

# Computação Visual

(Visual computing)

Licenciatura de Engenharia Informática

Docente:

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6.10**

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# Evaluation

- **Laboratory component:**

Project work (W): 75%

- **Theoretical component: (no minimum grade required)**

Two MAPS (25%)

- 1st Quiz
- 2nd Quiz

$$\text{Final Grade} = 0.75 \times W + 0.25 \times (\text{mean of Quizes})$$

# Working on the Labs ...

1) Matlab, or

2) Programming language: Python

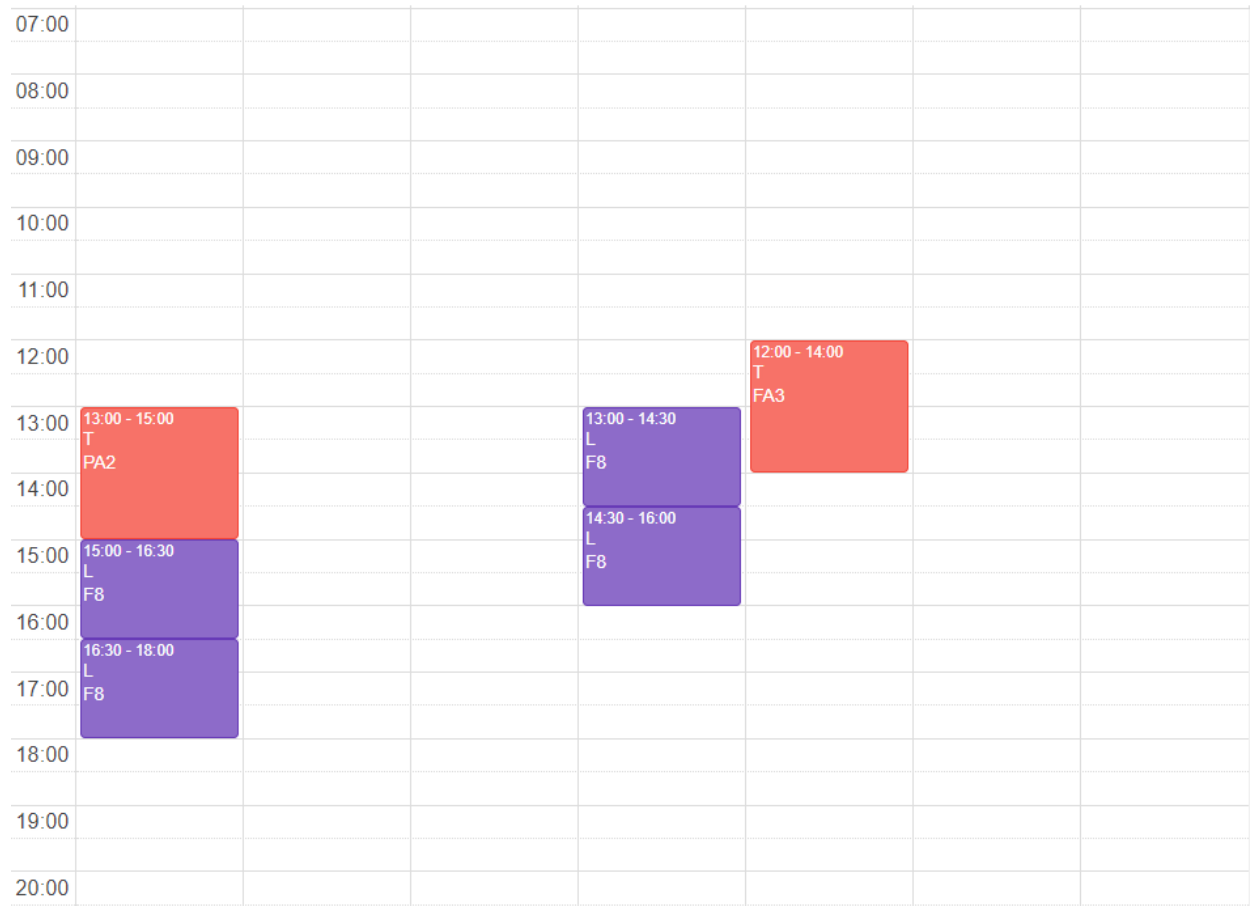
*Used Toolboxes* : OpenCV, numpy, matplotlib  
also with Visual studio ...

# Dates of the Quizes and Project Evaluation

Evaluation	Date
<b>1st Quiz</b>	<b>13th March</b>
<b>2nd Quiz</b>	<b>30th March (or 2nd April)</b>
<b>Exam (all material, i.e., 1<sup>st</sup> and 2<sup>nd</sup> quiz)</b>	<b>14th April</b>

**April 7-10 – Project Discussion**

# Working groups registration



# Laboratories

During the laboratories:

The teacher will conduct all the experiments during the lab sessions

Some of the students may be called upon to carry out exercises

It is highly suggested that all the students will perform the software development during the classes.

