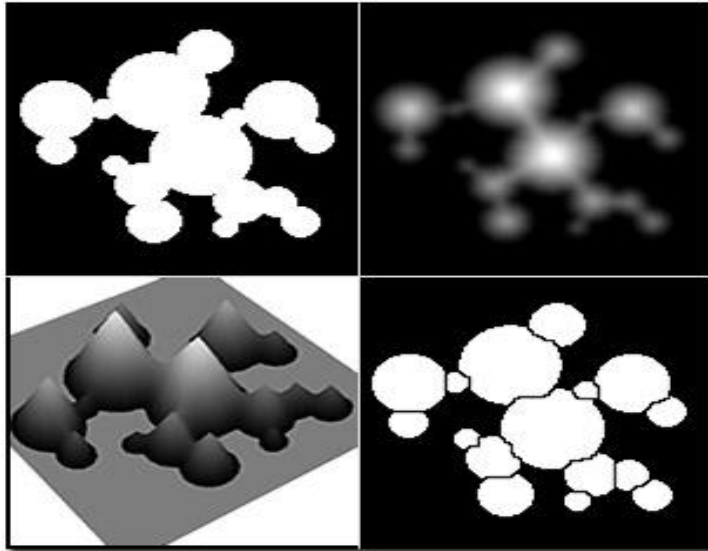
Original Image



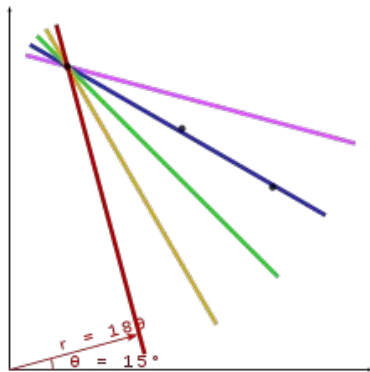
Edge Image



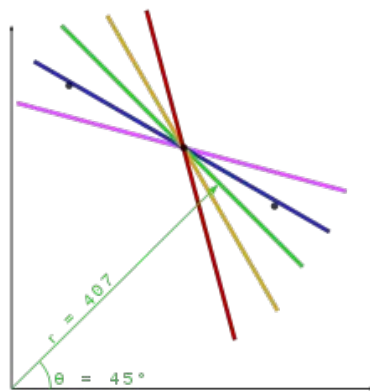
Detecção de Borda - Watershed



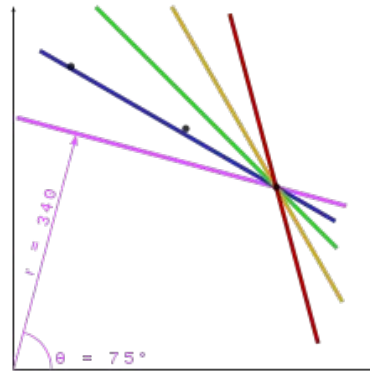
Retas/círculos: Transformação de Hough



θ	r
15	189.0
30	282.0
45	355.7
60	407.3
75	429.4



θ	r
15	318.5
