Team work
- Gopher
- Scientist/researcher
- Programmer/coder
- Documenter/publicist
- 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. Bicycle detection at street crossings

Specification of the task: Bicycle usage is becoming more common lately. In order to develop the city infrastructure and to maximize the growing usage, studies about bicycle behavior and information about the number of cyclists in given part of the city are required. Using video information, you should design a system that recognizes bicycle movements, records and provides useable information. The aim of this project is to develop a method for simple automated bike detection. You can easily capture video information.

Availability of test/train data if required: You can easily capture video information.

Bicycle detection at street crossings

Project 2. Butterfly recognition

Specification of the task: Build a butterfly recognition framework which returns a list of potential matches ranked according to the number of potential matches. The task is to build a simple, efficient and effective method for the automatic recognition of butterfly images.

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Availability of test/train data if required: http://www.comp.leeds.ac.uk/scs6jwks/dataset/leedsbutterfly/

Contact: Csaba Beleznai
Project 3. From Statistical Constraints to Global Regressors

From Statistical Constraints to Global Regressors

Project 4. Image Restoration by Using Different Deconvolution Algorithms

Image Restoration by Using Different Deconvolution Algorithms

Project 5. Blood vessel detection in fundus photographs

Blood vessel detection in fundus photographs
Project 6. Detection of Roadside Vegetation

Detecting vegetation on roads is used for navigating autonomous vehicles through on-road and off-road environments. For instance, it is crucial for accurate distance measurement by ultrasonic sensors. The right wayfinding system needs to be suitable for the environment. Brush placed on the road is a cheap and simple way of inducing vegetation into traffic safety sensors. The presence of vegetation will make the classification challenging as well. The images from the visible spectrum will not be sufficient to classify vegetation, as many other objects such as rocks and debris will have similar characteristics.

The proposed solution is a tool for classification of vegetation, taking into account the visible spectrum and infrared spectrum images.

Project 8. 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

Alternative Count roofs

- Counting roofs.
- Input: a digital photo of roofs
- Task: count all of the roofs in the image, give every roof a unique ID (number)
- Output: identifies roofs
- Difficulty: hard
Project 9. World Cup Highlights

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

Football matches in history
Project 10: Dental implantology

- Easy: Count the number of teeth on a CT of a jaw bone.
  - Input: CT of the jaw (3D volumetric data, files in DICOM format).
  - Output: the number of teeth on the image.

- Medium: Determine the missing teeth of the patient from a CT image.
  - Input: CT of a jaw bone
  - Output: A list of missing teeth. E.g.: teeth number 14, 23, 24, 25 are missing.

- Hard: Fill the missing teeth of a patient with surface tooth models from a database. The task is to align a complete healthy dental arch to the input image based on the patient’s existing teeth. Rotation, location and scale should be taken into account.
  - Input: CT of a partially edentulous patient + surface models of all 32 teeth (database, different patient)
  - Output: combined image of the patients own teeth and the filled in teeth.

Input will be provided.

Project 11: Liver vessel segmentation

- Background: Liver vessels are examined by various 3-dimensional imaging techniques in the clinical practice (CT, MRI, US). The accurate segmentation of liver vessels is very important because the liver has a complex vessel system (portal vein, hepatic vein, ...).

- Challenges: The different imaging techniques have very different image characteristics and artifacts, there is no general solution. The different vessel structures can run very close to each other, so segmentation methods usually look form one vessel to another.

- Goal: To segment liver vessels in CT (moderate difficulty), MRI (medium difficulty), and US images (high difficulty). In the first two cases the image involves the whole liver, so the problem can be simplified by manual delimitation of the volume of interest.

- Data: 6 image sets including the contrast-enhanced abdominal CT and MRI, and the 3D US image of the same liver. Since the image sets belong to the same patient it is possible to compare the segmentation results belonging to the different modalities.

Input will be provided.

Project 12: 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).

Project 13: Microglia analysis using microscopy

- Measuring area and perimeter of cells in fluorescent microscope images.
- Microglia are special cells of the central nervous system. Some research in cell biology requires to calculate area and perimeter of microglia in fluorescence microscopy images, which makes their correct segmentation necessary.
- The aim of this project is to find a method that automatically performs both the segmentation and the measurements.
- Two types of images are taken from each cell culture under different fluorescent lights. Blue is used for making only cell nuclei visible, while the whole cell bodies are shown under red light.
- Cells on the image margins being not completely visible must be eliminated before any calculations. Furthermore, if two or more cell bodies seem to be merged as one object in the image (two nuclei but seemingly one cell body), then those must be also ignored.

Input will be provided.
Microglia analysis using microscopy

Summary
1. Bicycle detection
2. Butterflies
3. Stat. constraints, models
4. Deconvolution
5. Blood vessel detection
6. Roadside vegetation
7. Doors and steps
8. Counting objects
9. Football
10. Dental
11. Liver vessel segmentation
12. Discrete Tomography
13. Microglia
14. suggestions

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

Please ask questions