“A project about automatic image annotations”

LELEC2885

“Project Description”

2014-2015

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Description

- Main objective:
  - automatic image segmentation,
    ... element classification,
    ... annotations

    $\Rightarrow$ Towards "automatic image interpretation"

- Area of interest?

  Louvain-la-Neuve!

- Database of images:
  - O(1000) pictures of LLN buildings

Your tools

- all the material learned in LELEC2885!!
- other methods if you described them properly

Outline

- Part 1 (short):
  Manual image annotation on about 100 images
  Remark: useful for *validating* future methods

  Deadline: Sep. 25th
  (see next slides)

- Part 2: Automatic image annotations
  reading/understanding/combining/programming

- Part 3: Evaluations

Part 1:

Manual image annotation

Which kind of annotations?

sky area

roof

windows/glass

brick texture

(or concrete texture)

vegetation

pedestrian

door

$\Rightarrow$ ID card of the image!

Manual annotation?

1. Download **all** images **of your group** through FTP
   (read icampus, part "Course description")

2. Download matlab file "tools/annotate_images.m"
   (read icampus, part "Course description")

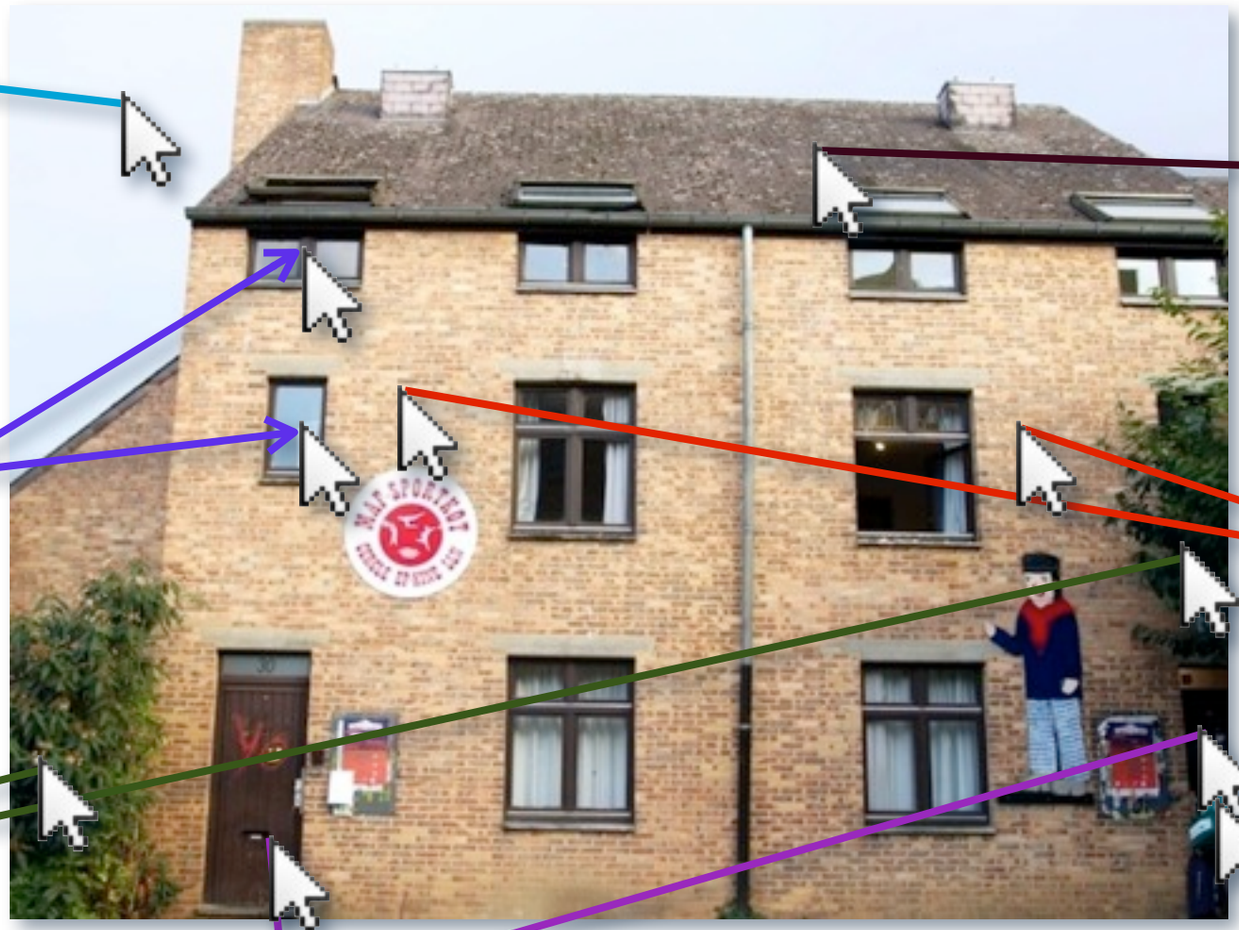
3. Place all files (images and mfile) in the same folder
   in your computer