30	376.8
45	407.3
60	409.8
75	385.3

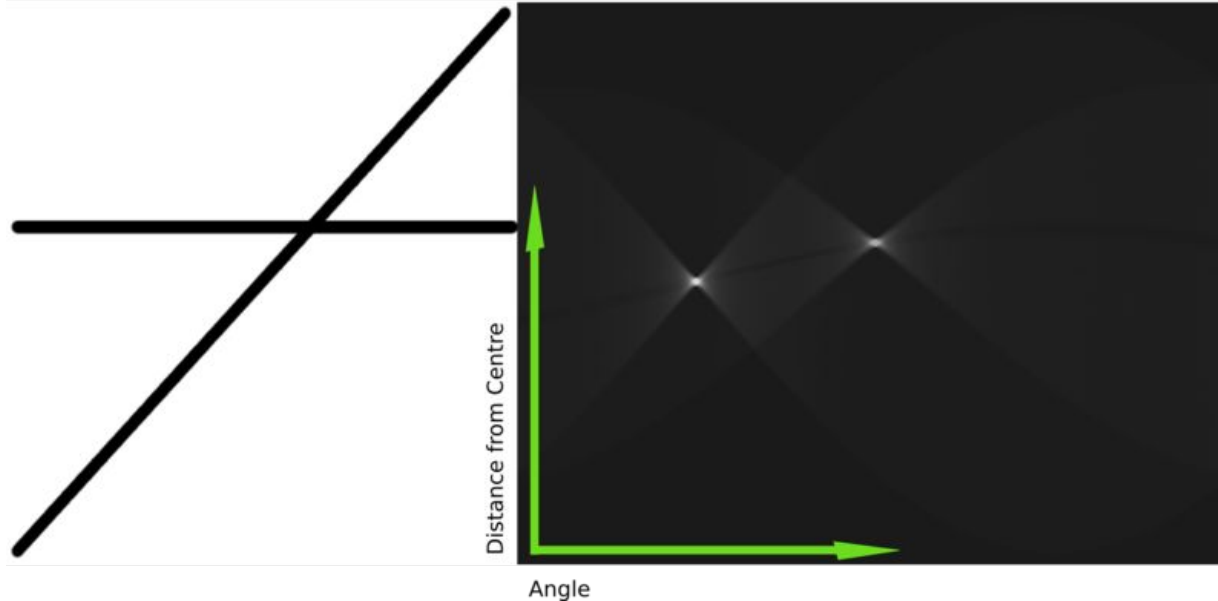


θ	r
15	419.0
30	443.6
45	438.4
60	402.9
75	340.1

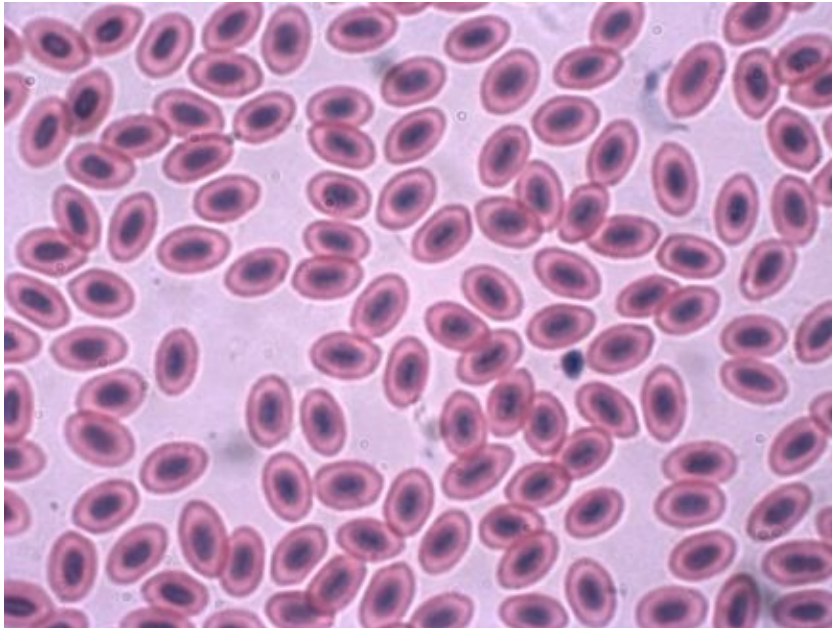
Retas/círculos: Transformação de Hough

Input Image

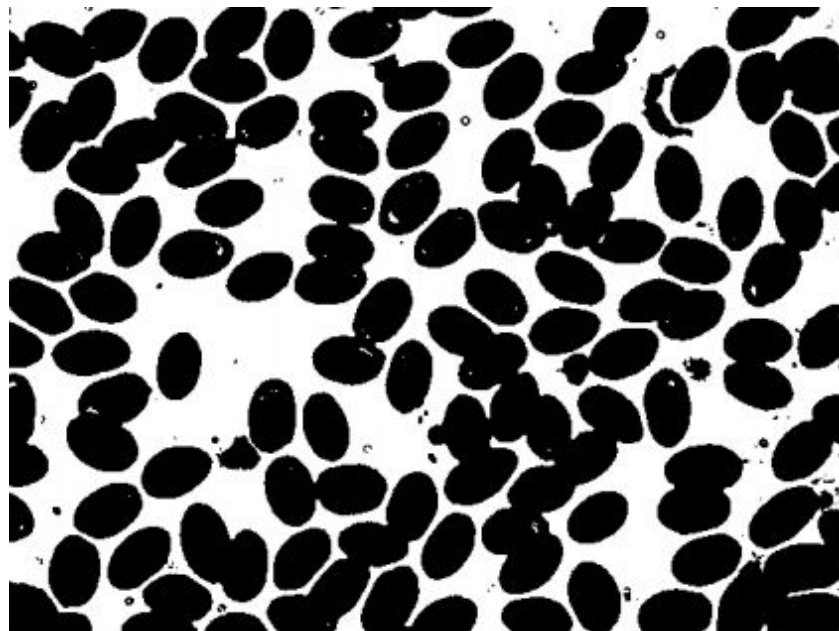
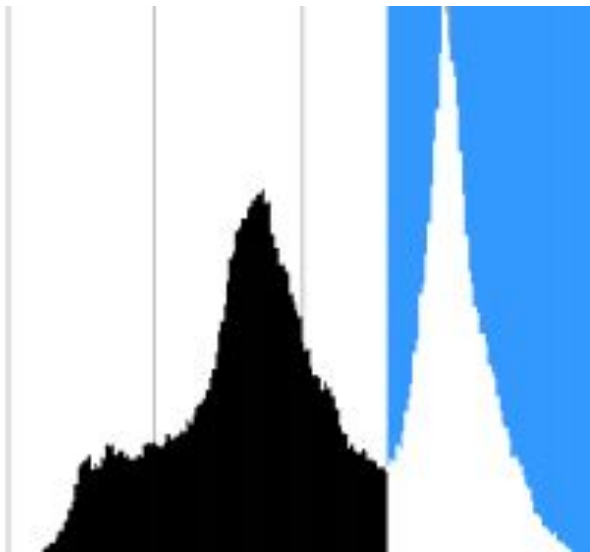
Rendering of Transform Results



