
Image Analysis and Pattern Recognition

Prof. Jean-Philippe THIRAN

Signal Processing Lab (LTS5)

Room ELD 240

E-mail: JP.Thiran@epfl.ch



Signal Processing Laboratory (LTS5)
Swiss Federal Institute of Technology (EPFL), Lausanne, Switzerland

EPFL

- Learn basic methods in pattern recognition and digital image analysis.
- Pattern Recognition:
 - Design an automatic or semi-automatic system able to recognise shapes presented to it.
 - Human being are perfect pattern recognition systems!
 - Image processing and machine learning techniques allow to approach those performances by automatic systems.

- Examples :

- Optical character recognition (OCR), word recognition, sentences recognition, meaning recognition ...

Valentin

est
très heureux
de vous
annoncer ...



La naissance
de son petit frère

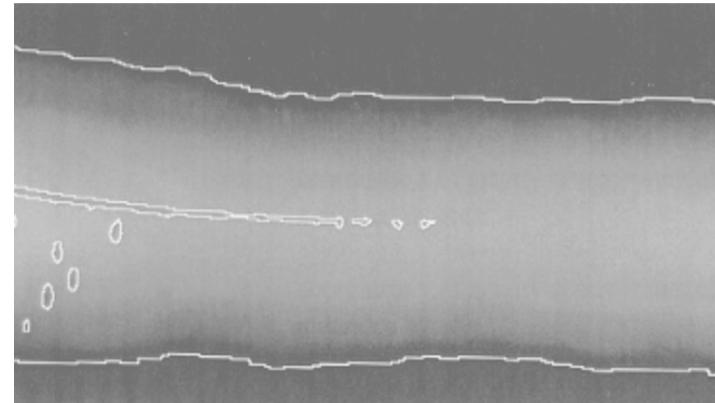
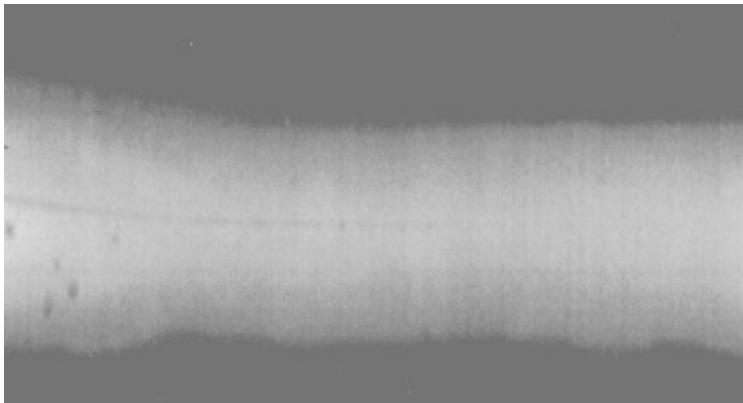
Né le 15/02/2000
à 11h16 du soir
avec un poids
de 3kg 140

Florent



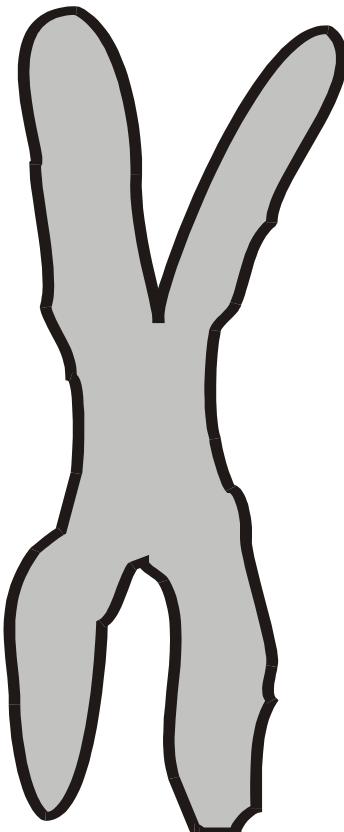
Name: *Florent*; brother of *Valentin*; date of birth: *15 February 2000*; weight: *3,140*

