

# Redes Neurais e Aprendizagem Profunda

## VISÃO COMPUTACIONAL INTRODUÇÃO

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# Visão Computacional

David Marr: abordagem precursora (1970-80s)



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Visão → Sistema de processamento de informação

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Visão  Sistema de processamento de informação

Níveis de análise:

- **Computacional**: o que o sistema faz
- **Algorítmico** : como o sistema faz
- **Físico** : a forma como o sistema é realizado fisicamente

# Visão Computacional

David Marr: abordagem precursora (1970-80s)



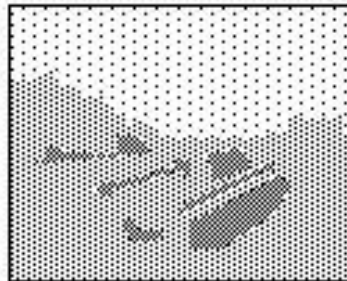
Visão  Sistema de processamento de informação

Níveis de análise:

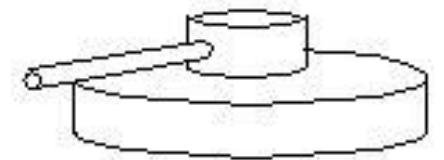
- **Computacional**: o que o sistema faz
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**Estágios  
da Visão**

input image



3-D model



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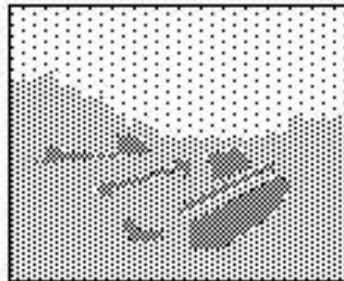
Visão → Sistema de processamento de informação

Níveis de análise:

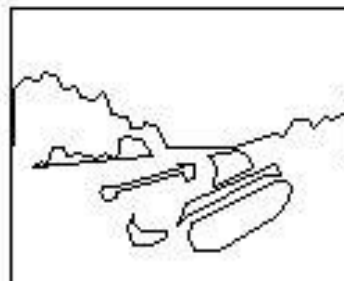
- **Computacional**: o que o sistema faz
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**Estágios  
da Visão**

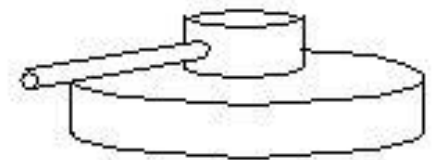
input image



edge image



3-D model



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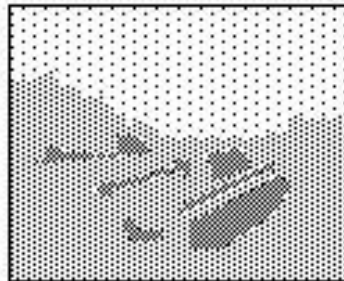
Visão  Sistema de processamento de informação

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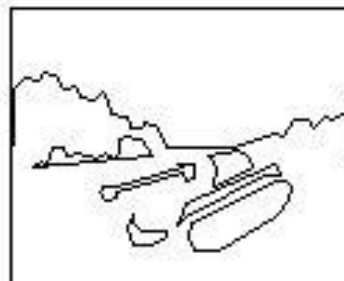
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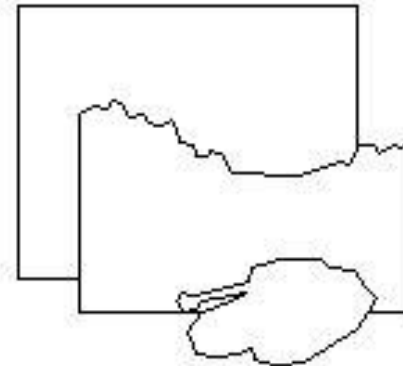
input image