With some exceptions, the teacher can make available the software in Github., specifically in:

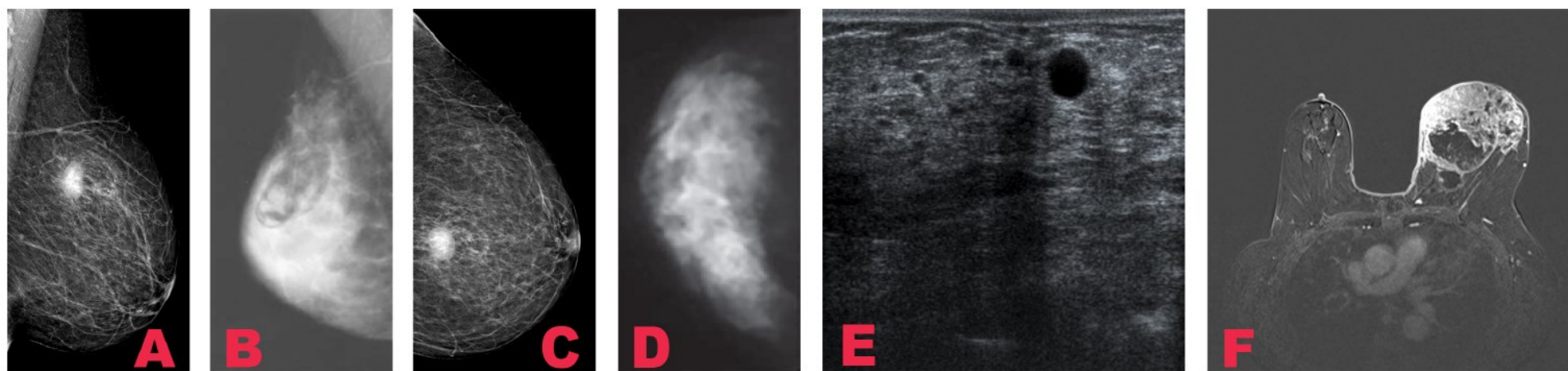
<https://github.com/JacintoCNascimento/ist-cv-2526>

**(Labs and Theoretical directories)**

# What I am doing, my research ...

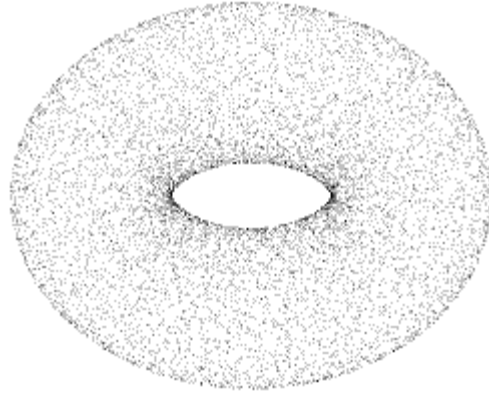
- **Machine learning (Deep Learning) applied in several image analysis applications:**
  - 1- Breast image
  - 2- Localizing organs responsible for mortality prediction
  - 3- Point cloud registration
  - 4- LV endocardium segmentation
- **New methods to speed-up Deep Neural Networks**

# Breast diagnosis using Deep Learning





# Why point Clouds ?



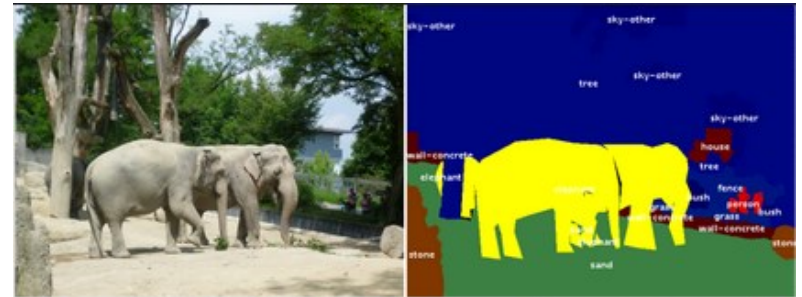
**Point clouds** are essentially the simplest form of 3D models. They are collections of individual points plotted in 3D space.

