

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

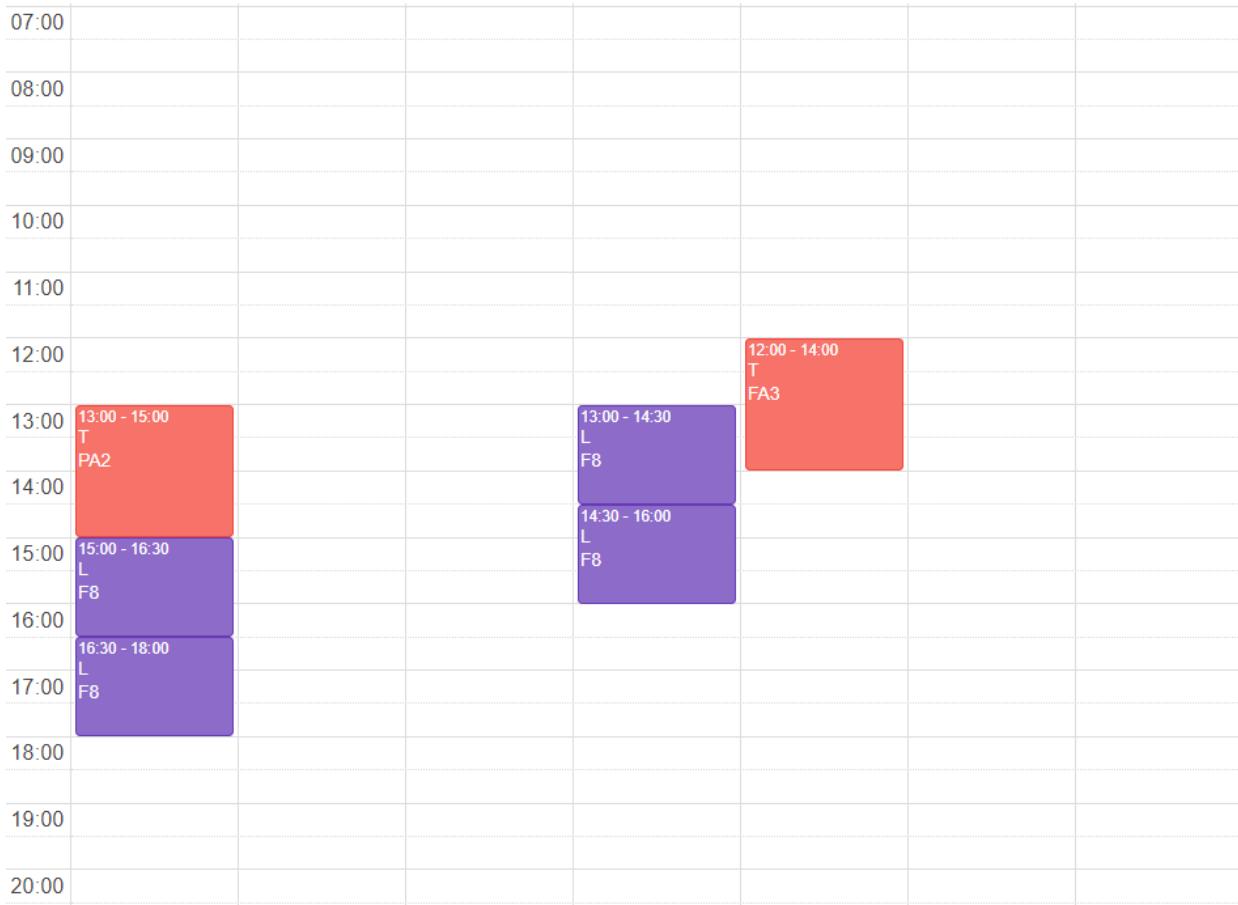
*Used Toolboxes : OpenCV, numpy, matplotlib
also with Visual studio ...*

Dates of the Quizes and Project Evaluation

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

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:

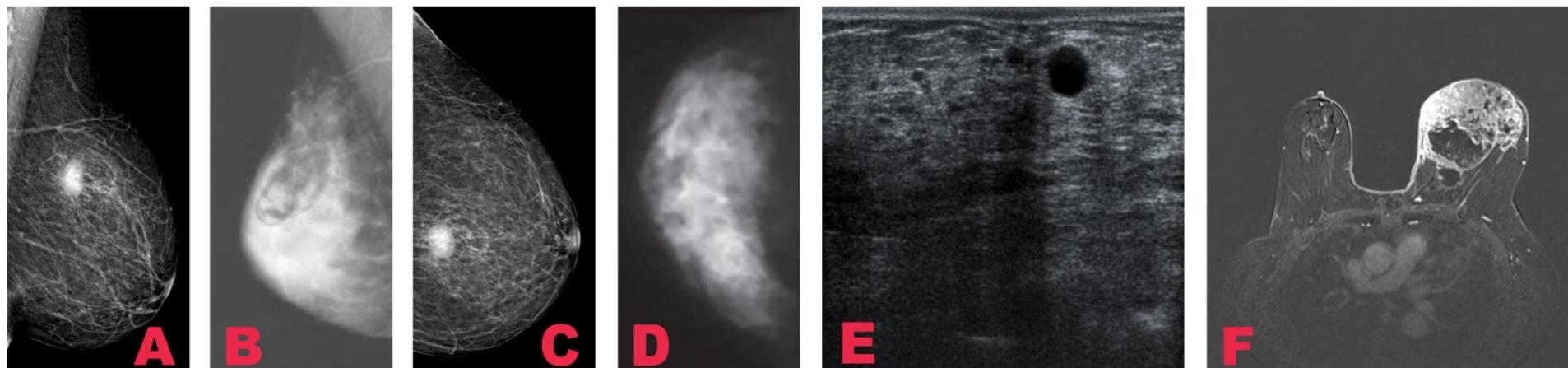
<https://github.com/JacintoCNascimento/ist-cv-2526>

