SUMMER SCHOOL ON IMAGE PROCESSING (SSIP) 2017, NOVI SAD

Home / Summer School on Image Processing (SSIP) 2017, Novi Sad

PROJECTS

Team work

- Scientist/researcher
- Programmer/coder (Matlab, C,..)
- Documenter/publicist (web page)
- Manager

You will be assessed in terms of:

- Ability to function as a team
- Scientific originality
- Use of resources
- Demonstration of function
- Quality of coding
- Quality of documentation
- Interest and imagination of Web pages

PROJECT 1.

Tracking pedestrian trajectories in outdoor videos

Specification of the task:	Detect pedestrians in videos from outdoor surveillance camera and track trajectories of the moving objects Further tasks can be: - Classify moving objects (adult, child, stroller, wheelchair, scooter, bicycle) - Detect/ classify abnormal behaviour in the scene Challenges: weather conditions, light changes during the day, busy junctions, bicyclists, occlusions (trees and stands), etc.
Availability of test/train data if required:	http://homepages.inf.ed.ac.uk/rbf/FORUMTRACKING/ https://motchallenge.net/data/MOT16/ https://motchallenge.net/data/ECCV_2016_Challenge/ You can also easily capture video information.

PROJECT 2.

Recognition of doors and steps

- Help blind people navigate by using images from their mobile phone (or webcam) by recognizing doors, steps, etc.
- Build object database
- Consider invariance
- Difficulty: medium to hard

Counting objects

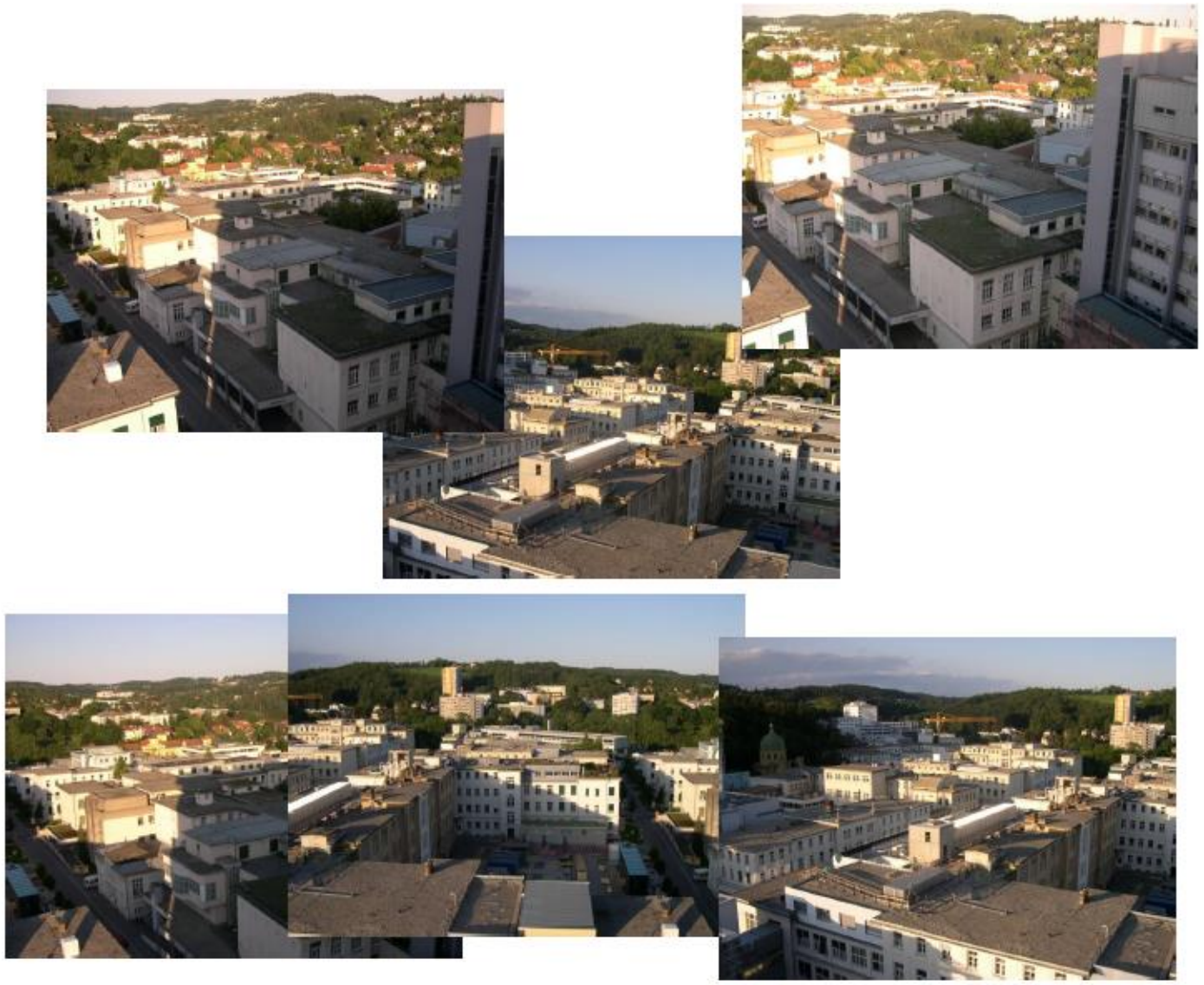
- Counting windows
- Input: photo of a building
- Task: detect and count windows
- Output: a number plus indication of where the windows are
- Difficulty: medium

