SSIP 2006

Project suggestions

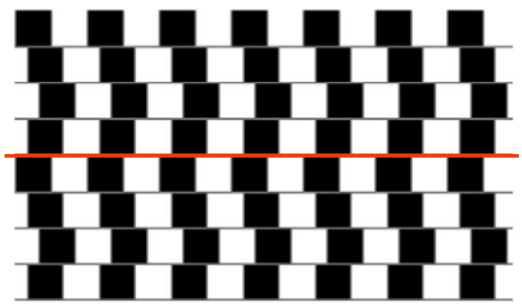
Guidelines -> Roadmap

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 World Cup Highlights

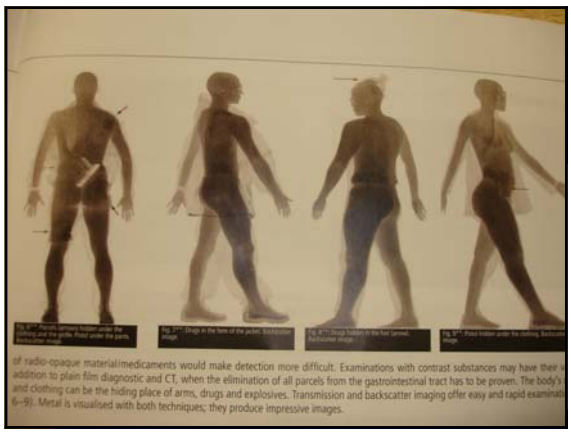
- Input: video sequence of part of football match
- Aim to detect key events such as goals, fouls (or diving)
- Output: statistics of match
- Remarks: Difficulty medium to hard.
- Note 'Use of camera tracking to observe if balls crosses line'

Football matches in history

Project 2 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 (or views from strange orientations).
- 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 3 Group photograph

- Input: Group photograph
- Identification of faces
- Output labeled image of people
- Remarks: Difficulty variable depending on input image.

Alternative

- Door entry system- feature analysis of a face using point separation / wavelets
- Input: images of several faces
- Operation: Identify key points (end of nose/ ears/ mouth). Measure distances and angles between these (for different orientations). Feed results into a statistical analysis routine. Identify for unknown image most likely match. Alternatively use the wavelet transform to generate 'spectrum' nd identify key 'frequencies'. Then do statistical matching. Wavelet transform (see Numerical recipes) needs to be downloaded). An alternative would be images of hands.
- Output: Demo of door entry type system based on photo.
- Coding: as desired (but not development of GUI)
- Remarks: Difficulty quite hard.

Project 4 Grim grins

- Smiling faces.
- Input: a set of photos of the same person with different face expressions and the information that some of them are smiling faces. Can you determine the 'emotion'.
- Task: to write a program (e.g., neural network) recognising the smiling faces of the same person
- Output: smiling or not, and the statistics of the implemented method.
- Difficulty: hard

Project 5 Top model

- Input: photos of participants and fashion models from web
- Aim: classification of models v. normal unattrative faces
- Sub goal: what makes models apparently attractive (which features) and can you simulate this by distorting facial images
- Output: images of participants with attractiveness score
- Difficulty medium

Are these models?

Can you recognize the person's gender?

Project 6 Flags

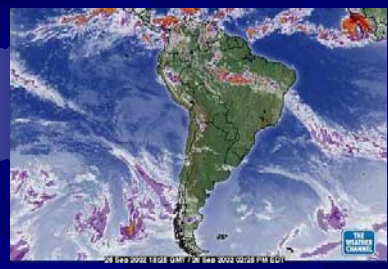
- Input: images of flags and training set
- Try to identify flags given that they will be distorted
- Output label. Include non-identified flag in test set.
- Remarks: Difficulty variable.

Project 7 Keys

- Input: images of keys, and reference images
- Try to match keys to reference images (for example by detecting and tracing edges)
- Output labeled image (with probabilities?)
- Remarks: Difficulty variable depending on input image definition.

Some keys

Alternative: matching of edge segments (coastline / river)

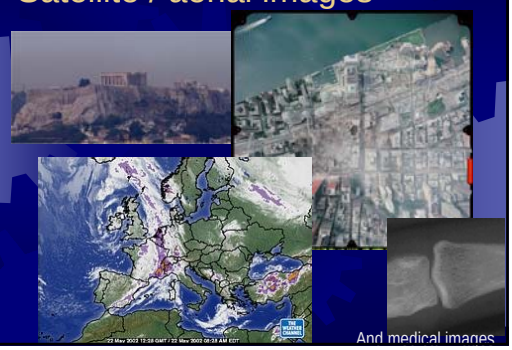


Different orientations, scale, level of detail ....