- Speech recognition
- Industrial inspection & quality control

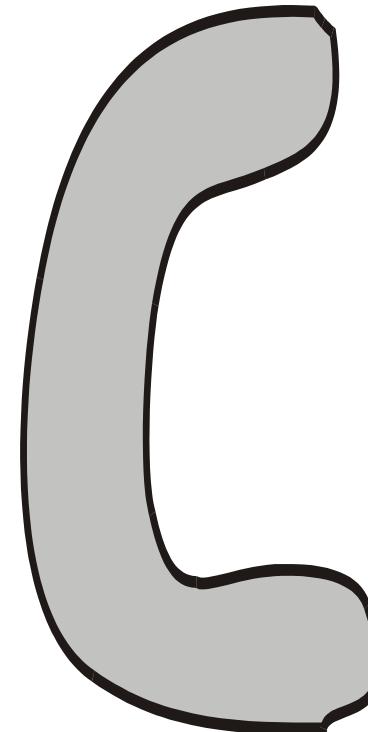


Rx Image of a welding
Accept or reject ?

- Chromosome classification



Submedian chromosome



Telocentric chromosome

- Automatic guidance

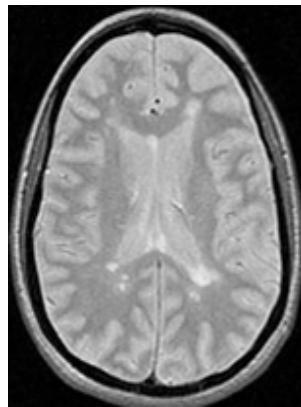


- Fire & Smoke detection

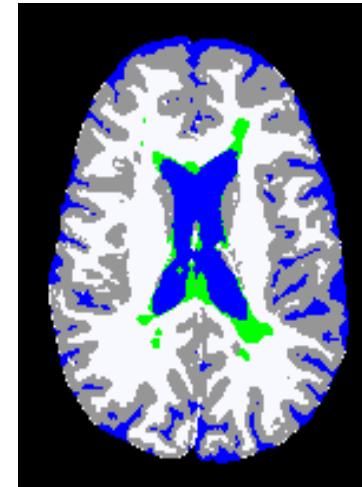
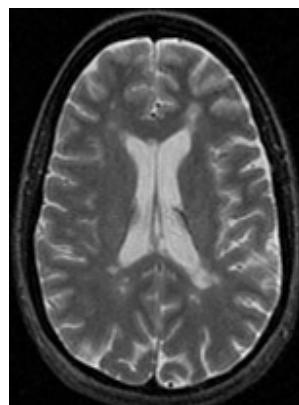