PROJECT 3.

Alternative: Count roofs

- Counting roofs
- Input: a digital photo of roofs
- Task: count all of roofs in the image, give every roof a unique id (number)
- Output: identifies roofs
- Difficulty: hard

PROJECT 3.



PROJECT 3.

PROJECT 4.

Sport highlights

- Input: video sequence of part of a game (e.g. football match)
- Aim to detect key events such as goals, fouls (or diving)
- Output: statistics of match
- Difficulty: medium to hard
- Note ‘Use of camera tracking to observe if ball crosses line’

PROJECT 4.

PROJECT 4.

Football matches in history

PROJECT 5.

Binary tomography

- Calculate projections of binary images in few directions (MATLAB, ImageJ: Radon transform)
- Try to reconstruct the original image from the projections (can be solved by optimization)
- Improve reconstruction quality by using prior knowledge: binary values, homogeneity, structural information (Discrete Tomography)
- More challenges: noisy projection data

PROJECT 6.

Detecting (near) planar regions in stereo image pairs

- **Input**
  - Two images of the same scene (buildings) taken by smartphones (Different viewpoint, nearly at the same time)
  - Different devices, sensors (Color differences may occour)
  - Camera calibration parameters are available
- **Desired output**
  - Segments in the image forming planar patches (in one of the images, patch correspondence between the image pairs is not necessary)

PROJECT 6.

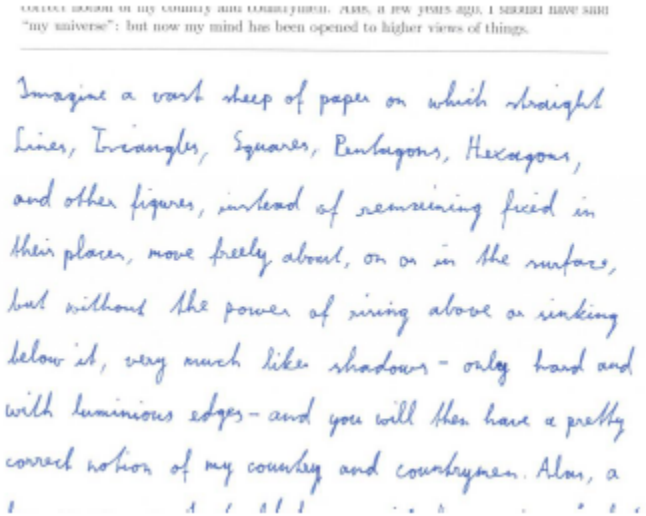
Detecting (near) planar regions in stereo image pairs

- Application
  - Patch matching
    - http://www.inf.u-szeged.hu/rgvc/projects.php?pid=patchreg
  - Spatial stereo reconstruction
    - http://www.inf.u-szeged.hu/rgvc/projects.php?pid=patchrecon
- Idea
  - Detect ASIFT keypoints in the images
  - Try to find subset of corresponding points that are related by homography
  - Expand the region between the keypoints
- Other approaches are also welcome!
- Literature
  - Simon J.D. Prince. Computer Vision: Models, Learning, and Inference. Cambridge University Press, 2012. http://www.computervisionmodels.com/ (eBook in PDF is available for free!)

PROJECT 7.

Writer identification by handwriting

- Who is the owner of the handwritten text?
- Extract features and identify the writers!
- CVL public database can be used
  http://www.caa.tuwien.ac.at/cvl/research/cvl-databases/an-off-line-database-for-writer-retrieval-writer-identification-and-word-spotting/


"my universe": but now my mind has been opened to higher views of things.