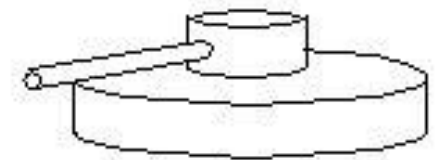
edge image



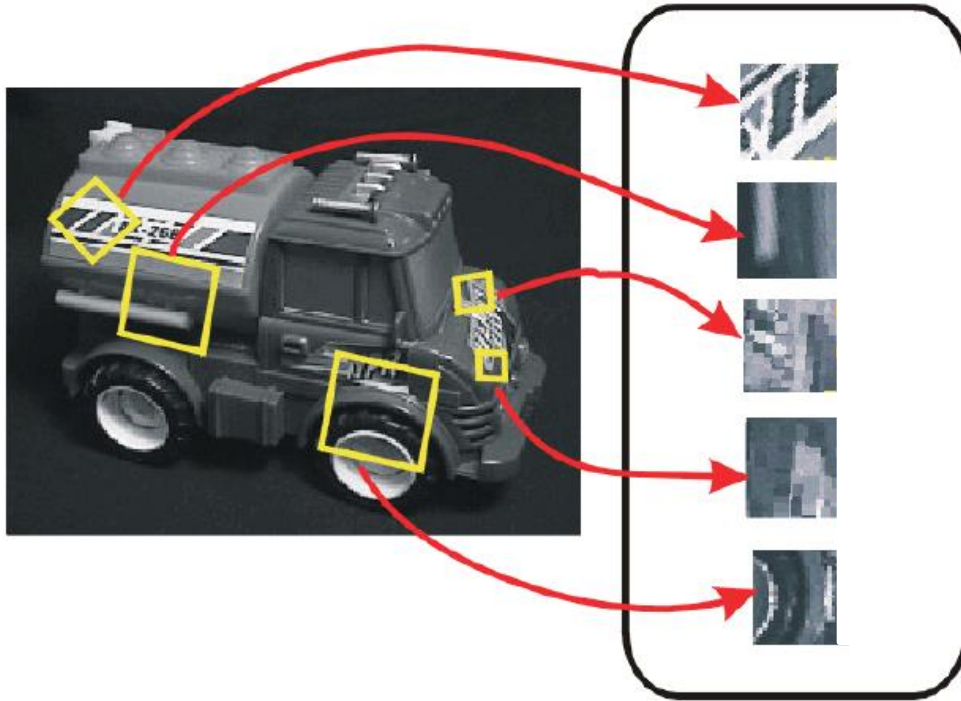
2<sup>1</sup>/<sub>2</sub>-D sketch



3-D model

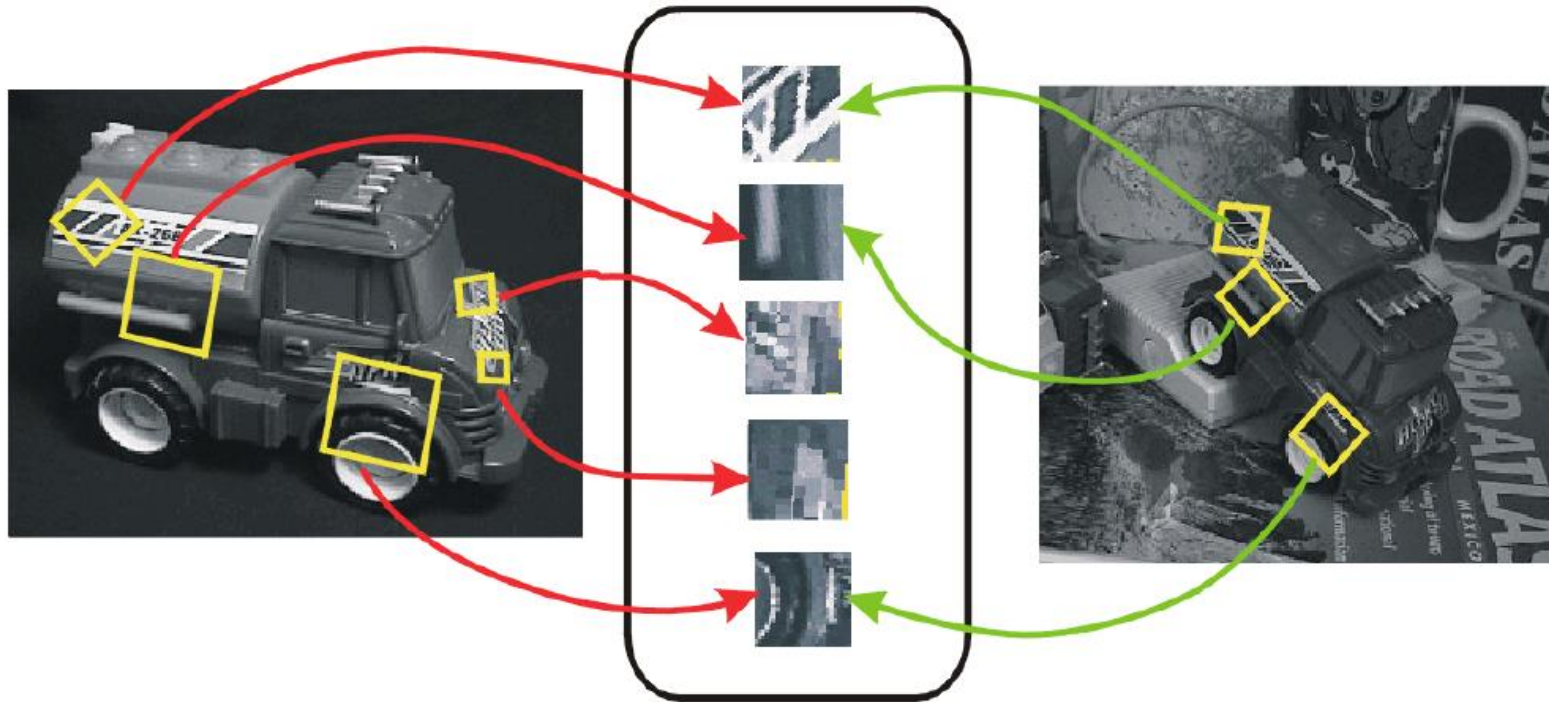


# Visão Computacional – Características Invariantes

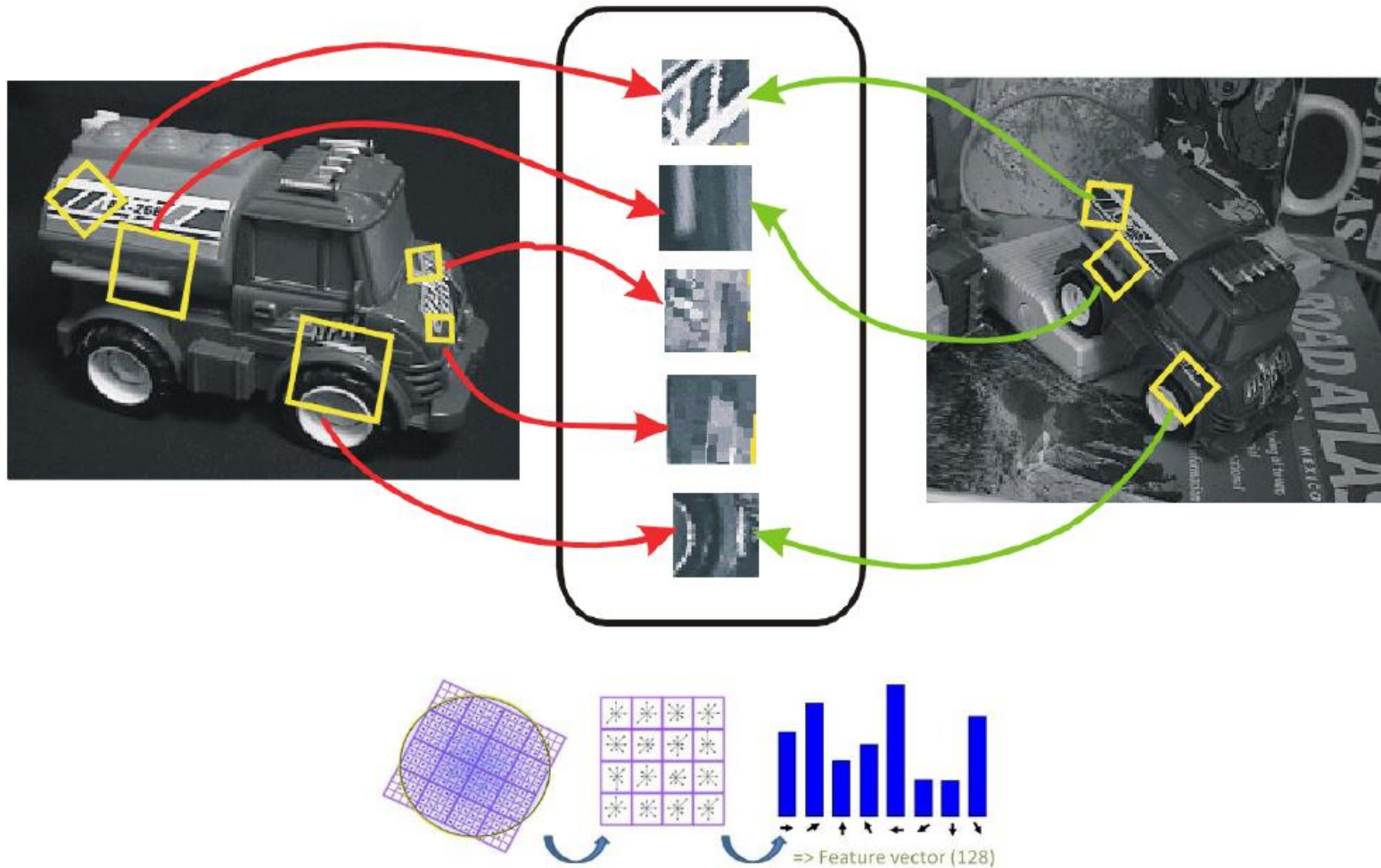




# Visão Computacional – Características Invariantes



# Visão Computacional – Características Invariantes



“SIFT” & Object Recognition, David Lowe, 1999

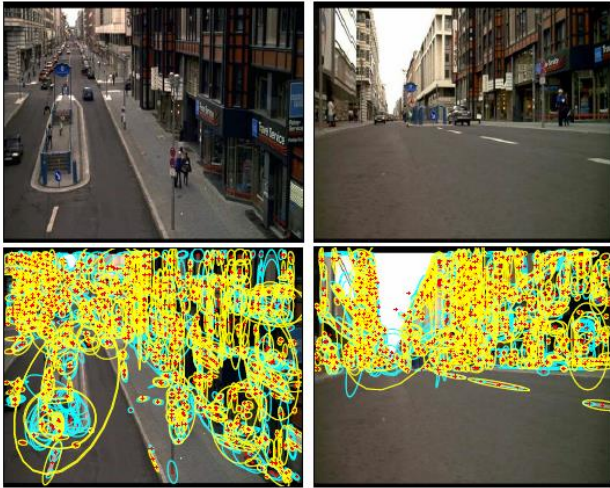
# Visão Computacional – Quantização Vetorial

Sivic and Zisserman (2003) – “Video Google”