4. Launch matlab, "cd <folder>", run "annotate_images"

5. This mfile parses each image one by one

Manual annotation?

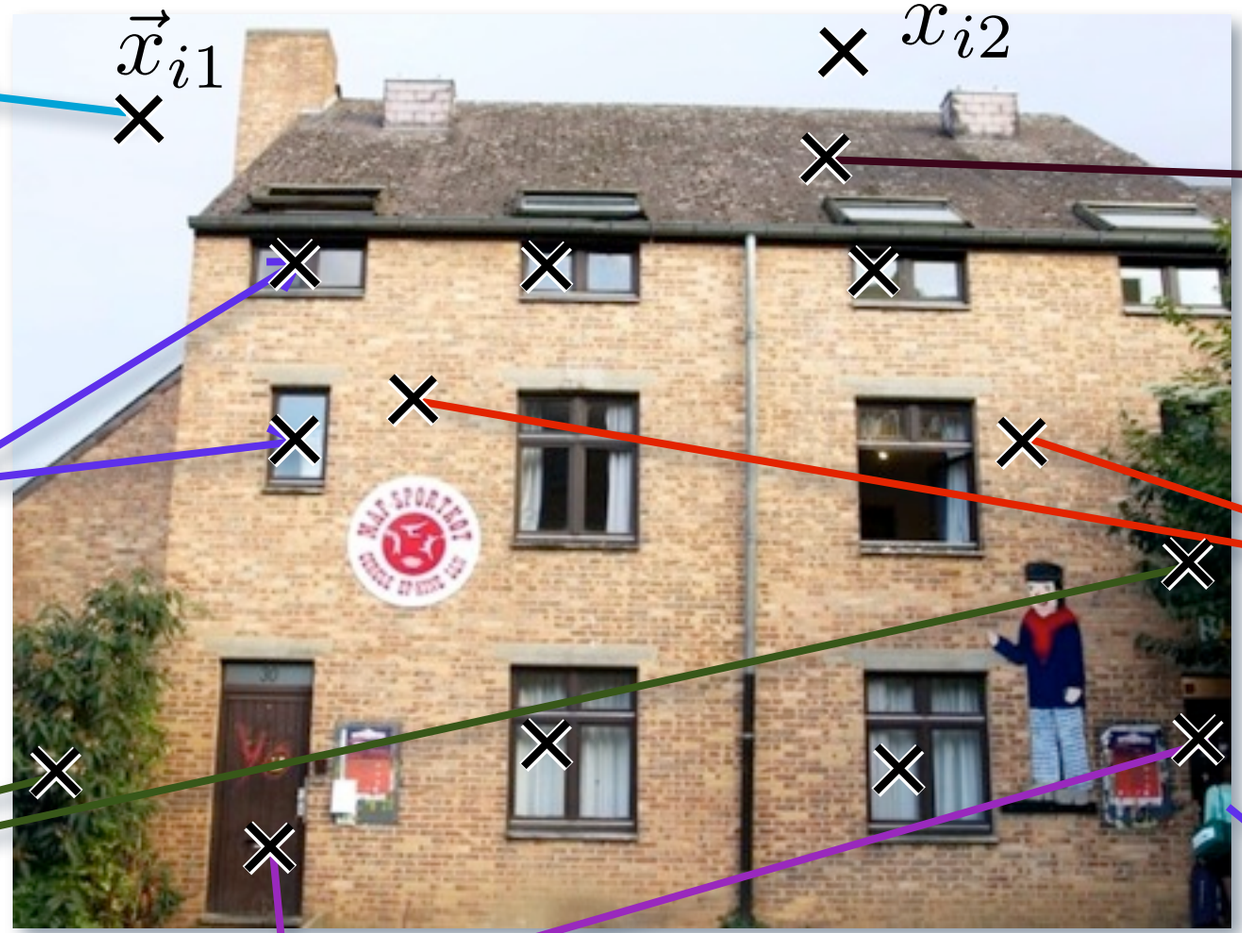
5. For each image, mfile ask you to click on