# Applications of Point Clouds (i)

- 2D Semantic segmentation

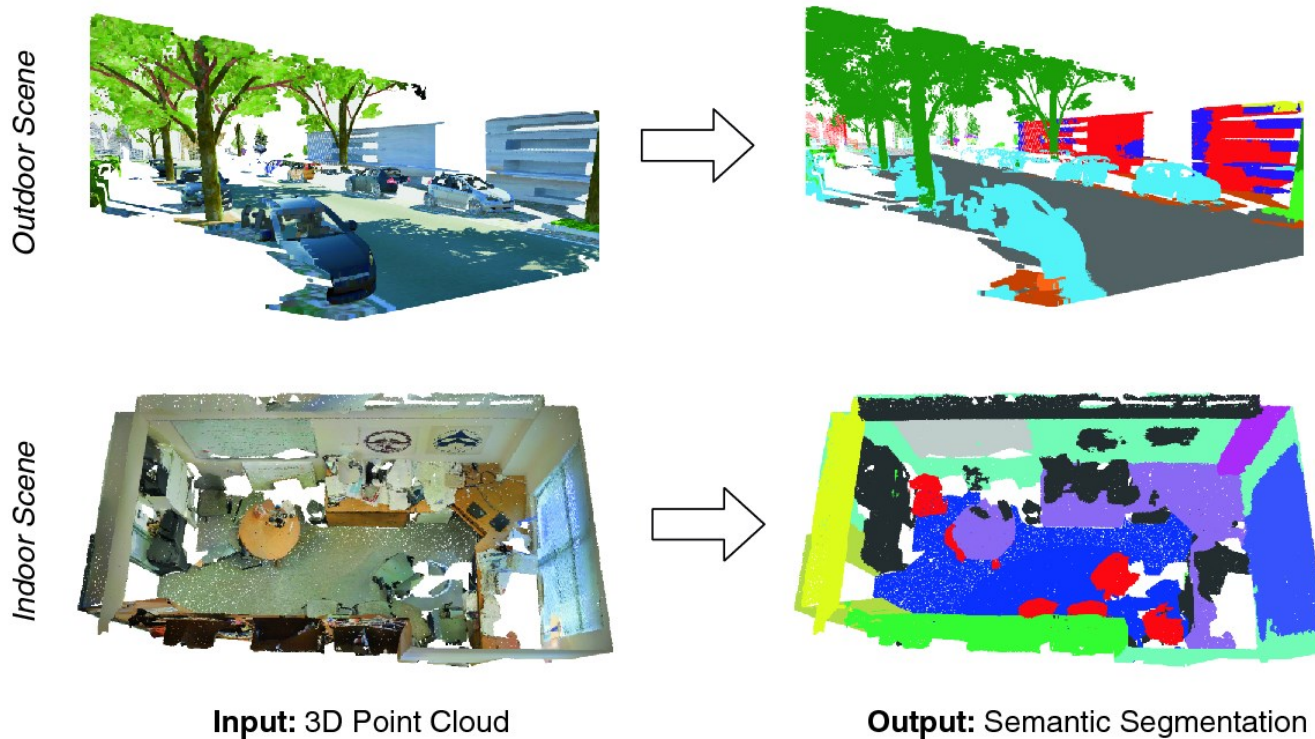


Road	Sidewalk	Building	Fence
Pole	Vegetation	Vehicle	Unlabel



# Applications of Point Clouds (ii)

- 3D Semantic segmentation



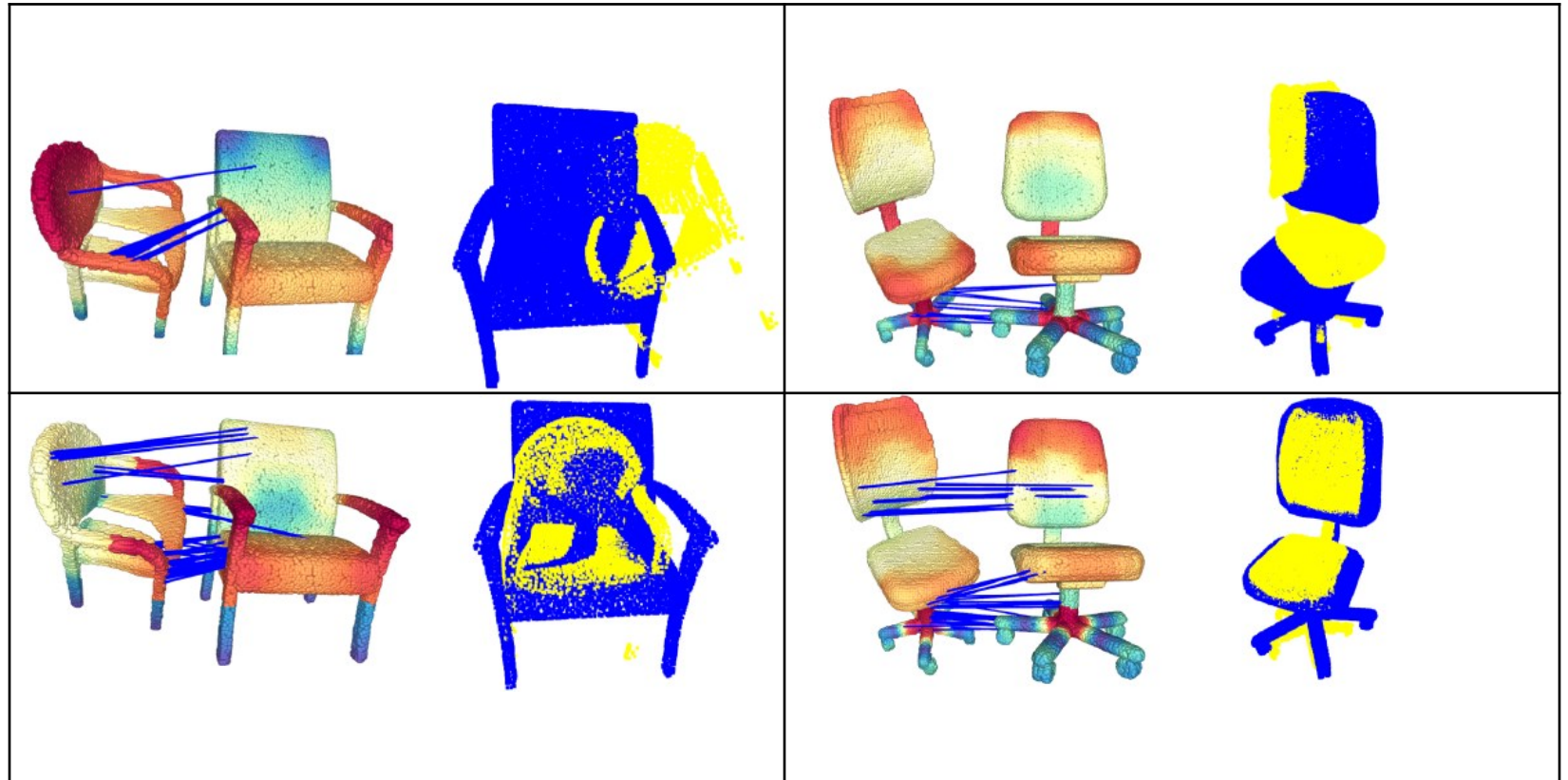
# Applications of Point Clouds (iii)