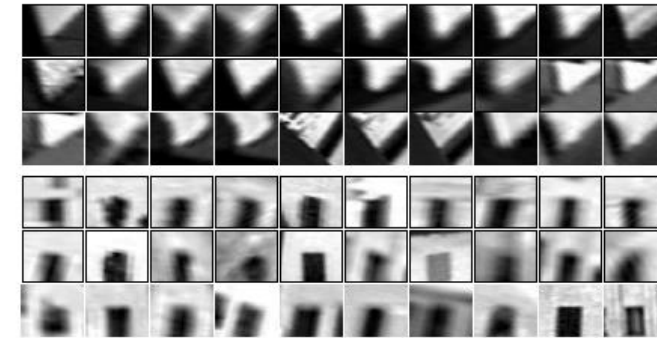
# Visão Computacional – Quantização Vetorial

Sivic and Zisserman (2003) – “Video Google”

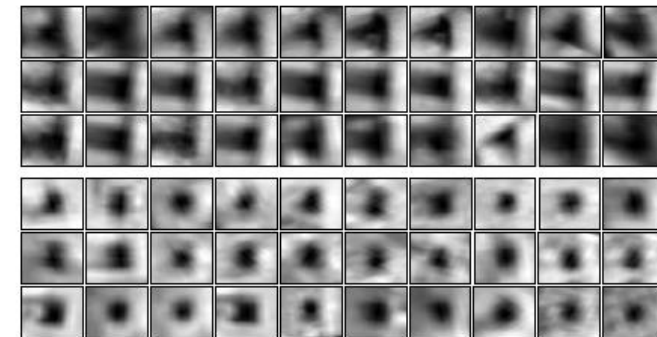


# Visão Computacional – Quantização Vetorial

Sivic and Zisserman (2003) – “Video Google”



(a)

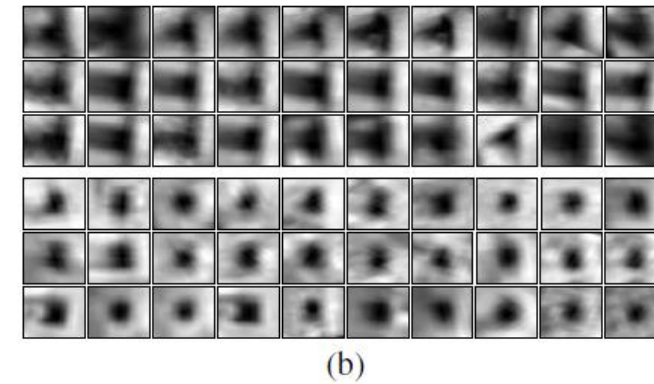
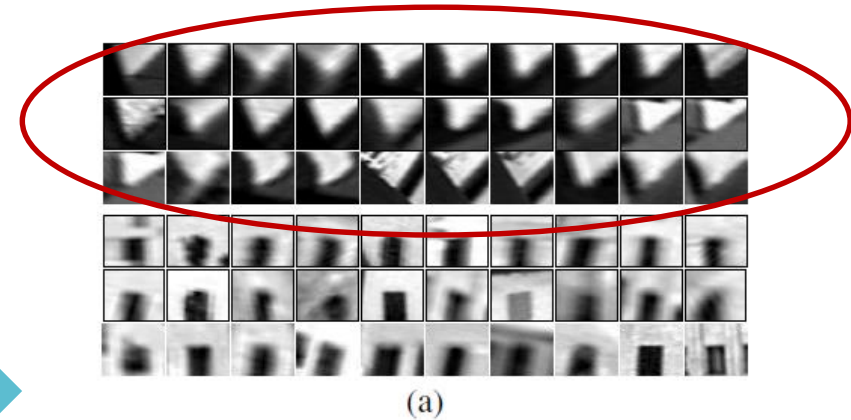


(b)