(Labs and Theoretical directories)

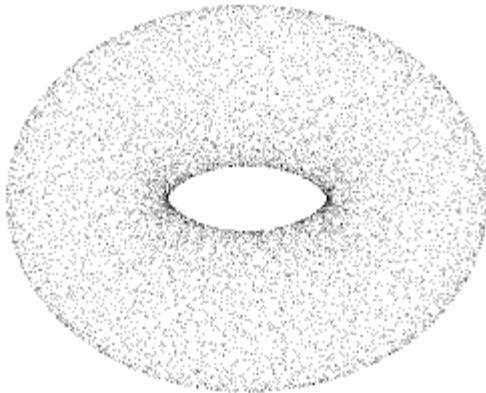
What I am doing, my research ...

- **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



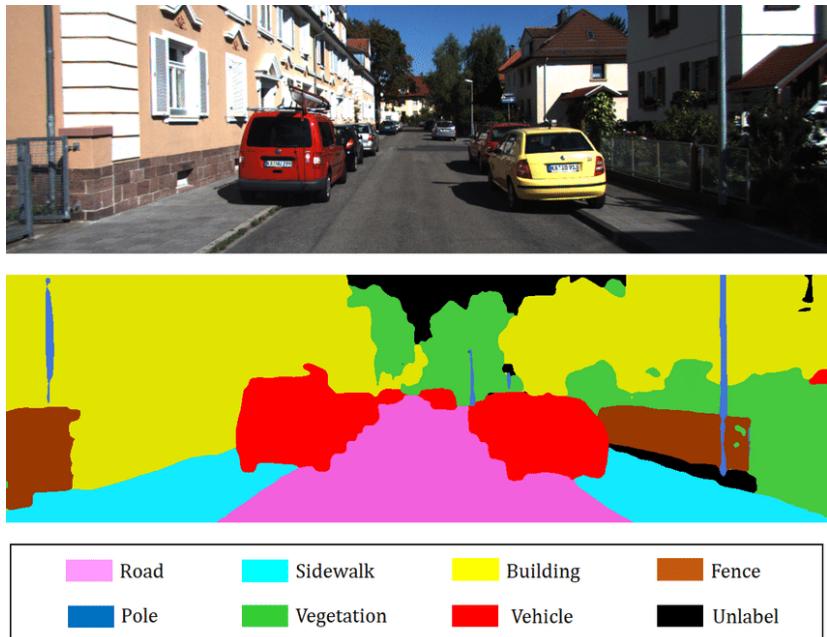
Why point Clouds ?



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

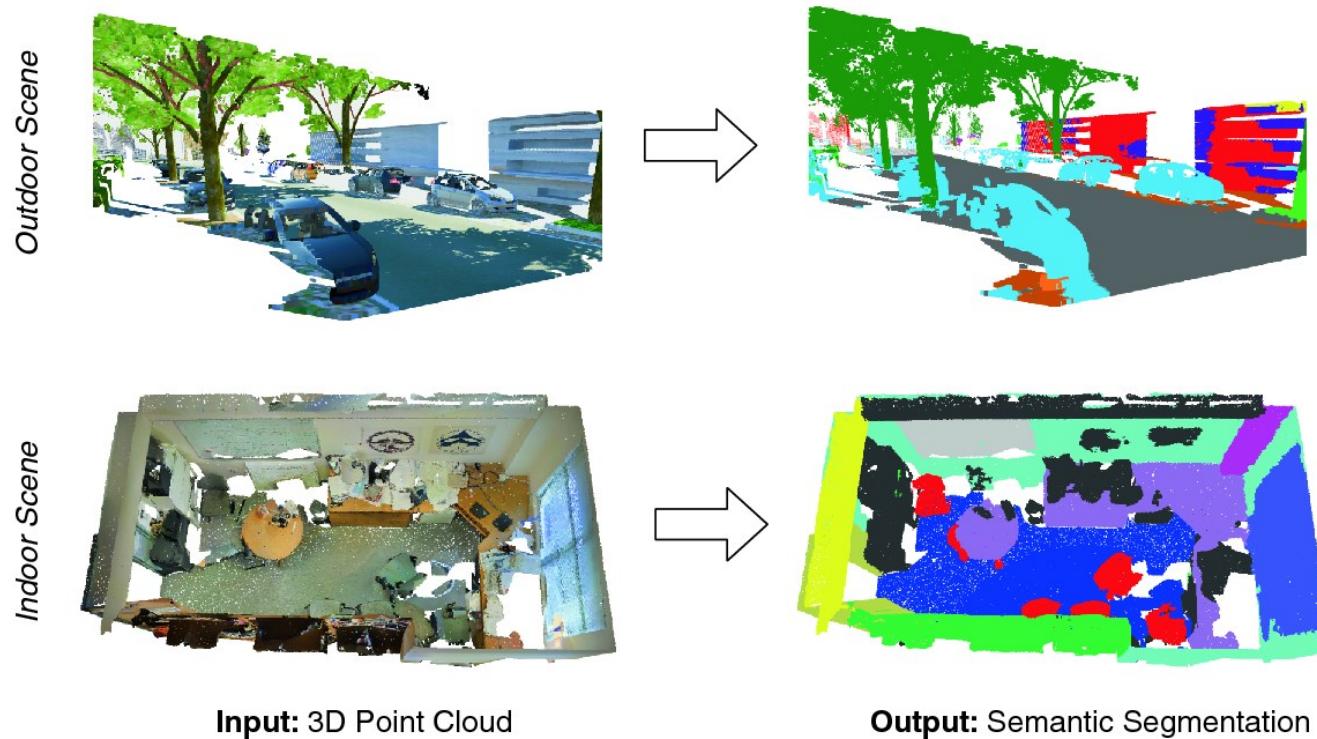
Applications of Point Clouds (i)