Imagine a vast sheep of paper on which straight lines, Triangles, Squares, Pentagons, Hexagons, and other figures, instead of remaining fixed in their places, move freely about, on or in the surface, but without the power of rising above or sinking below it, very much like shadows - only hard and with luminous edges - and you will then have a pretty correct notion of my country and countrymen. Alas, a

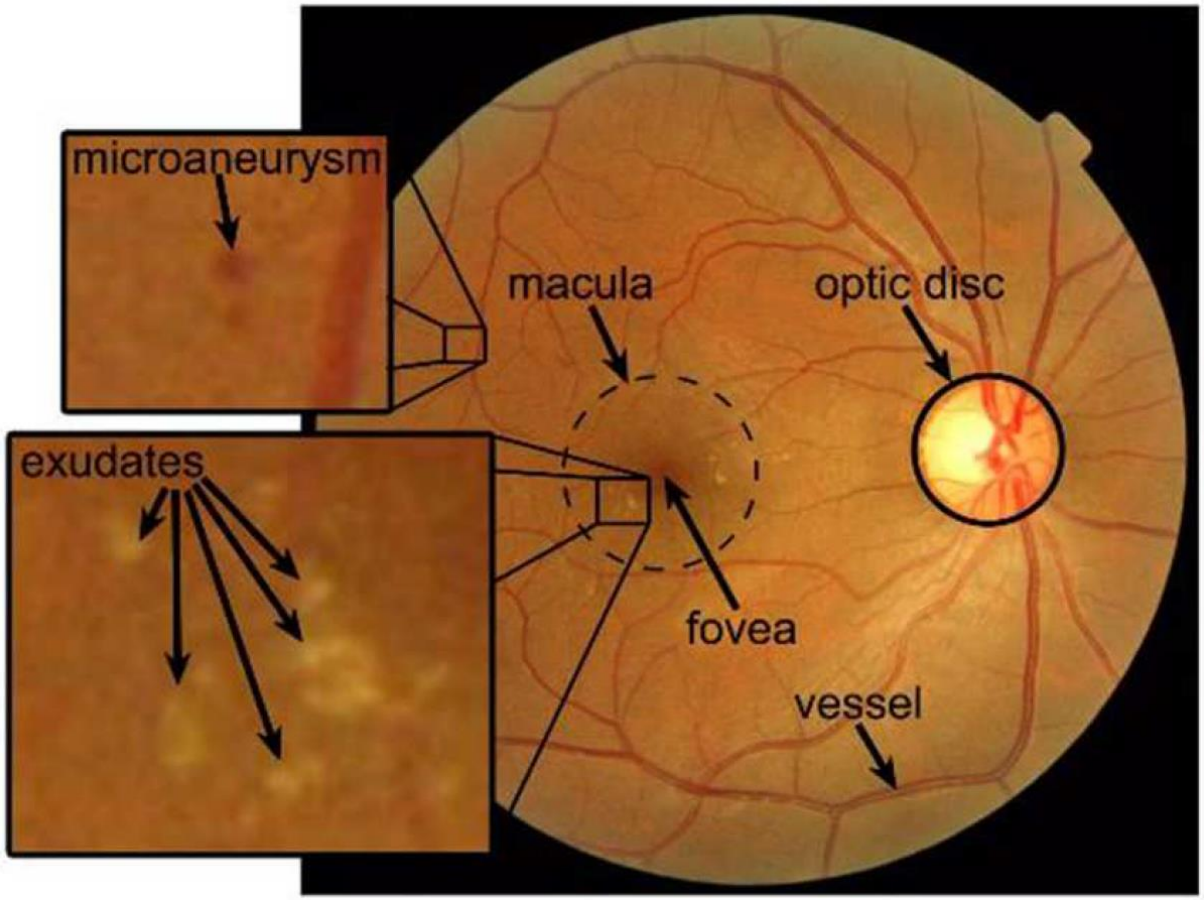
PROJECT 8.

Recognizing lesions in retinal images

Contact: Andras Hajdu

PROJECT 8.

Several diseases have associated lesions in the human retina. Among the most frequent lesions we can find dark (haemorrhages, microaneuysms) and bright ones (exudates); see the image. The task is to locate/segment these lesions; testing state-of-the-art machine learning techniques are highly welcome in the solution for segmentation purposes or to restrict the focus.



PROJECT 9.

Food classification

Build an automated vision-based Food/Non-Food Image Classification and Food Categorization system. The system should recognize the content of a plate/bowl based on one (or few) input picture.

- Define your own categorization granularity (for example the 11 major food categories of Food-11 dataset).
- You can use the publically available Food-11 and Food-5K datasets (http://mmspg.epfl.ch/food-image-datasets), and Food Dataset (http://iplab.dmi.unict.it/madima2015/).
- Evaluate your framework on independent data.
- Think of aspects beyond classification, such as estimating quantities, linking classification results with nutritional data, etc.