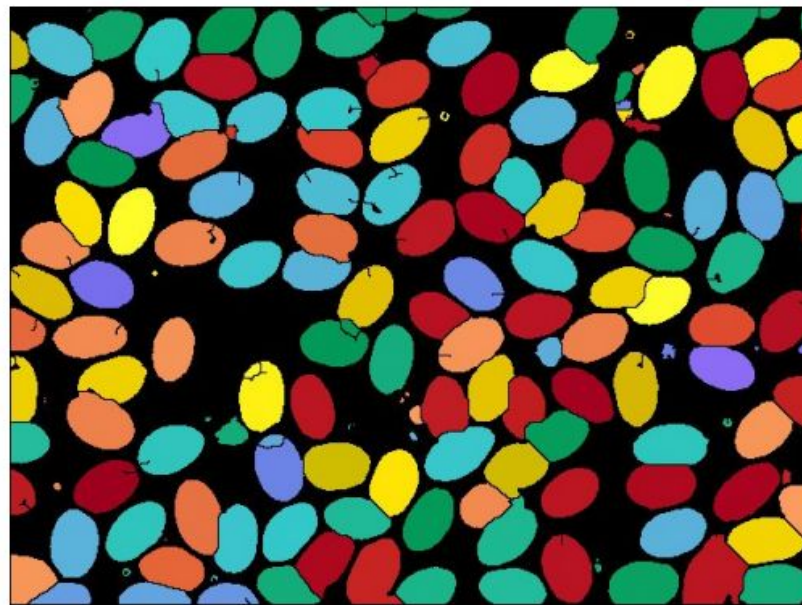
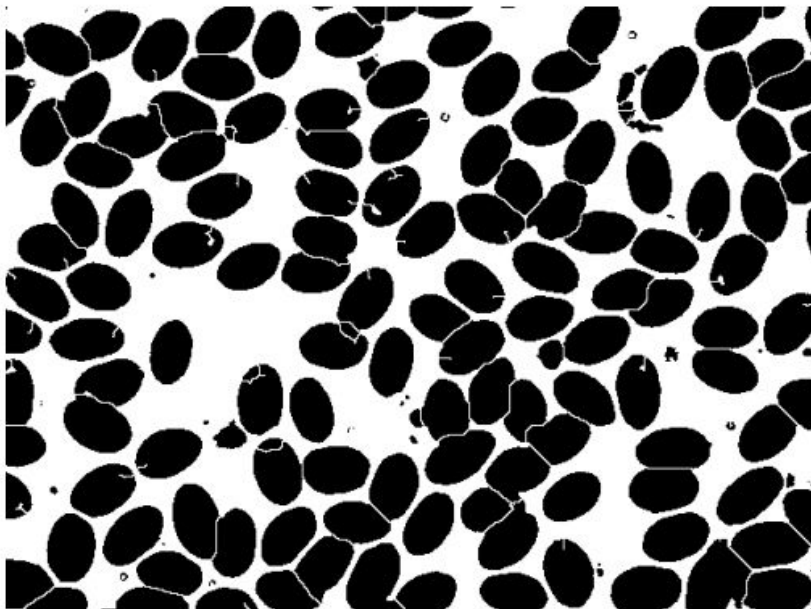
Exemplo: Análise de Hemácias