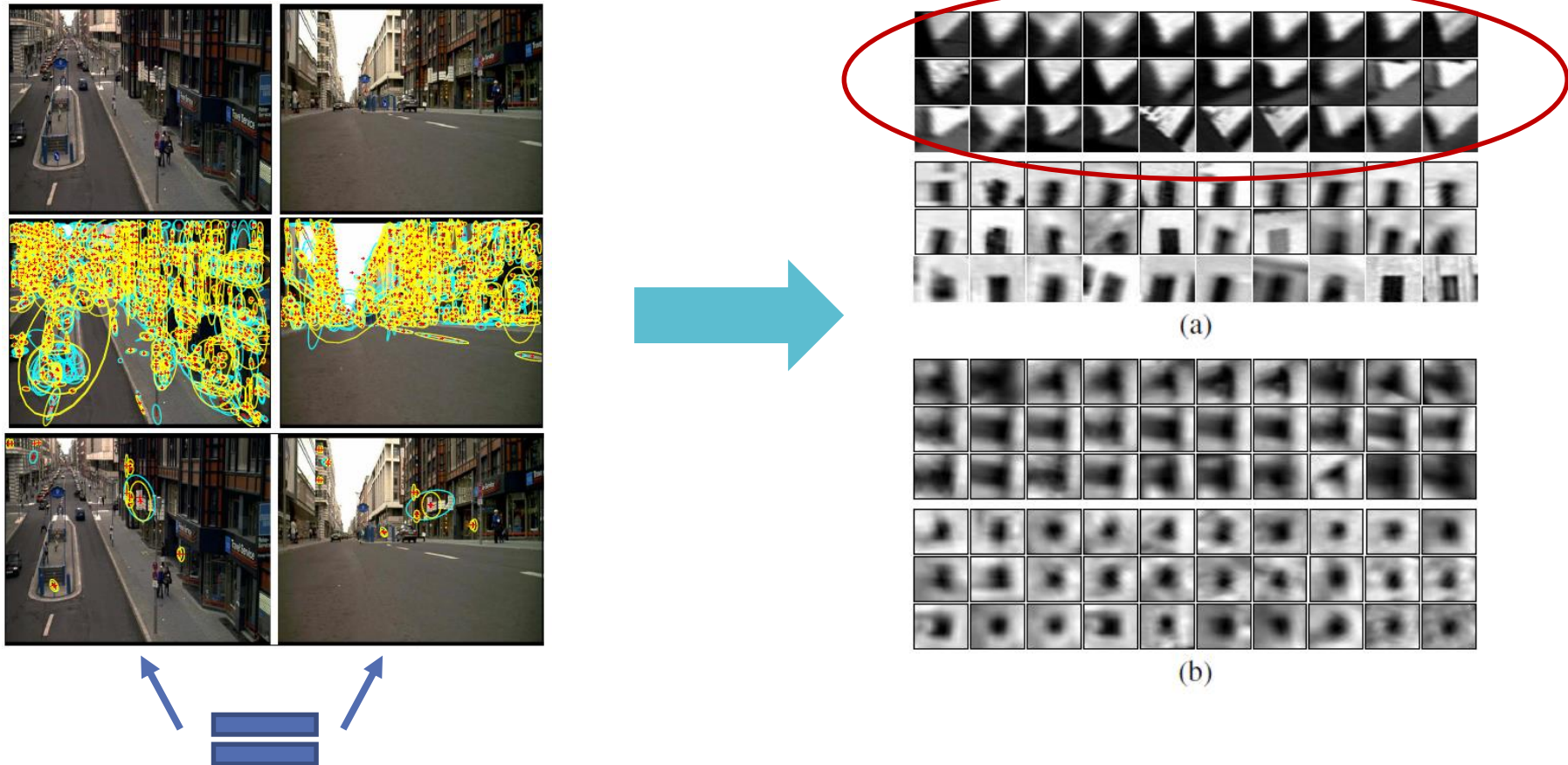
# Visão Computacional – Quantização Vetorial

Sivic and Zisserman (2003) – “Video Google”

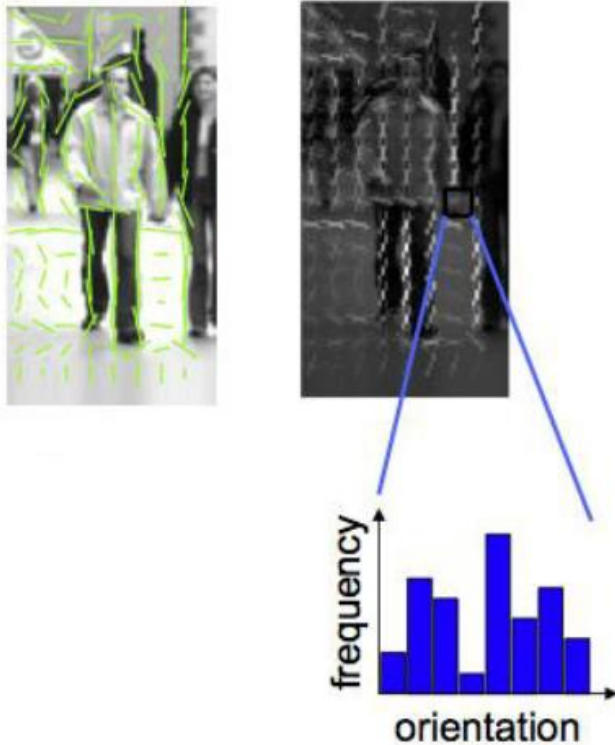


# Visão Computacional – Quantização Vetorial

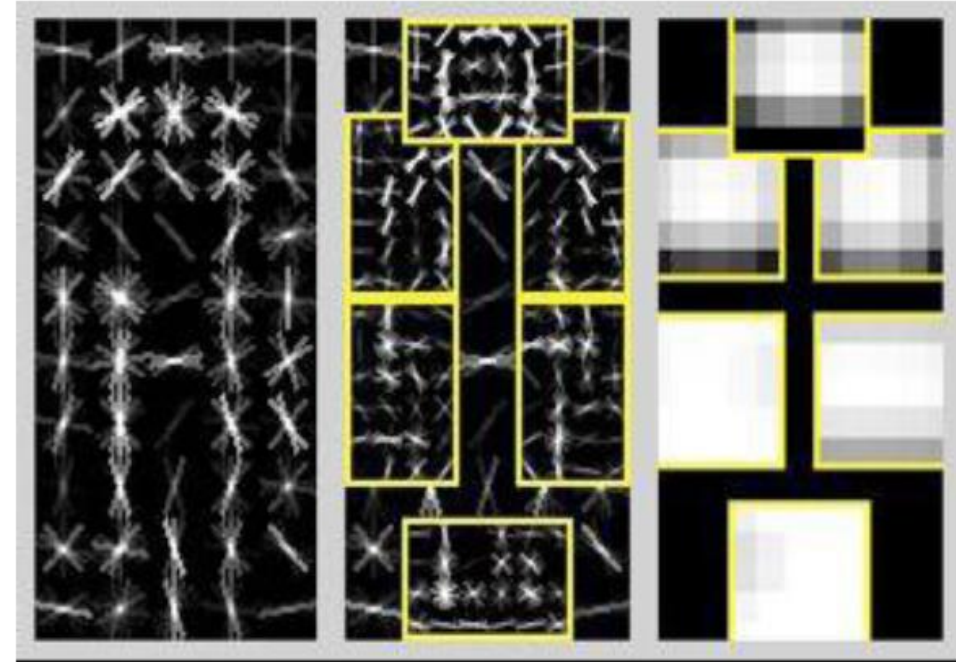
Sivic and Zisserman (2003) – “Video Google”