- 2D Semantic segmentation



Applications of Point Clouds (ii)

- 3D Semantic segmentation

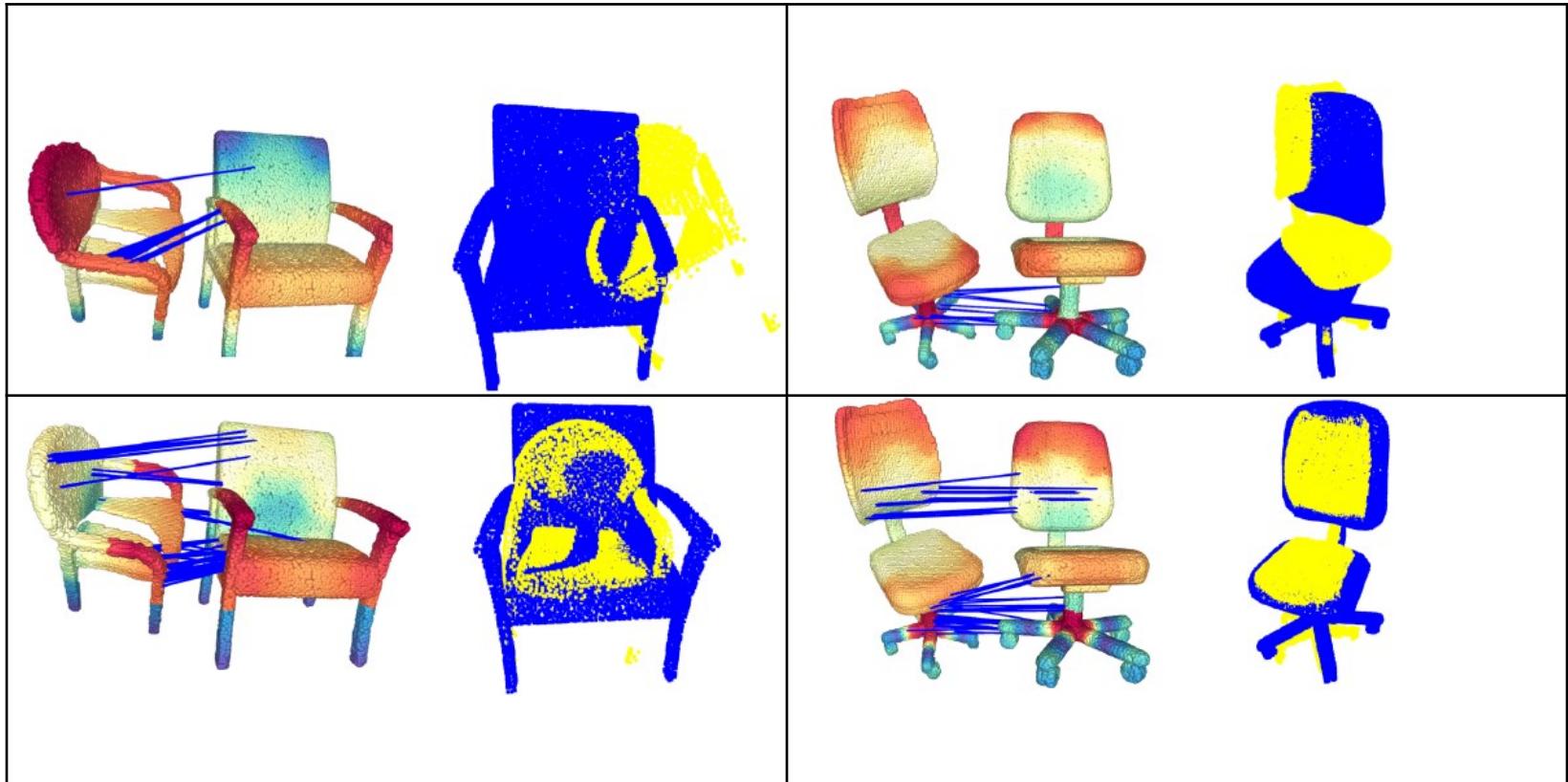


Applications of Point Clouds (iii)