- 3D Semantic segmentation

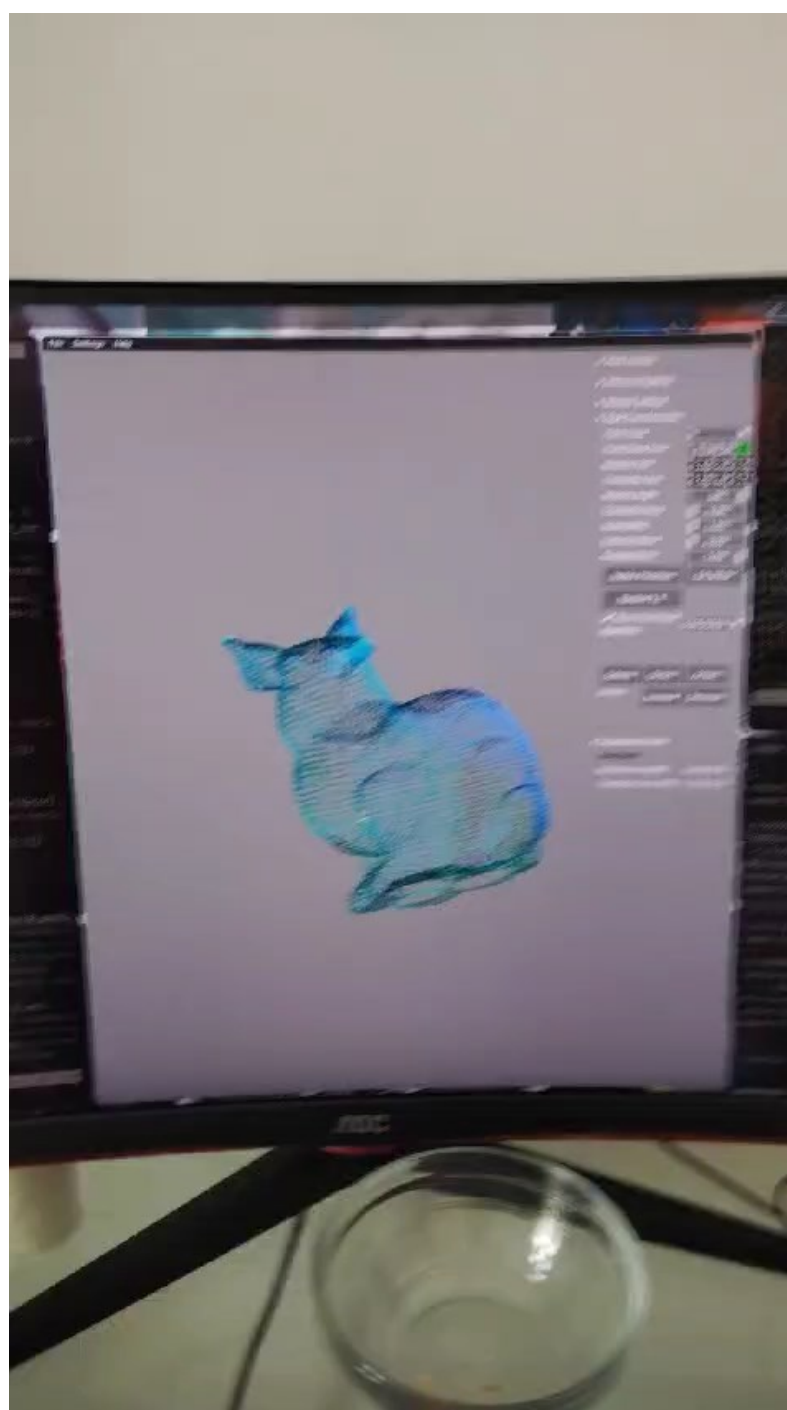




# Why is difficult ?



Example: pose registration of different object instances from the same category



# Course contents

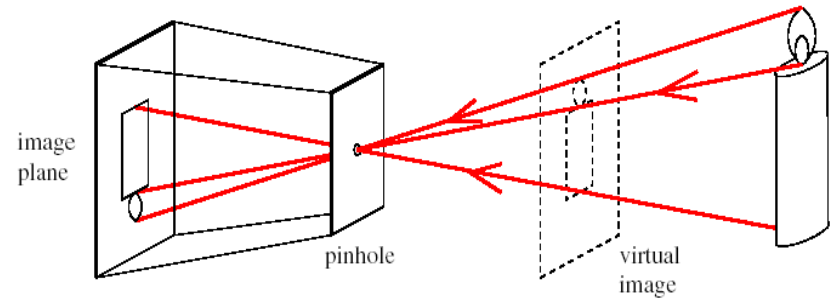
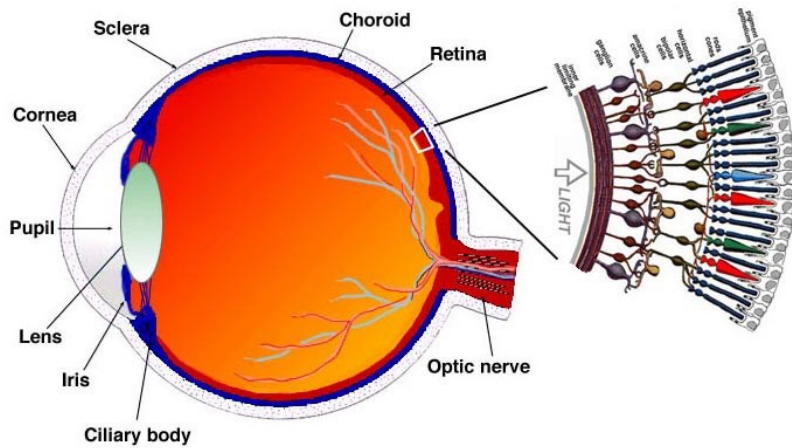
- 1 – Introduction
- 2 – Fundamentals
- 3 – Binary image analysis
- 4 – Image pre-processing
- 5 – Extraction of color and texture
- 6 – Motion analysis
- 7 – Region segmentation
- 8 – Interactive segmentation, Tracking, Applications
- 9 – Calibration and Homography