- Tissue classification in medical imaging

MRI
Proton density



MRI
T2

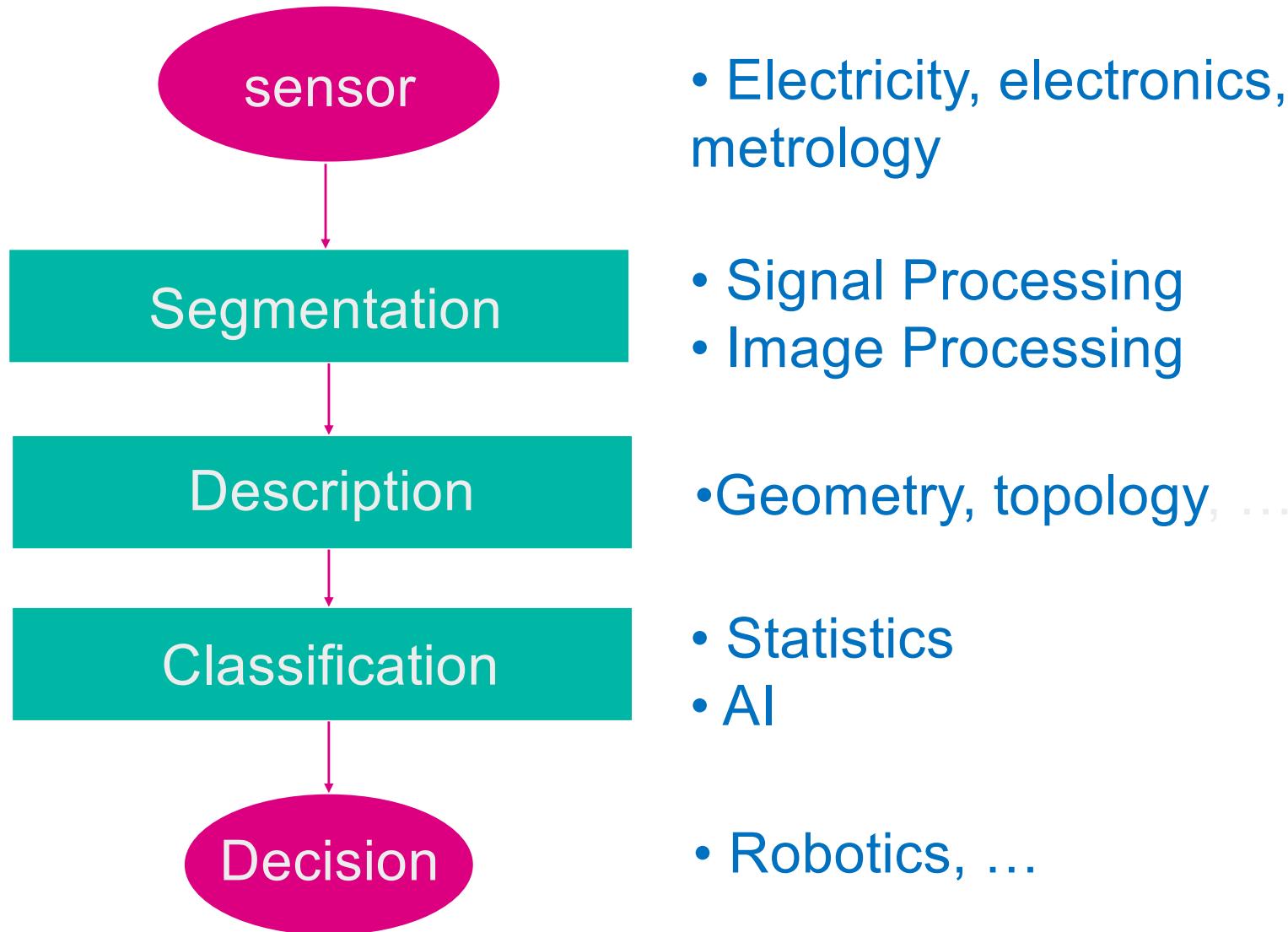


Automatic classification :

- Grey matter
- White matter
- CSF
- Lesions (multiple sclerosis)

- Intuitively, Pattern Recognition can be seen as a “system”
 - **Input** x : raw data obtained by a sensor
Images, image sequences, 3D images, etc.
Other signals: 1D (ECG), sound, speech, ...
 - **Output** y : classification of those data based on their content





- **2+2 hours per week**
 - Main methods in the three main areas of pattern recognition:
Segmentation, Description, Classification
 - Lectures + access to the videos of last year(s)
- **3 series of labs on computers (Python)**
 - Real problems
 - 1 weeks per lab (4h)
- **Special project**
 - Apply image analysis & ML techniques to a real problem
- **Continuous evaluation**
 - Lab reports (20%)
 - Individual meetings at the end of the semester (40%)
 - Special project (40%)