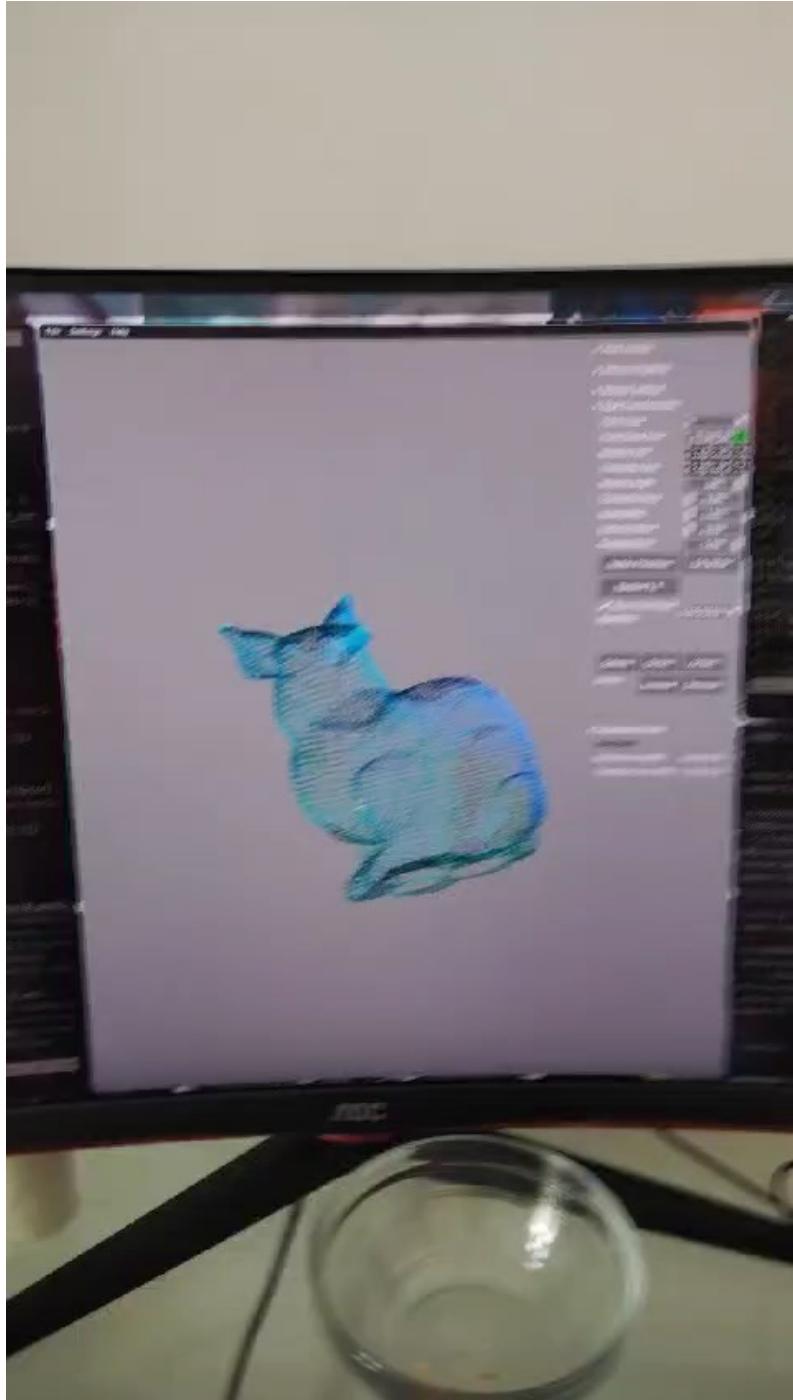
- 3D Semantic segmentation



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, 3^a 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

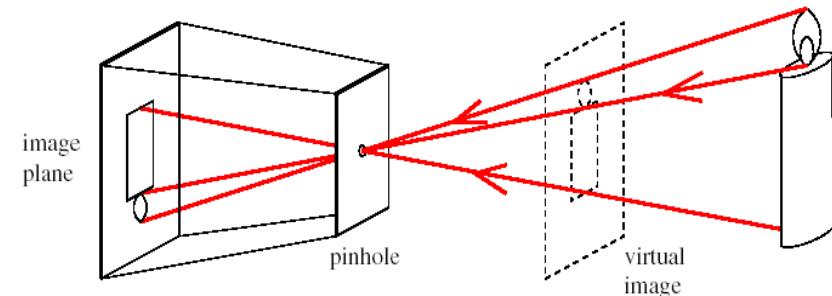
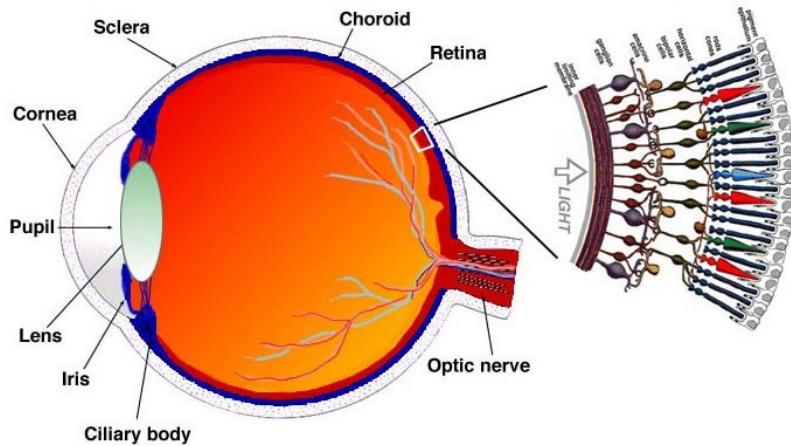
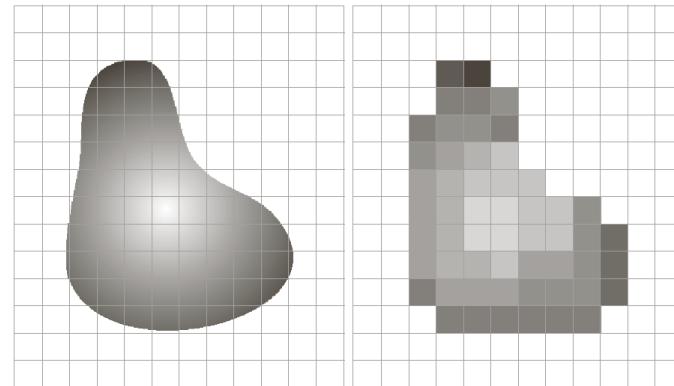
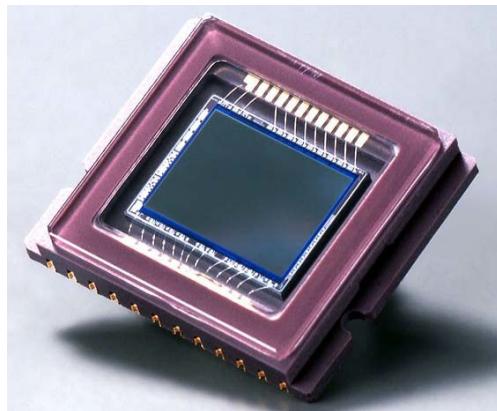