# Bibliography

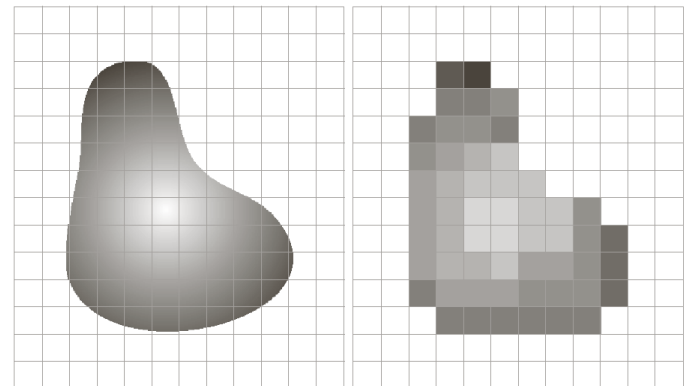
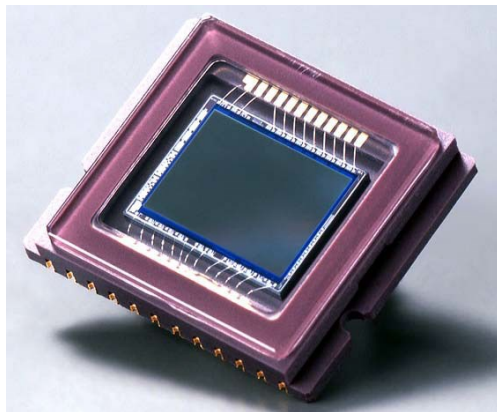
- [1] - L. Shapiro, G. Stockman, “Computer Vision”, 2001, Prentice Hall, ISBN – 0-13-030796-3;
- [2] - R. Gonzalez, R. Woods, “Digital Image Processing”, Pearson International Edition, 3ª edição, 2008, ISBN: 0-13-505267-X;
- [3] – Mubarak Shah, Fundamentals of Computer Vision, December, 1997, on-line publication;
- [4] - Richard Szeliski, Computer Vision: Algorithms and Applications, Springer, 2011 (a pdf version is freely available at: <http://szeliski.org/Book/>)



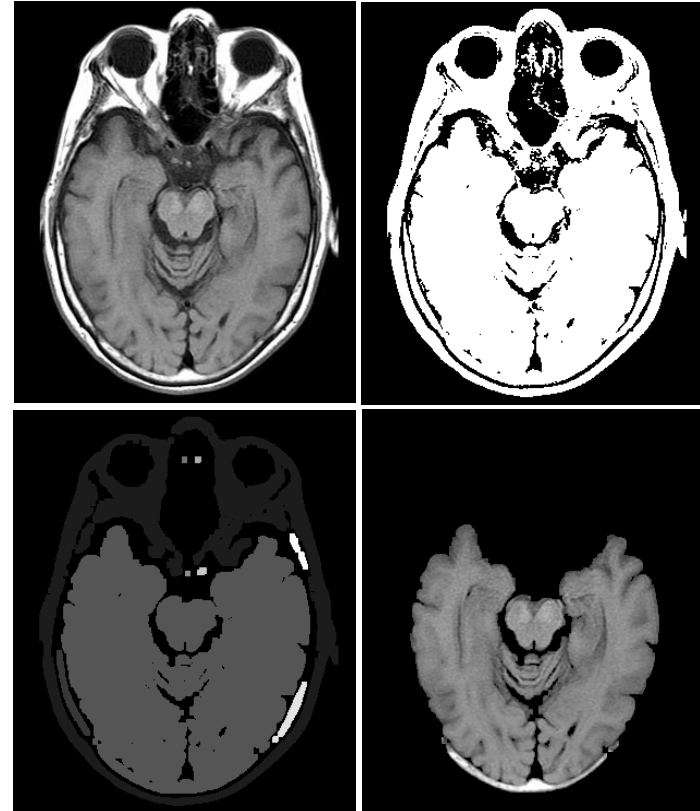
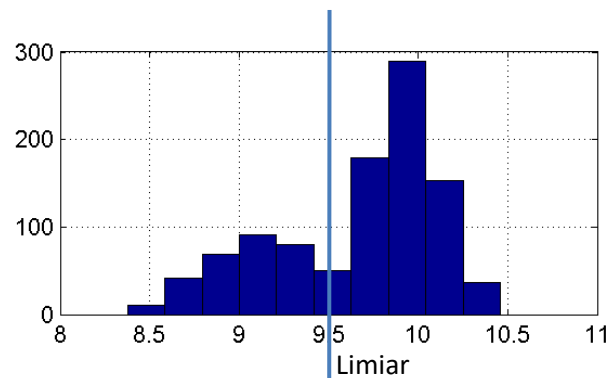
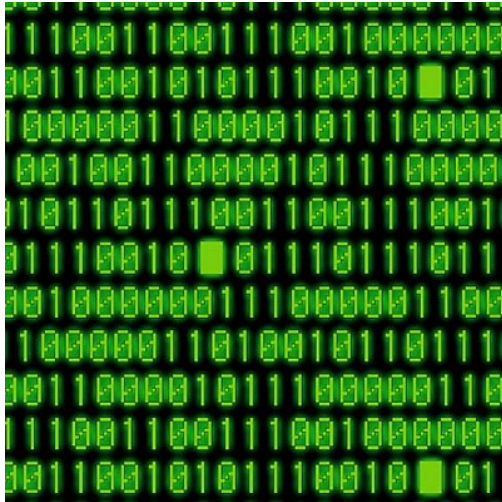
# Fundamentals