Agenda 2025

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February 21 - 8:30am	Lecture	Introduction	ELA1
February 28 - 8:30am	Lecture	Image segmentation	ELA1
March 7 - 8:15am	Lab 1		
March 14 - 8:30am	Lecture	Object description	ELA1
March 21 - 8:30am	Lecture	Classification	ELA1
March 28 - 8:15am	Lab 2	Object description	
April 4 - 8:15am	Lab 3	Classification	
April 11 - 8:30am	Lecture ML (1/2) + Special project introduction		ELA1
April 18	Easter break		
April 25	Easter break		
May 2 - 8:30am	Lecture ML (2/2) + Special project		ELA1
May 9 - 8:30am	Special project		ELA1
May 16 - 8:30am	Special project		ELA1
May 23 - 8:30am	Special project		ELA1
May 30 - 8:15am	Final project presentation		



Reconnaissance des formes et analyse de scènes

Publié sous la direction de Murat Kunt
Collection Électricité, Traitement de l'Information, Volume 3, PPUR

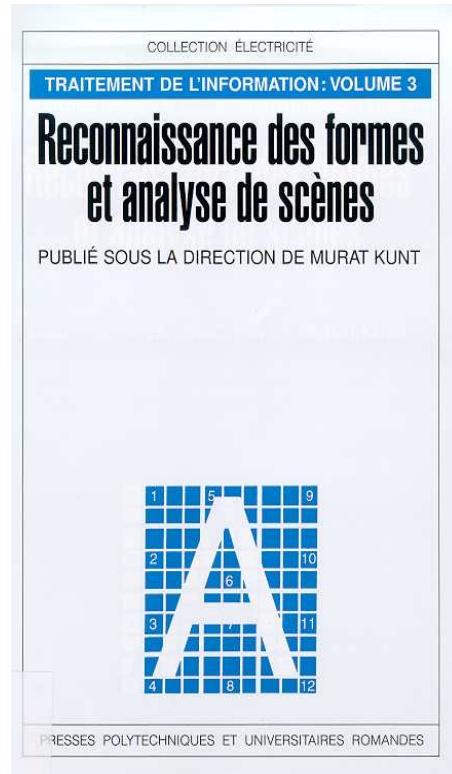
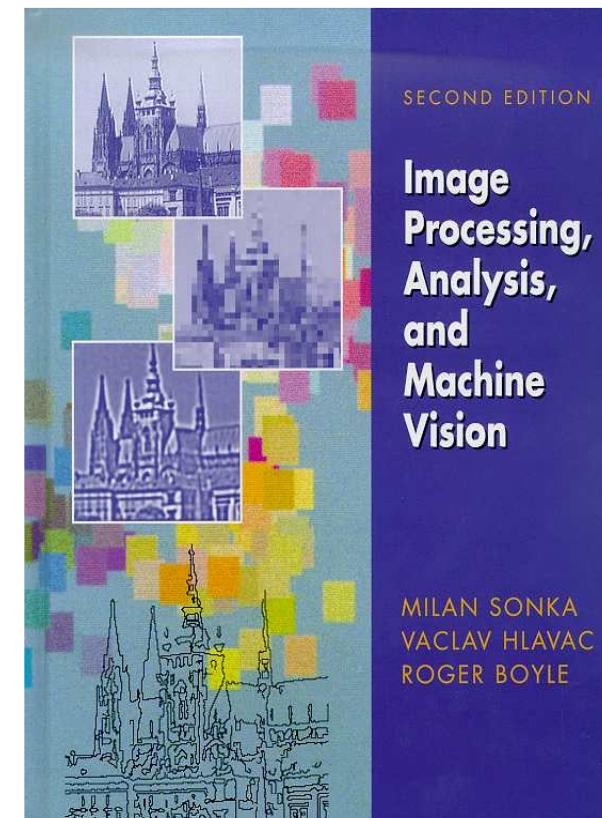


Image Processing, Analysis and Machine Vision

Milan Sonka, Vaclav Hlavac et Roger Boyle
Second edition, PWS publishing, 1998



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EPFL

- <http://moodle.epfl.ch>
- Course outline
- Agenda
- Course Support
 - Slides
 - Reference books
- Labs
- Contacts
 - Assistant coordinates
- Enrollment key: **imagepattern25**