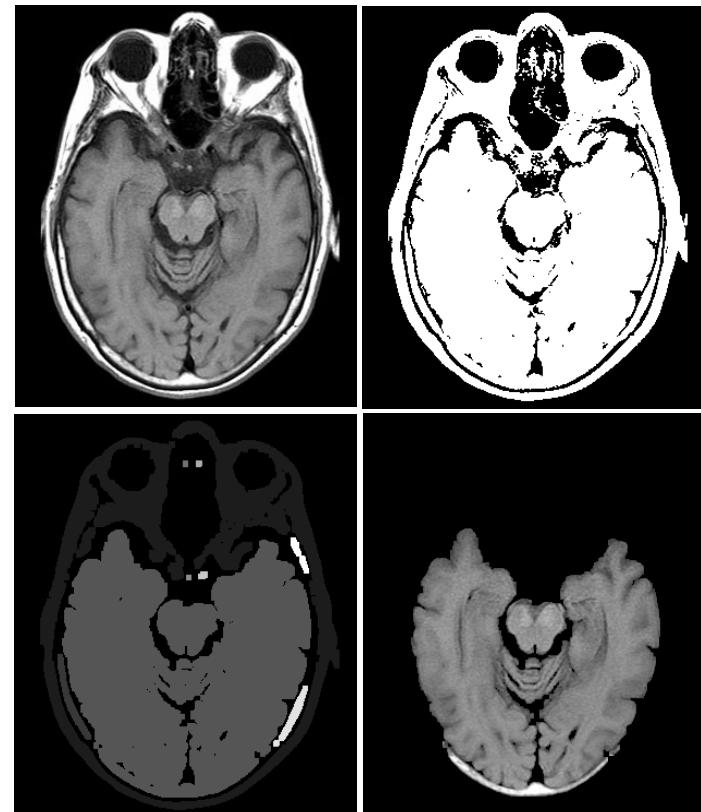
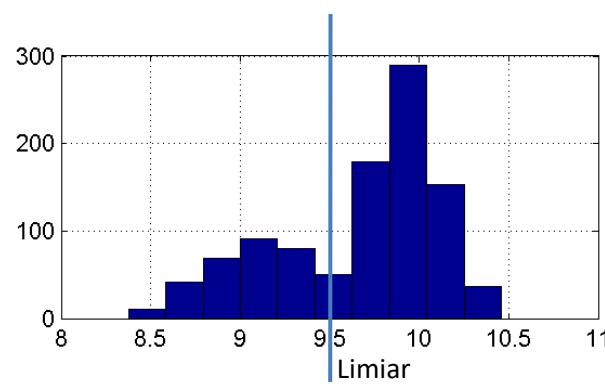
Fig. 1.1. A drawing of a section through the human eye with a schematic enlargement of the retina.



Binary image analysis

A 10x10 grid of binary code representing a brain image. The code consists of green digits on a black background. The pattern is a grayscale brain scan where darker areas are represented by '0's and lighter areas by '1's.

```
111001100111001000000  
00110010101110010■01  
100000110000101110000  
00100110000101110000  
1101101110011001111001  
01110010■01110111011  
001000000111000001100  
100000110100101101111  
001100001011100000110  
111001100111001000000  
00110010101110010■01
```



Pattern recognition

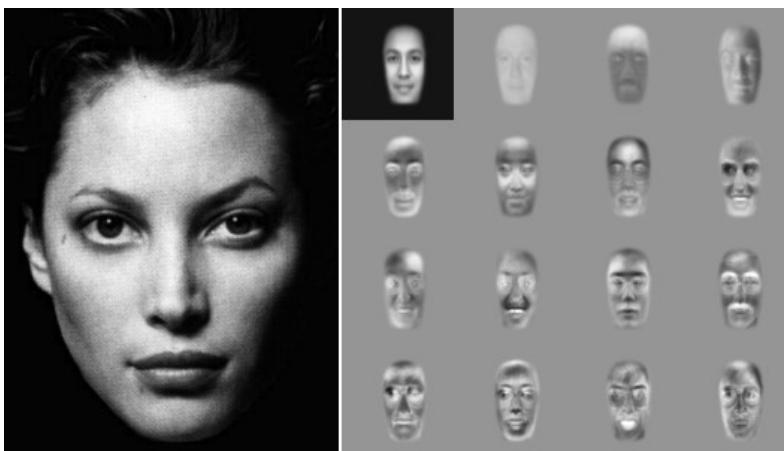
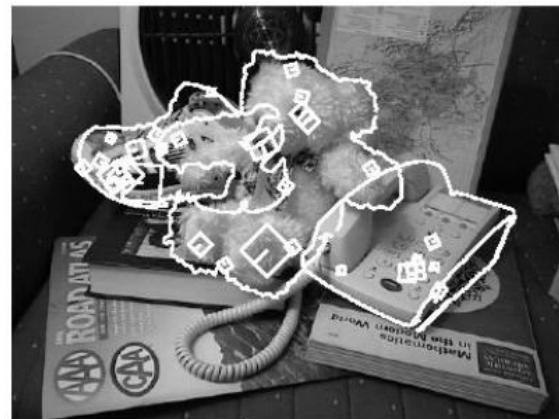