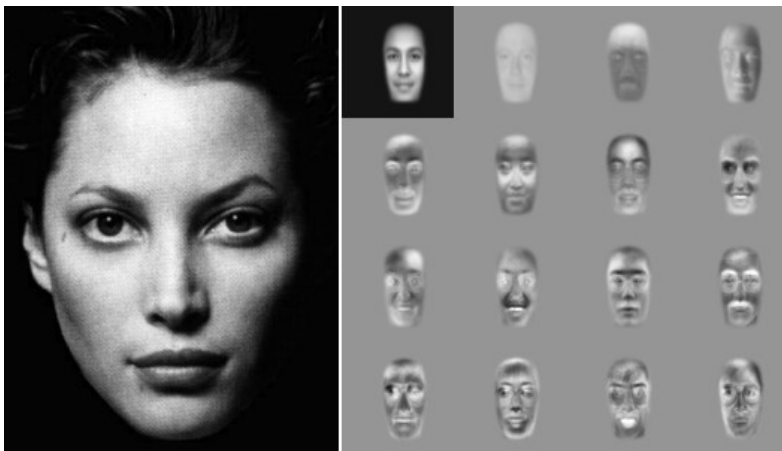
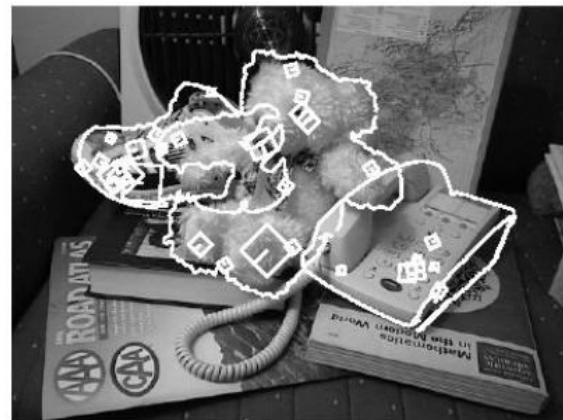
*Fig. 1.1. A drawing of a section through the human eye with a schematic enlargement of the retina.*



# Binary image analysis

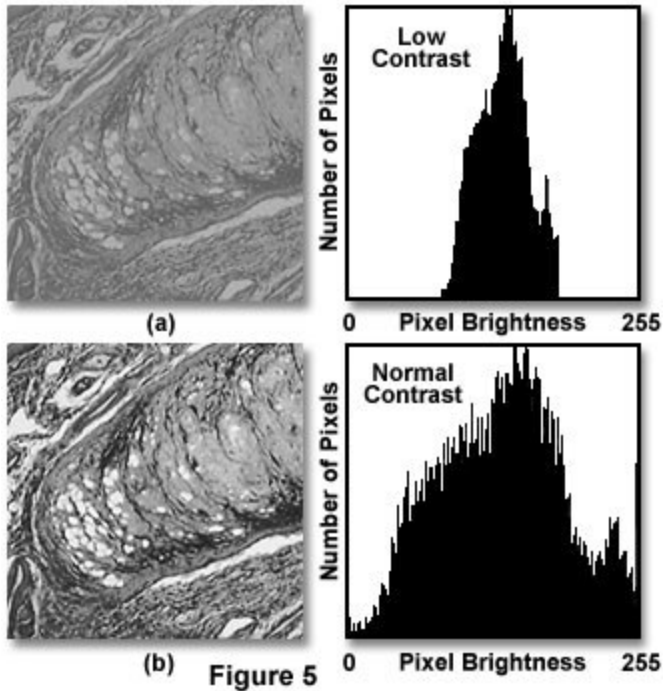


# Pattern recognition



# Image pre-processing

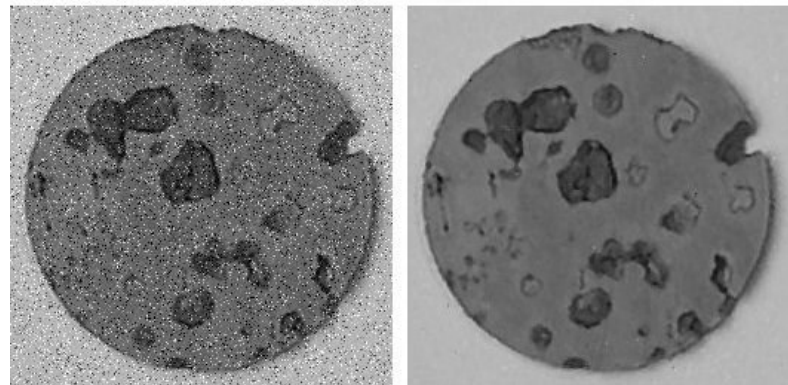
Contrast Enhancement by Histogram Stretching



