Guidelines -> Roadmap
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
Are the horizontal lines parallel or do they slope?
Project 1 What monument am I looking at?

- Take photos of landmarks in Vienna.
- Find images of the same landmark in the Internet and use associated text to find out the name of the landmark.
- Difficulty: Hard
Project 2: Identification by Hand Geometry

- Build a simple system identifying enrolled individuals based on hand geometry.
- Use a webcam and feel free to design your setup (keep it simple, e.g. hand on black paper viewed from above).
- Difficulty: Medium
Project 3: Ear Biometry

- How well can you recognise somebody by measurements of their ears?
- Create a database of the ears of all the class participants.
- Write a program incorporating an ear-recognition algorithm developed by your group which will output the name of the person based on the ear image.
- Also output the recognition statistics.

- Difficulty: Medium
Project 4: Male or Female?

- Find faces in images.
- Classify them as either male or female.

Easier to start with portrait type photos, then try with photos having more than one face.

Difficulty: Medium
Project 5: Football

- Given an image of a football pitch, find
  - Players of the two teams
  - The ball
- Your algorithm should work on a wide variety of images.
- Difficulty: Fairly hard
Variant: Tracking of moving person against background

- Input: video sequence of for example 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 6: Game partner

- Choose a board game such as Draughts, Backgammon, Chess.

- Point a webcam at the board.
- The computer should follow your moves in real time and play against you (suggest moves from its side).
• Discuss the game that you choose with us.
• The emphasis should be on the visual processing – interface your program with an existing game strategy engine.
• Difficulty: rather difficult (for chess or Go, extremely difficult!)
Project 7: Vision-based badge detection

- Detection of a visual pattern in form of a badge encoding some useful information like a personal ID. The task could consist of two subtasks:
  - the design of a pattern which is easy to detect and reliable to readout at various scales, poses, illumination (for feasibility within the short time span, you are allowed to introduce some constraints). Possibilities: multiple colors, binary patterns, etc.
  - building a computationally-efficient detection (readout) algorithm, which copes with the above variations in viewing conditions.

- Difficulty: Medium
Project 8: Automatic CAPTCHA Decoding

- Captchas are online tests to detect if a human is using the computer.
  - Yahoo
  - Gmail
  - Paypal
  - Slashdot

- Task: See how many CAPTCHAs you can crack
How?

- It is impossible to write a CAPTCHA cracker that works on all CAPTCHAs.
- A crack for a CAPTCHA is a sequence of image processing operators to apply to it so that it can be read by a standard OCR program.
- Use a freeware OCR program, don’t write one yourself!
- Measure what percentage of each type of CAPTCHA can be cracked by your program.
- Difficulty: Depends on the CAPTCHAs chosen.
Project 9: Binary/ Discrete Tomography

- Calculate projections of binary images
- Add noise to the projections
- Reconstruct the image from noisy projections
- Test accuracy and speed depending on
  - size of the image
  - number of projections
  - characteristics of noise

Test also in 3D
Project 10: Facial emotion recognition based on mouth analysis

- Input: videos or static color images of a person’s face, under natural conditions; good lighting, but, no makeup!
- Objective: recognize emotional state using mouth information; useful for computer tutoring systems. Mouth must be located first
- Tasks to do:
  - find the mouth region in a facial image (relatively of known position and size, assume you’re in front of a computer and you have a webcam)
  - analyze the mouth shape and state – find suitable descriptors for it, in order to accurately classify different emotions
  - at least basic emotions should be identified (i.e. neutral, happy, sad, surprised) but also some spontaneous emotion would be nice
- Output: the mouth identified and the emotion recognized
- Remarks:
  - difficulty – high;
  - Any suggestions as of how could one distinguish from video only between mouth change during speech and emotion?
Some example images:

Happy

“Screaming....”