# Visão Computacional – Projeto de Características



Histogram of Gradients (HoG)  
Dalal & Triggs, 2005



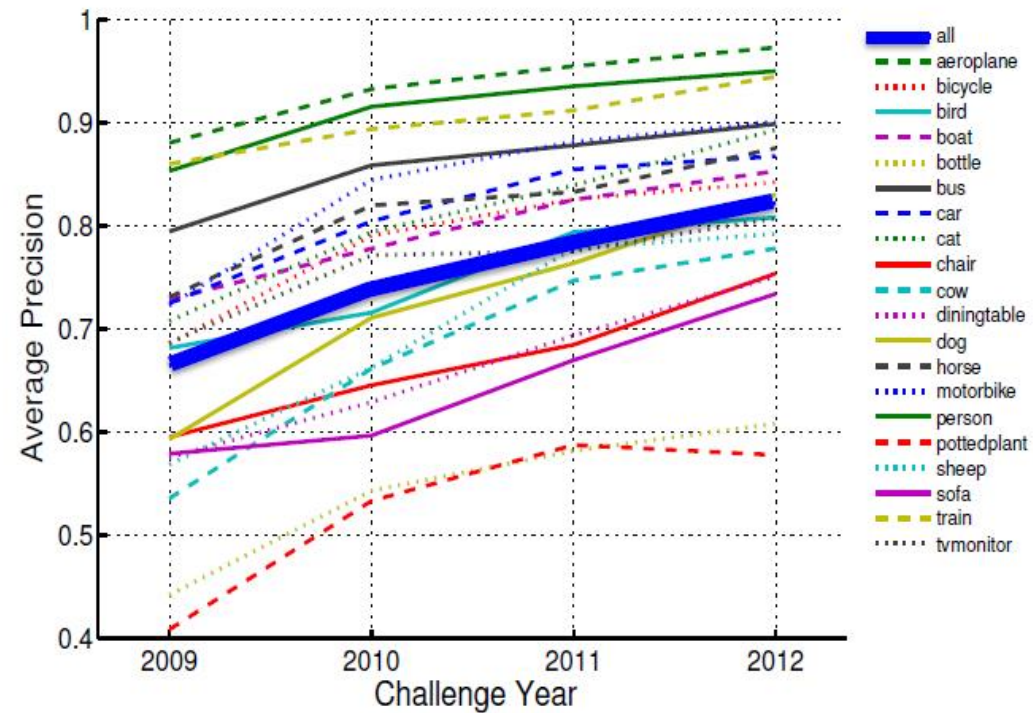
Deformable Part Model  
Felzenszwalb, McAllester, Ramanan,  
2009



# Visão Computacional – *Datasets Desafiadores*

## PASCAL Visual Object Challenge (20 object categories)

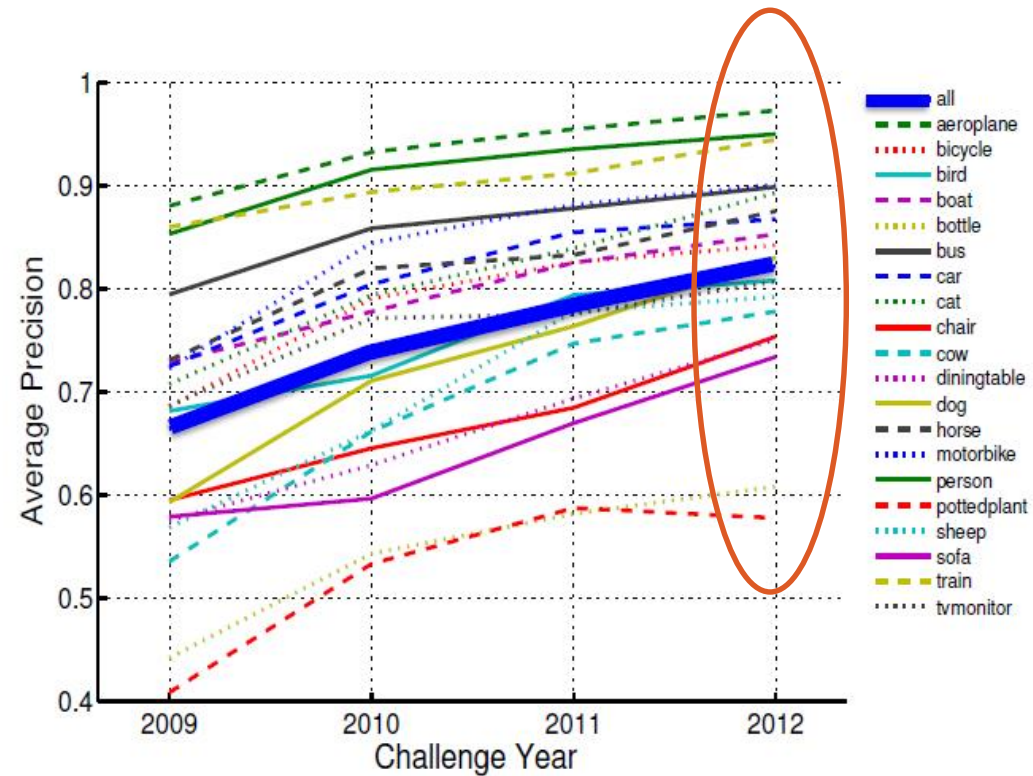
[Everingham et al. 2006-2012]