Embossing filter

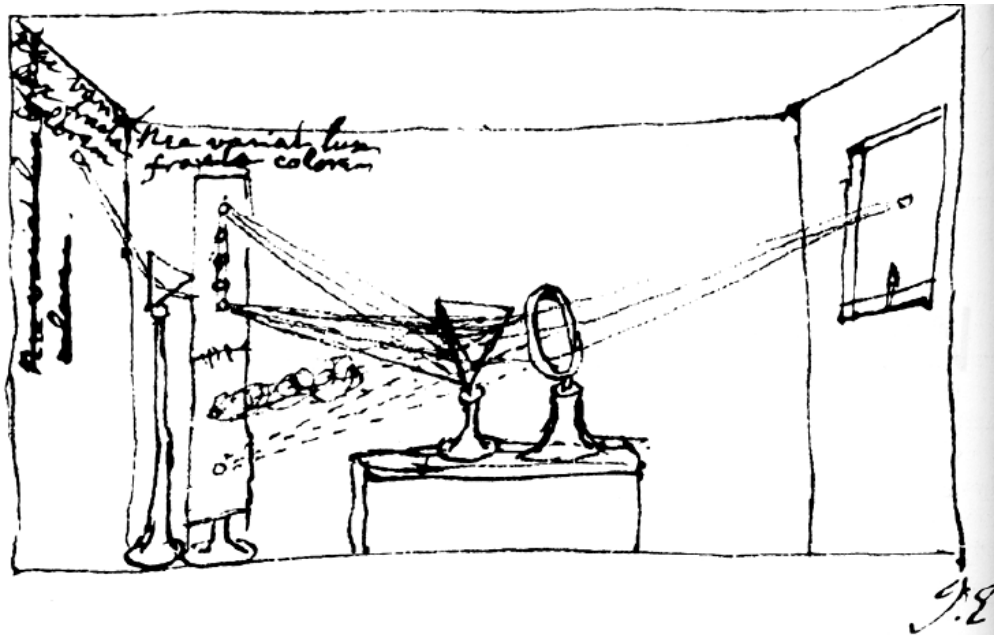


MEDIAN FILTER

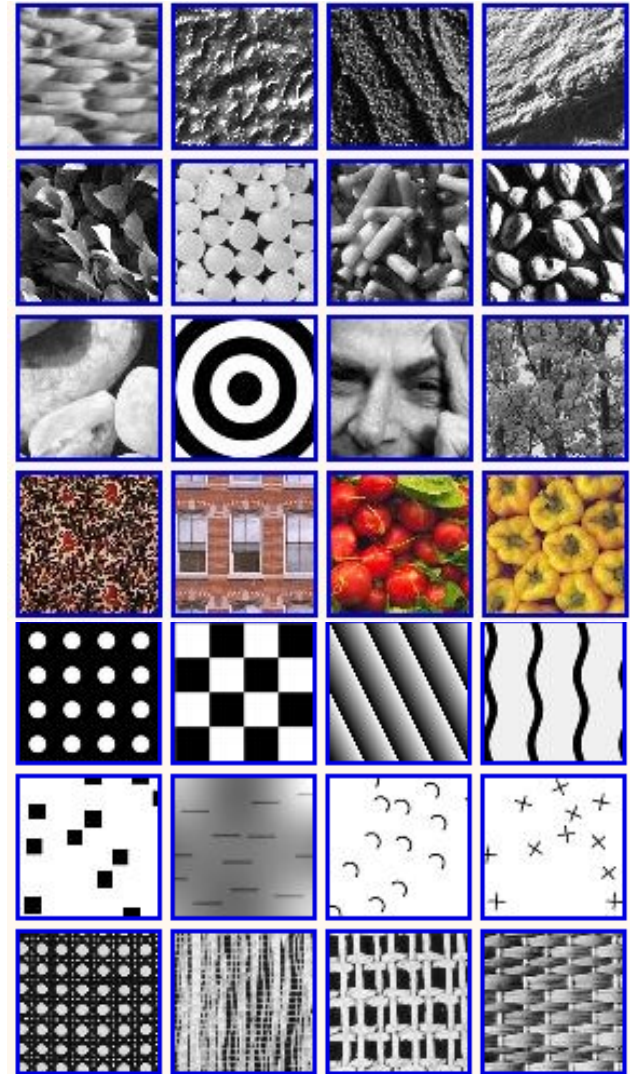




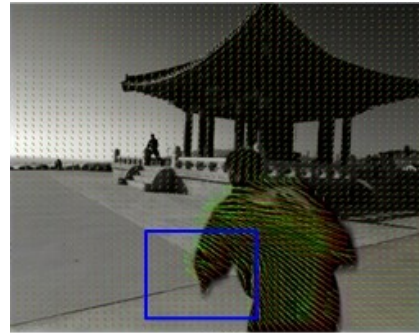
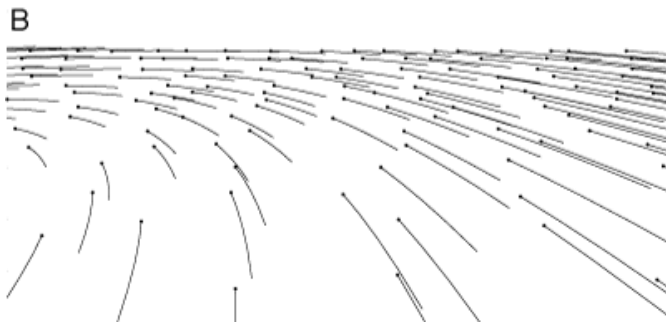
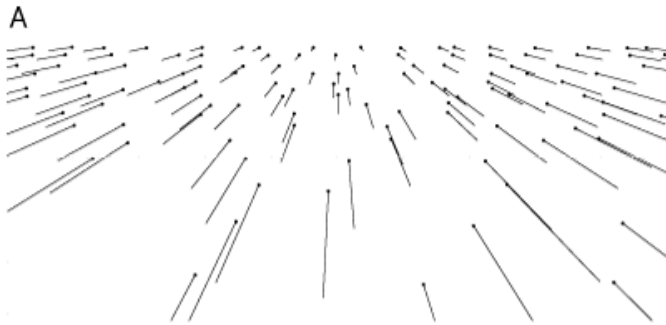
# Color and texture