Image pre-processing

Contrast Enhancement by Histogram Stretching

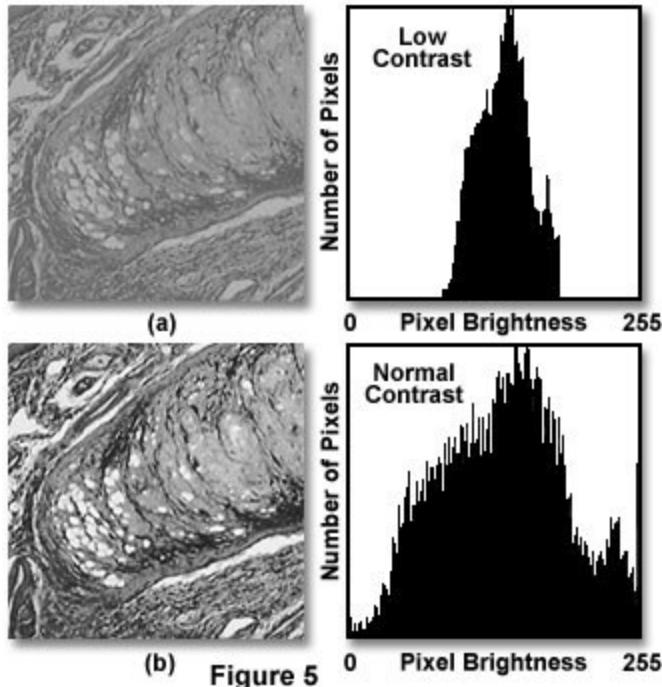
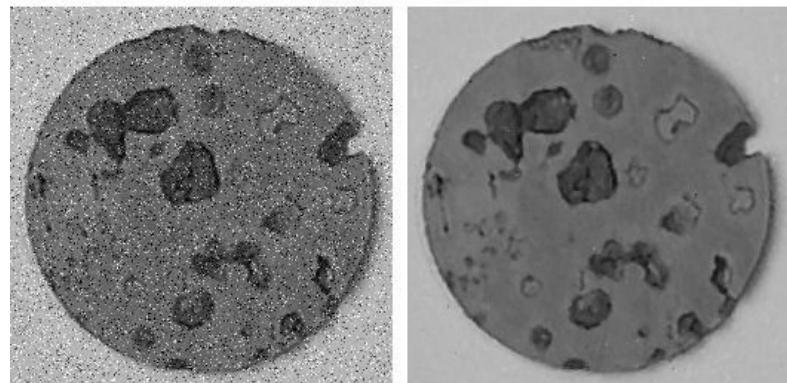