Angry

Neutral
Project 11: Photographs restoration for scratch removal and date superposition removal

- Input: printed and scanned photographs affected by scratches or printed text, as date – time imposed
- Objective: removal of such unwanted ⇔ filling in the missing part with information that looks as natural as possible; can be done with image in-painting techniques.
- Tasks to do:
  - develop an application implementing such an algorithm, for photographs restoration
  - no constraints on the implementation environment
  - user interaction should be implemented to select the part to be restored
  - the application should preserve both color and texture – the not deteriorated part of the image should not be affected in any noticeable way by the algorithm
- Output: the restored image in digital format
- Remarks:
  - difficulty – medium to high;
  - extra-work: can you design/implement a version which does not require user interaction, i.e. the deterioration automatically assessed based on the analysis of the photograph? (scratch detection, text detection)
Example photographs to be restored (1):

After restoration
Since 1699, when French explorers landed at the great bend of the Mississippi River and celebrated the first Mardi Gras in North America, New Orleans has brewed a fascinating melange of cultures. It was French, then Spanish, then French again, then sold to the United States. Through all these years, and even into the 1900s, others arrived from everywhere: Acadians (Cajuns), Africans, indige-
Example object removal from a photograph:

Original image

Object to remove

Result after removal
Project 12 OCR with a difference
Project 13: Modelling of traffic flow.

- Queuing theory demonstration
- Input: None
- Method: Demonstrate graphically illustration of queuing theory. A good example would be a simulation of road traffic flow, to illustrate wave phenomena (standing and moving waves) associated with partial obstructions.
- Output: Graphical demo, preferably in form of 2d image/map [along lines of Sim city with graphs].
- Difficulty: variable
Cautious drivers
Project 14 Avatar/ dancer

- **Aim:** to place some avatars in a street scene
- **Input:** Street scene
- **Aim generation:** of some realistic human figures walking about in street scene. Can you add facial expression.
- **Output:** video clip with avatars moving
- **Alternative:** avatar walking up stairs, dancer dancing
- **Remarks:** Difficulty variable
Project 15 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
View from my window
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 16 Landsat classification

- Input: Landsat images of terrain, plus sample images of fields/sea, forest etc

- Aim: segmentation of scene based on texture (and colour)

- Additional goal: identification of key features such as cave openings etc

- Output: labeled scene

- Remarks: Difficulty – reasonably easy
Satellite images
Project 17: Vision-based paper-scissors-rock game

- Use a webcam (positioned e.g. above the hand), which you can play against the computer.
- Difficulty: Medium
Project 18: Top model

- **Input:** photos of participants and fashion models from web
- **Aim:** classification of models v. normal unattractive faces
- **Sub goal:** what makes models apparently attrative (which features) and can you simulate this by distorting facial images
- **Output:** images of participants with attractiveness score
- **Difficulty medium**
Are these models?
Project 19: Terrorists

- Take photographs of your group and maybe other participants
- A few of you are terrorists and need to be identified when passing a security screen
- Aim is positive identification of a few faces
- Problem is that terrorists try to disguise themselves.
- Can you positively identify the disguised person
- What kind of disguises are difficult to handle and can the algorithm be improved in this respect

Remarks: Difficulty medium
Some terrorists?
Project 20: FEM model of bone

- Create a fine level model of bone
- Estimate strength of bone as a function of direction and forces
- Difficulty hard
Summary

1. Mobile monuments
2. Hand geometry
3. Ear Biometry
4. Gender detection
5. Football
6. Game partner
7. Badge detection
8. CAPTCHA
9. Binary Tomography
10. Facial emotion
Cont.

- 11. Photo restoration
- 12. Korean OCR
- 13. Traffic flow
- 14. Avatar/ dancer
- 15. Counting windows/ roofs
- 16. Landsat classification
- 17. Paper/ scissors/ rock
- 18. Modelling of models
- 19. Terrorist detection (disguised)
- 20. FEM of Bone

- 21. … any suggestions?
Please ask questions