Contact: Csaba Beleznai

PROJECT 9.

PROJECT 9.

PROJECT 10.

Estimating roulette game outcome based on multiple images

- Use HD videos posted on YouTube to get video sequences, such as https://youtu.be/0Zj_9ypBnzg (downloading using a downloader plugin, such as 1-click YouTube Video Downloader)
- Estimate and track roulette pose (color and section layout),
- Estimate the ball position speed,
- Estimate the rotation speed of the roulette wheel,
- Estimate the section of the roulette wheel in which the ball will make contact first. Evaluate accuracy on multiple videos.

Contact: Csaba Beleznai

PROJECT 11.

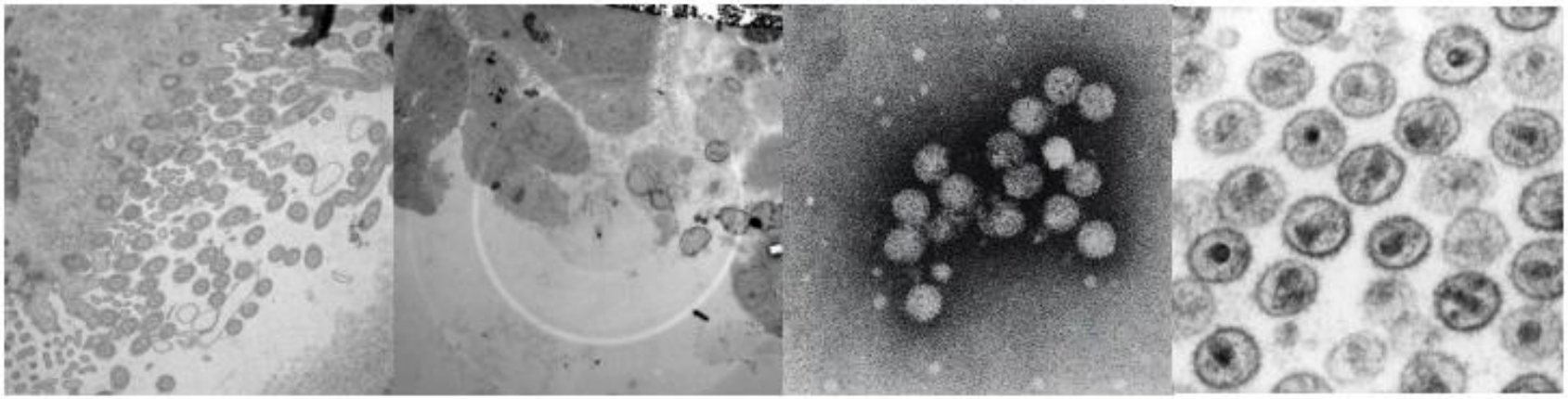
Image Denoising for Electron Microscopy

Noise and blur, present in the images acquired by electron microscope (EM), highly impact the manual image analysis. The noise in electron microscopy commonly follows a mixed Poisson-Gaussian distribution and its modeling is rather challenging. Noise and blur heavily influence automated image analysis, thus image denoising/deblurring techniques are desirable as a preprocessing step. Information about the Point Spread Function (PSF) is rarely available. Therefore, both blind and non-blind deconvolution methods and various denoising techniques have to be combined in EM image enhancement and restoration.

In this project, a set of TEM images is provided. Some examples are shown below.
The task is to try to restore the images, preferably by both deblurring and denoising them. Observe that this requires noise and blur estimation. At least one restoration technique should be tested and the results should be evaluated and quantified. Evaluation strategy design is a part of the project too! Supporting data for establishing ground truth is provided as well.

Extra task: Different restoration techniques can be tried, including those utilizing deep learning. Their performance can be compared. If possible, a statistical study (based on appropriate synthetic data) can be designed to support the evaluation.

PROJECT 11.



Cilia
(High-magnification)

Cilia
(Low-magnification)

HepcInEcoli virus

HIV virus

Contact: Natasa Sladoje, Joakim Lindbald, Amit Suveer.

PROJECTS

Summary

1. Tracing pedestrian trajectories in outdoor videos
2. Recognition of doors and steps
3. Counting objects
4. Spot highlights
5. Binary tomography
6. Detecting (near) planar regions in stereo image pairs
7. Writer identification by handwriting
8. Recognizing lesions in retinal images
9. Food classification
10. Estimating roulette game outcome based on multiple images
11. Image denoising for electron microscopy

Now...

- Take a project selection form
- Select your three favourite projects
- Order them - 1,2,3
- Write your name on the form
- Hand it in