Figure 5

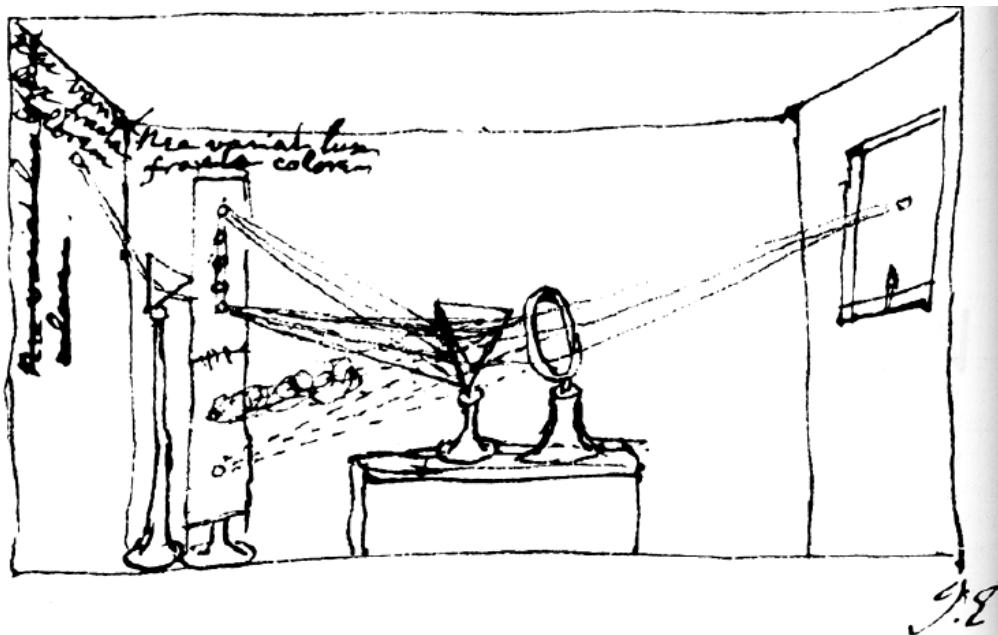
Embossing filter



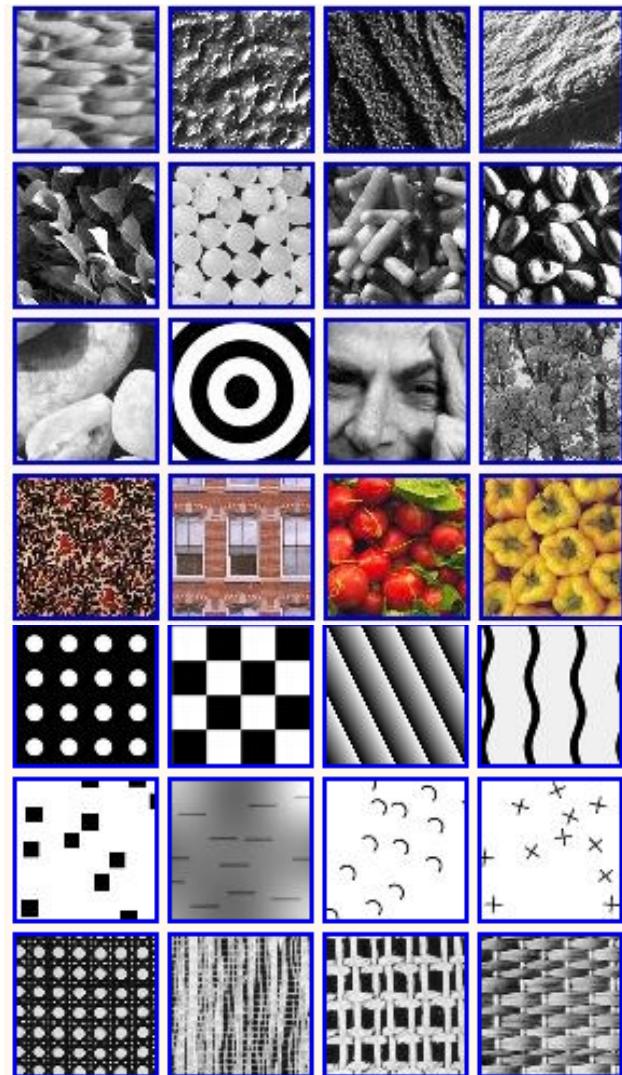
MEDIAN FILTER



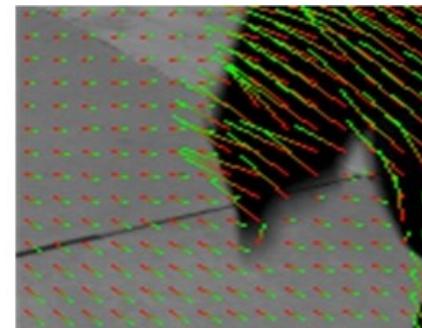
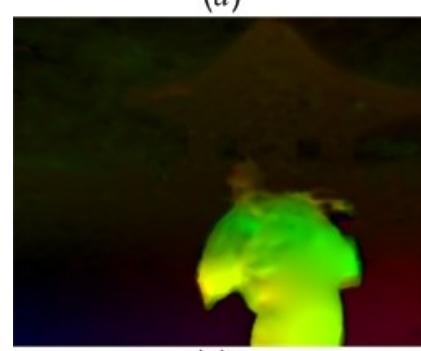
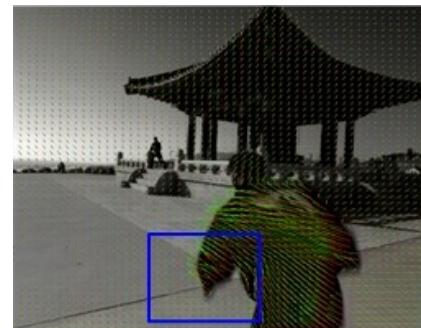
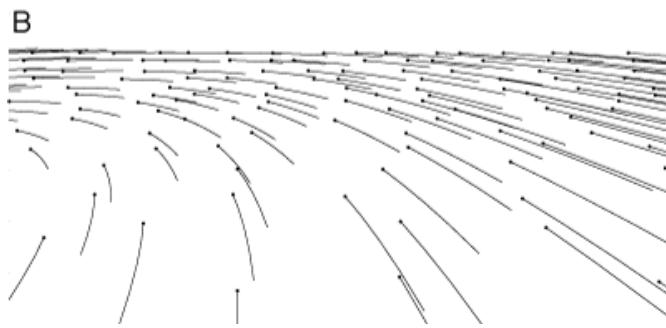
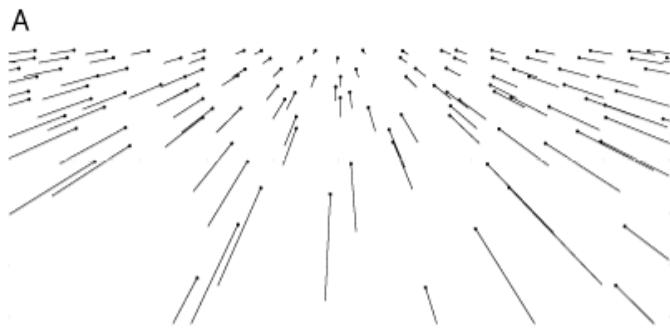
Color and texture