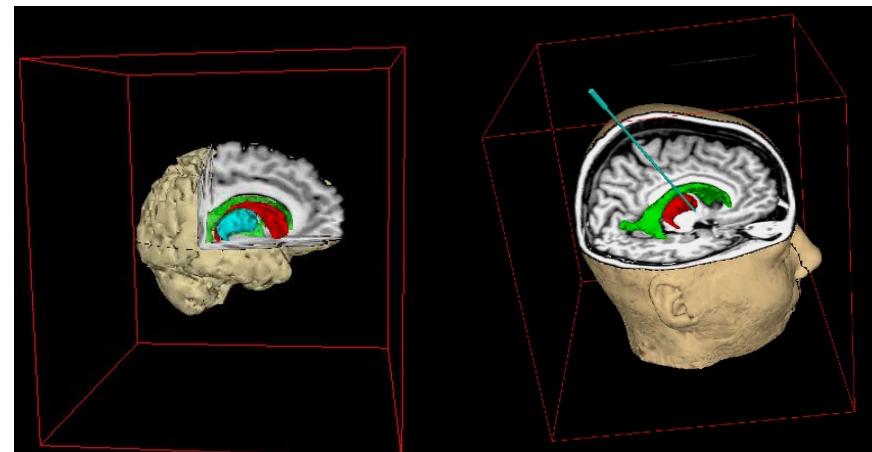
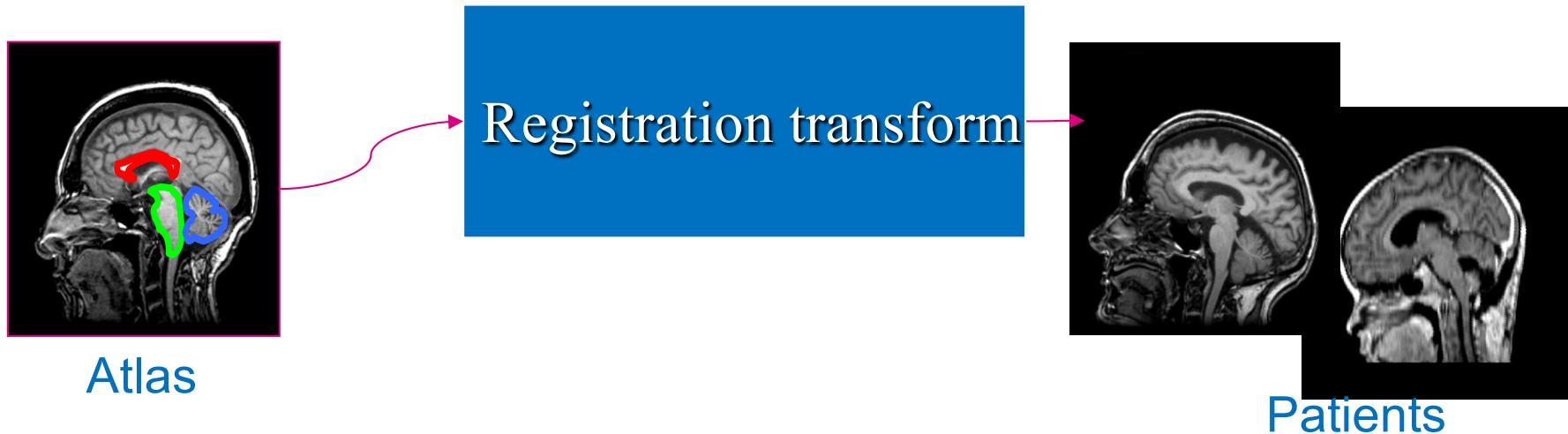
Some examples of image analysis & pattern recognition projects