6. Collected "clicks" saved in "<imgname>.mat" files

7. When finished, upload them in group folder in FTP

Collected clicks?



sky area

$\vec{x}_{i1}$

$\vec{x}_{i2}$

roof

windows/glass

brick texture

(or concrete texture)

vegetation

pedestrian

door

Points of i^{th} Category: $\mathcal{C}_i = \{\vec{x}_{i1}, \cdots, \vec{x}_{iM_1}\}$

class index

(e.g., sky, vegetation, ...) $\Rightarrow$ Category Set $\{\mathcal{C}_1, \cdots, \mathcal{C}_K\}$

Collected clicks?

Points of i^{th} Category: $\mathcal{C}_i = \{\vec{x}_{i1}, \cdots, \vec{x}_{iM_1}\}$

class index

(e.g., sky, vegetation, ...) $\Rightarrow$ Category Set $\{\mathcal{C}_1, \cdots, \mathcal{C}_K\}$

The save .mat file contains a Matlab structure

IDCard = e.g., skys

<elementname1>:

centroidCoordinates: M1 x 2 array

amountOfObjects: M1

<elementname2>:

...

Image examples

Part 2:

Automatic image annotation

Your tools

- **Feature vectors design:**
  - **colors/textures/edges/variances/shape descriptors ...**
- **Image segmentation based on them (mandatory!)**
- Classification tools: K-Means, (SVM)
- (possibly) Segmentation trees
- (possibly) image summarization:
  - SIFT/BRIEF/FREAK/...
- External "black boxes" (e.g., toolboxes) allowed but **only if you know what's inside!!**

In summary: Free choices but...

Test, Explain, and Validate (on many cases)!

For each image you should arrive to ...

Definition of areas of pixels: $\{\widetilde{C}_1, \cdots, \widetilde{C}_K\}$

$$\widetilde{C}_i = \{\text{all pixels segmented for element } i\}$$

Evaluation (compare manual/auto)

- We want:
  - TP/TN/FP/FN averaged evaluation (type I/II errors)
    for each element on all images
    on average for all elements
  - ROC curves
- Critical evaluation your results (limitations)

TP/TN/FP/FN?

[e.g., http://en.wikipedia.org/wiki/Evaluation_of_binary_classifiers]

$$\mathrm{TP}_i := \#\{\vec{x} \in \mathcal{C}_i \mid \vec{x} \in \widetilde{\mathcal{C}}_i\}$$

$$\mathrm{FN}_i := \#\{\vec{x} \in \mathcal{C}_i \mid \vec{x} \in \widetilde{\mathcal{C}}_{\bar{i}}\}$$

$$\mathrm{FP}_i := \#\{\vec{x} \in \mathcal{C}_{\bar{i}} \mid \vec{x} \in \widetilde{\mathcal{C}}_i\}$$

$$\mathrm{TN}_i := \#\{\vec{x} \in \mathcal{C}_{\bar{i}} \mid \vec{x} \in \widetilde{\mathcal{C}}_{\bar{i}}\}$$

$\bar{i}$ = "all but i"

"reality" "detection"

or condition

"Confusion matrix"

condition \ detection	Object $= i$	Object $\neq i$	
Detect. $= i$	TP	FP	$\Sigma = 100\%$
Detect. $\neq i$	FN	TN	$\Sigma = 100\%$
	$\Sigma = 100\%$	$\Sigma = 100\%$	

Agenda

- **September 25th**: Project introduction (during the lecture).
- **September 25th**:

  All groups must be formed and registered on icampus!
- **September 25th**:

  We provide a code for the image annotation
  (released on the FTP, see Database access below).
- **October 2th**:

  Image annotation must have be done and uploaded!
- (**October 5th**: mutualizing all annotations on ftp)
- **November 3-7** (8th week):

  Mid-term project presentation
- **December 12th**: Project reports must be provided.
- **December 15-19** (14th week): Final project presentation.