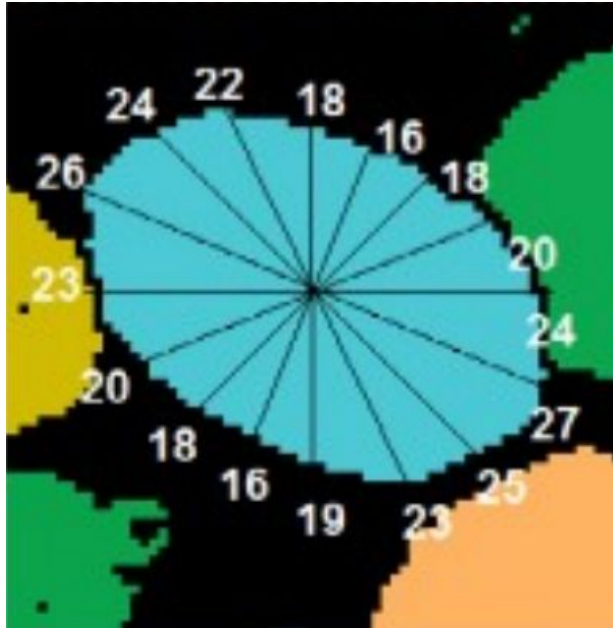
Exemplo: Análise de Hemácias



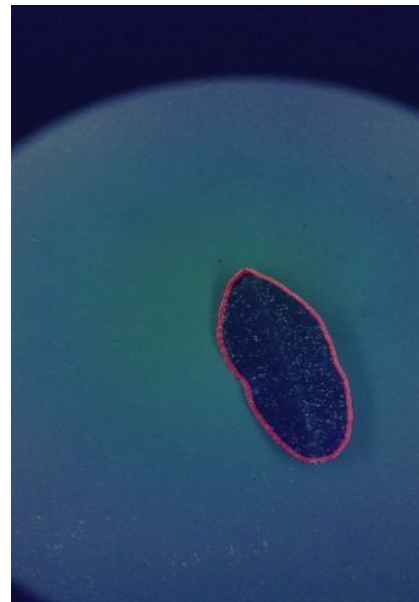
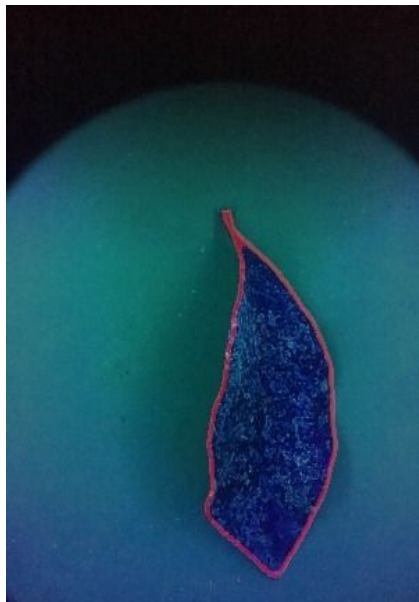
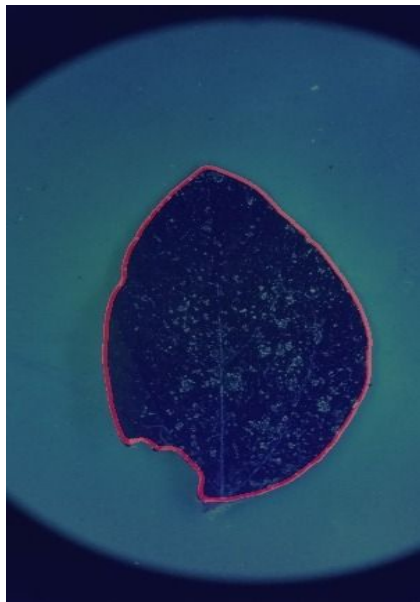
Exemplo: Análise de Hemácias



Exemplo: Análise de Hemácias



Exemplo: Borda de folha





Recomendações finais

- Não existe bala de prata
- Não mate formiga com tiro de canhão
- Cuidado com caixas-pretas
- Pesquise soluções de problemas semelhantes
- Não procure problemas pras suas soluções



Obrigado!



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