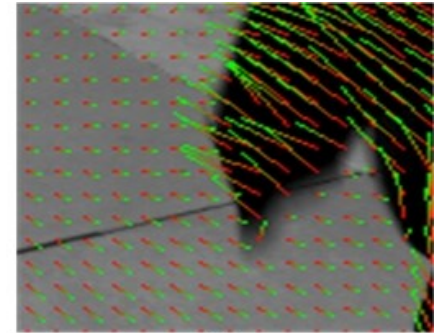
4.1 NEWTON'S SUMMARY DRAWING of his experiments with light. Using a point source of light and a prism, Newton separated sunlight into its fundamental components. By recombining the rays, he also showed that the decomposition is reversible.



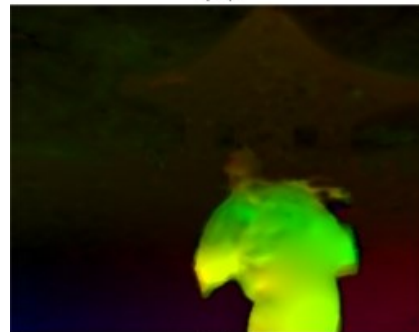
# Motion analysis



(a)



(b)

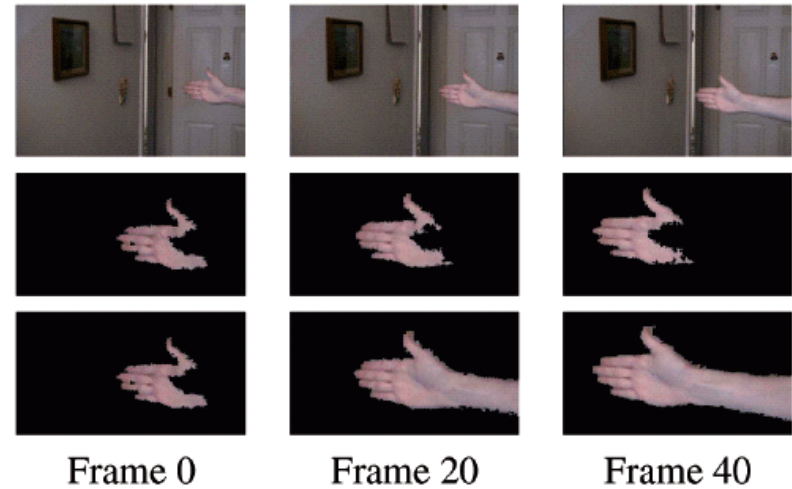
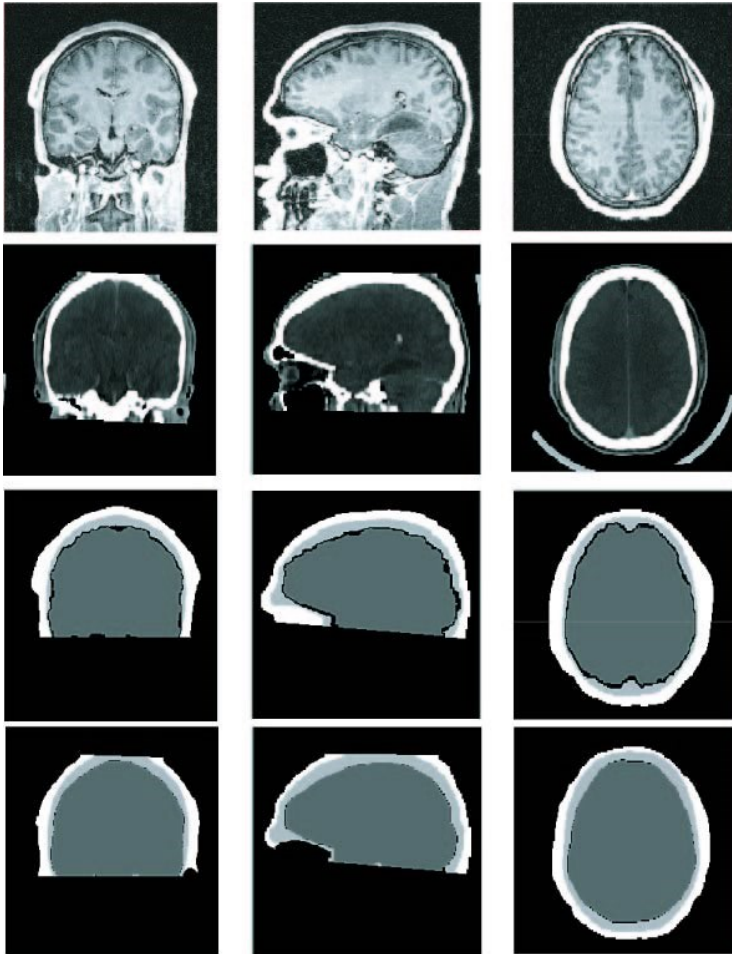


(c)



(d)

# Segmentation





# Calibration and Homography