# Visão Computacional – *Datasets* Desafiadores

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[Everingham et al. 2006-2012]






# Visão Computacional – *Datasets* Desafiadores



IMGENET

[www.image-net.org](http://www.image-net.org)

 **22K** categories and **14M** images

- Animals
  - Bird
  - Fish
  - Mammal
  - Invertebrate
- Plants
  - Tree
  - Flower
  - Food
  - Materials
- Structures
  - Artifact
  - Tools
  - Appliances
  - Structures
- Person
  - Scenes
    - Indoor
    - Geological Formations
  - Sport Activities



Deng, Dong, Socher, Li, Li, & Fei-Fei, 2009



# Visão Computacional – *Datasets* Desafiadores

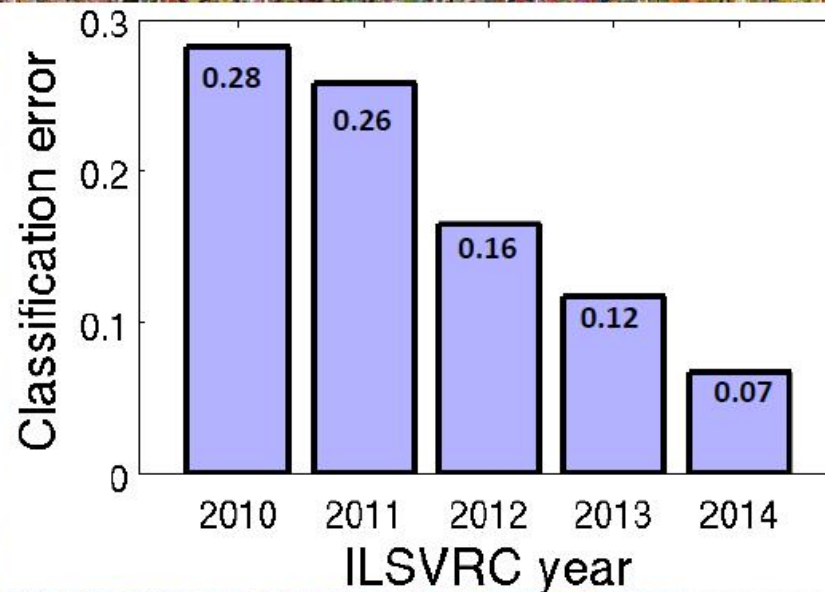
## IMAGENET Large Scale Visual Recognition Challenge

Steel drum

The Image Classification Challenge:

1,000 object classes

1,431,167 images



Russakovsky et al. arXiv, 2014

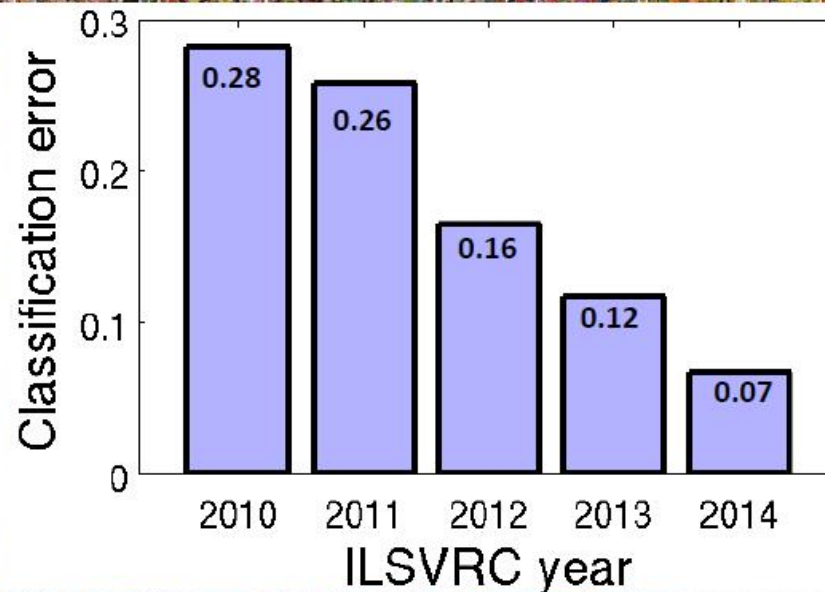


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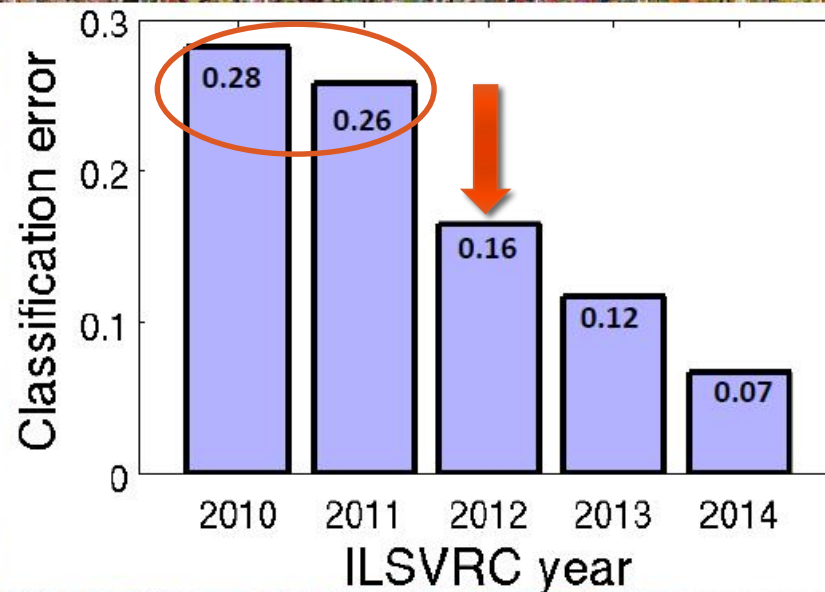


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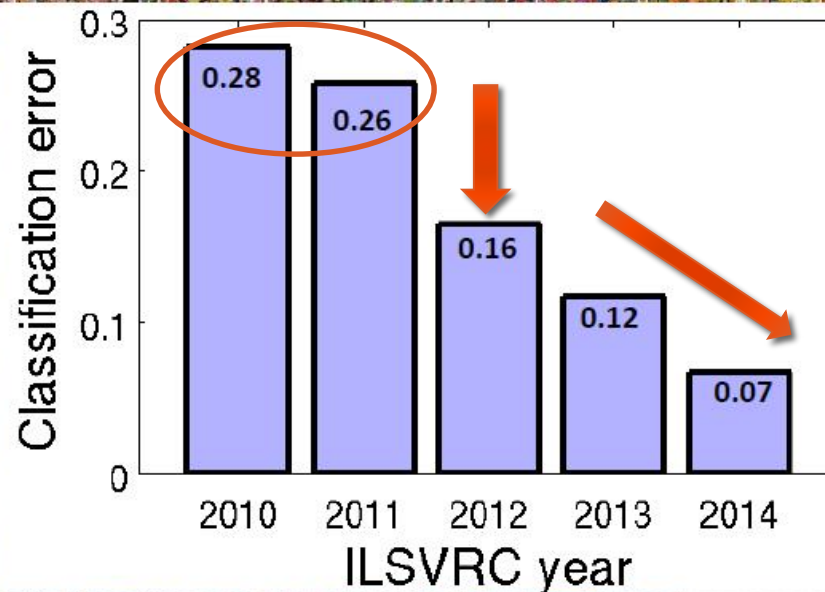


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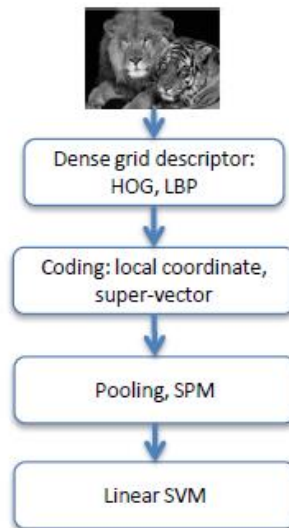
Russakovsky et al. arXiv, 2014

# Visão Computacional – Aprendizagem Profunda

## IMAGENET Large Scale Visual Recognition Challenge

Year 2010

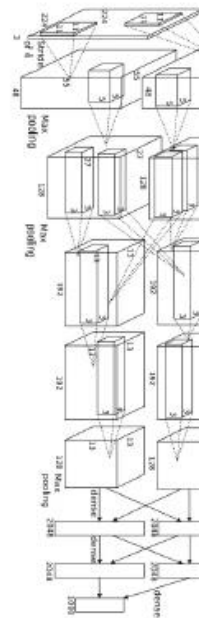
NEC-UIUC



[Lin CVPR 2011]

Year 2012

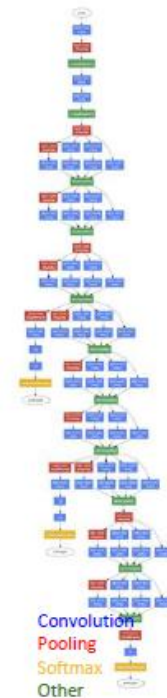
SuperVision



[Krizhevsky NIPS 2012]

Year 2014

GoogLeNet



[Szegedy arxiv 2014]

VGG



[Simonyan arxiv 2014]

Year 2015

MSRA