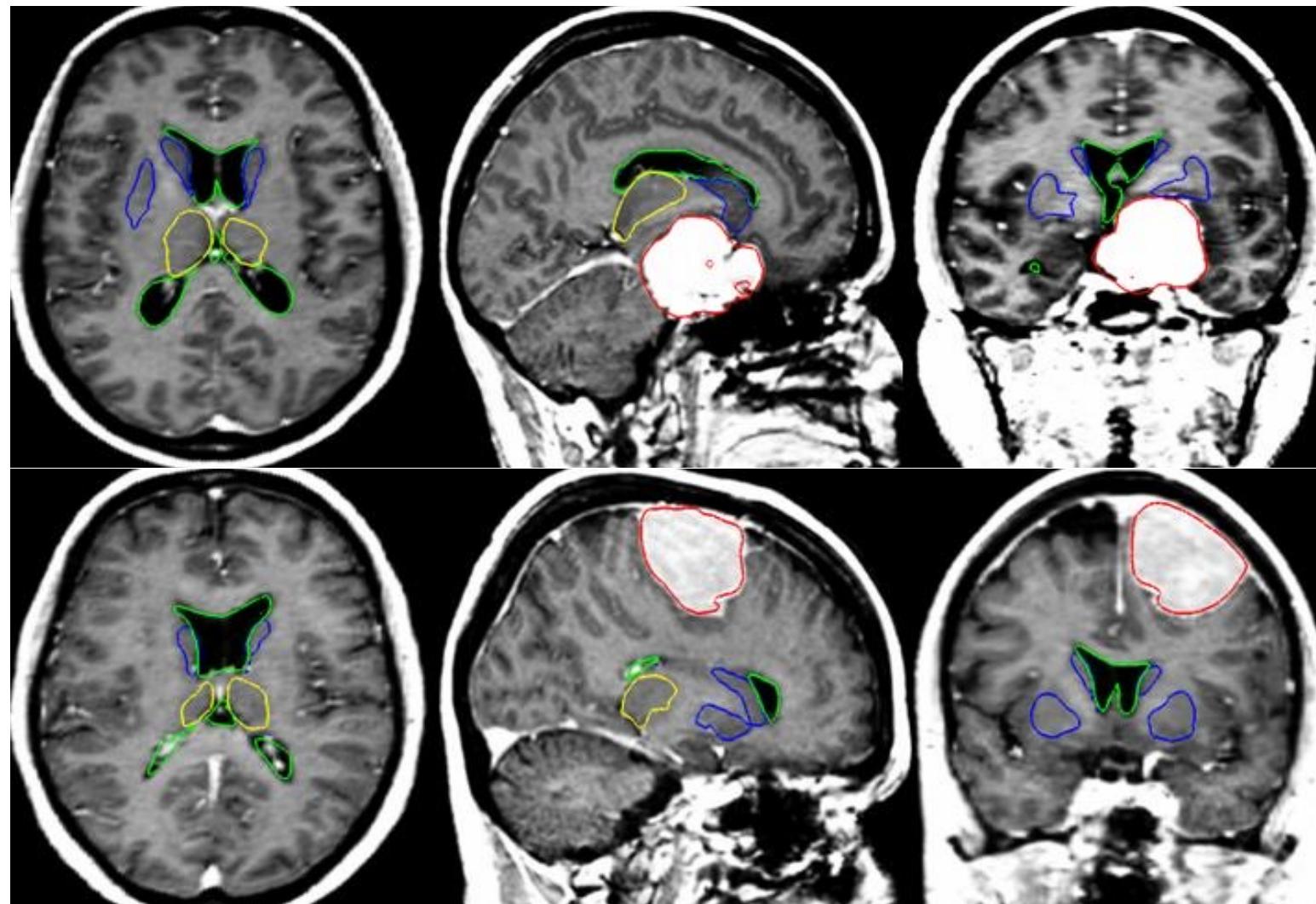


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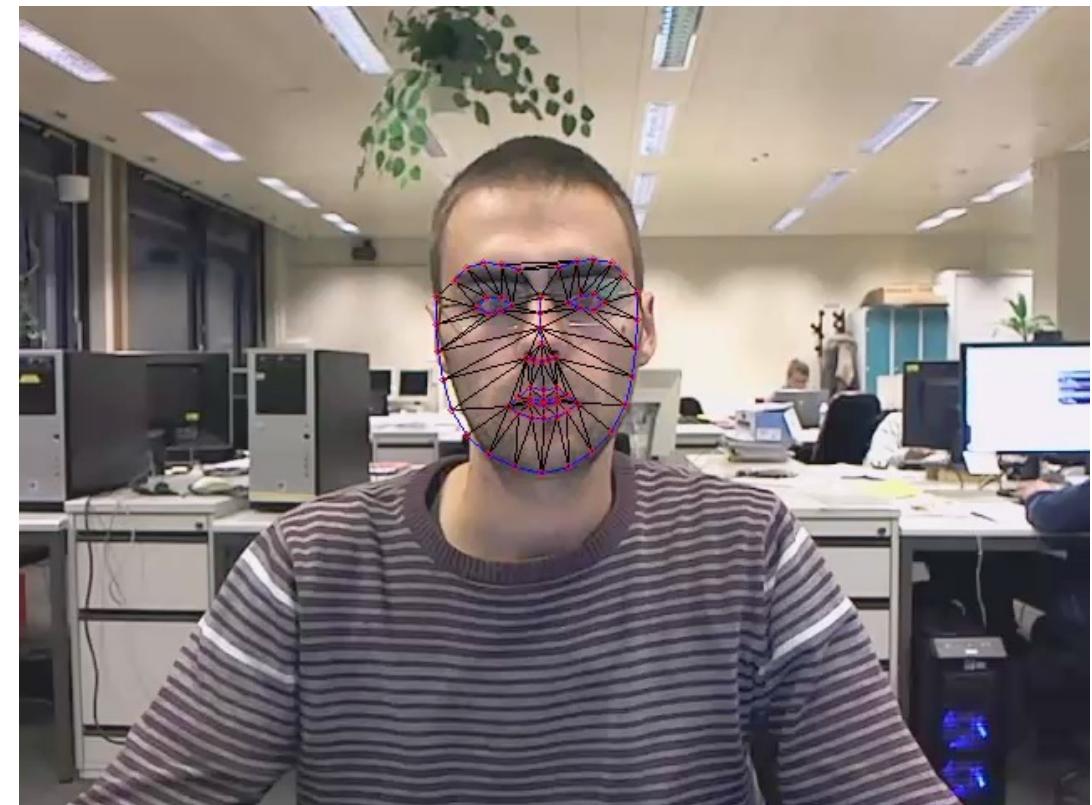
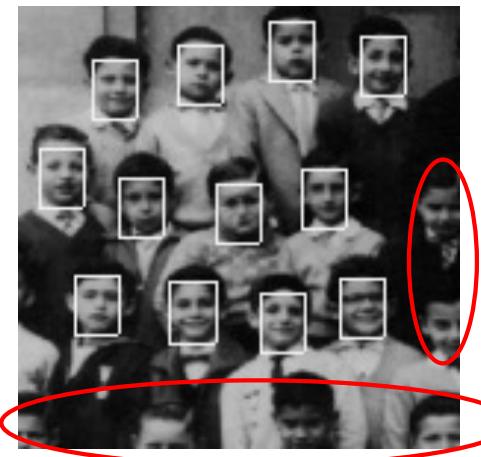
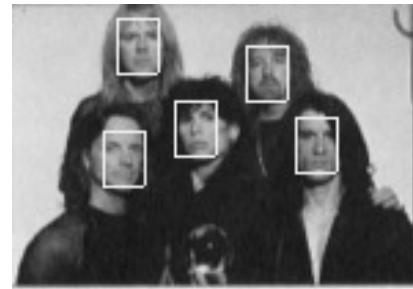
- Prior knowledge through Atlas-based segmentation





Face detection

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- **Hardware**
 - Infrared cameras
 - Infrared illuminator
- **Software**
 - Face detection, tracking & classification