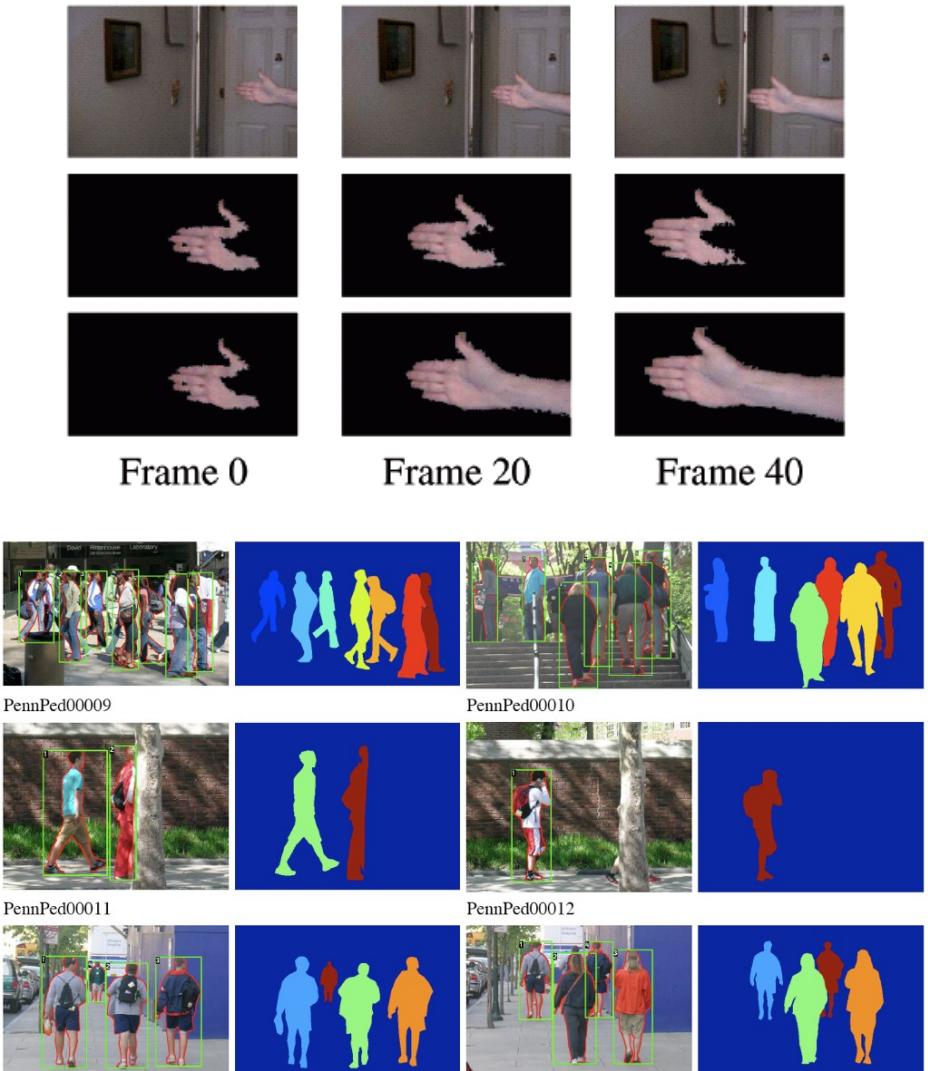
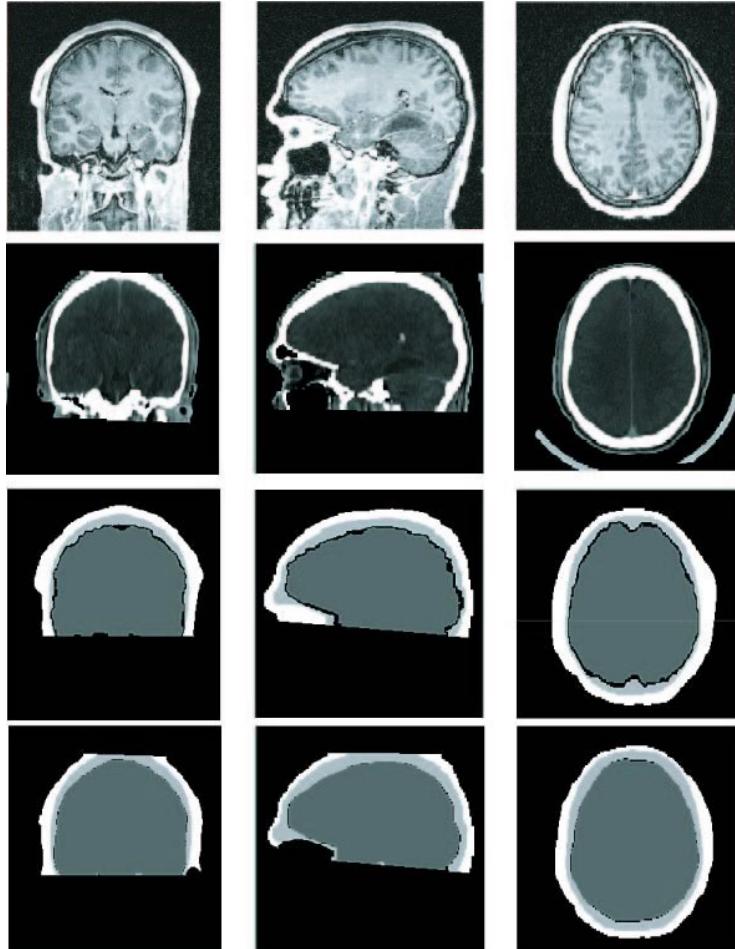
4.1 NEWTON'S SUMMARY DRAWING of his experiments with light. Using a point source of light and a prism, Newton separated sunlight into its fundamental components. By reconverging the rays, he also showed that the decomposition is reversible.



Motion analysis



Segmentation



Calibration and Homography