Project 8 Texture classification

- Input: Input images such as Landsat images of terrain, plus sample images of fields/ sea, forest etc
- Aim: segmentation of scene based on texture (and colour) Tools could be wavelets, ANNs, SVMs...
- Additional goal: identification of features such as corners, crossings, tanks, ambushes.
- Registration of images from different viewpoints
- Output: labeled scene
- Remarks: Difficulty – reasonably easy

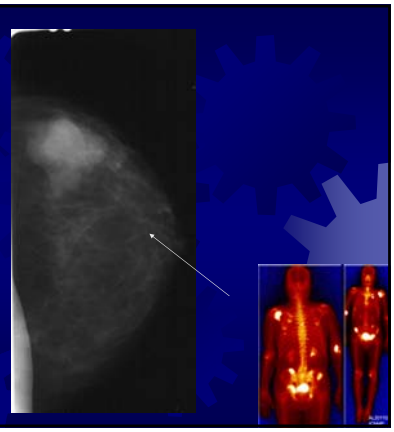
Satellite / aerial images



And medical images

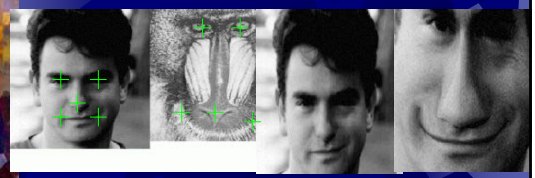
Alternative

- Detection of clusters of small features such as circles or microcalcifications on a noisy features background
- Input: Given an image for example of industrial image of object with holes or such as a mammogram with the presence of micro calcifications of different size and shape which can be introduced by simulation for the purpose of this project) Method: Design a matched filter/ Hough transform, capable of detecting them (in either space or Frequency space). The important feature is that the micro calcifications/ circles are not of unique size or shape and are noisy. Possible application also of neural net. An alternative would be images of building with windows and counting windows.
- Output: images with detection indicated
- Coding: as desired (not GUI)
- Remarks: Difficulty medium



Nodule analysis in lung CT scans

Warping and Non Rigid registration



source target linear TPS warped

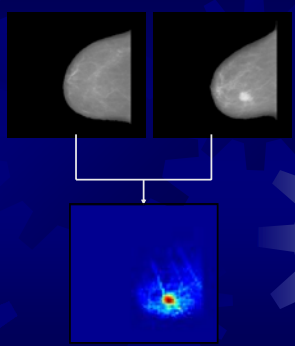


Image registration, how does one image transform into another

Project 9 Robot driver

- Input: Images of road as seen by a driver
- Aim: Robot assistance to driver
- Additional feature: avoidance of traffic in front, identification of road signs, hazards et
- Output: Intelligent feedback based on traffic conditions.

Cautious drivers

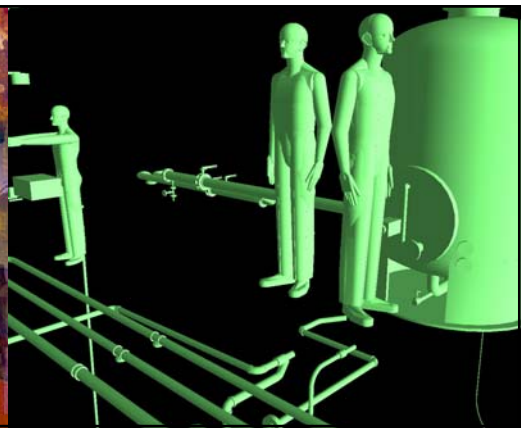
Make a video sequence- now straightforward

Alternative version

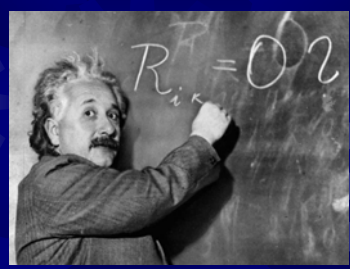
- Queuing theory demonstration
- Input: None
- Method: Demonstrate graphically illustration of queuing theory. A good example would be a simulation of road traffic flow, to illustrate wave phenomena (standing and moving waves) associated with partial obstructions.
- Output: Graphical demo, preferably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

Project 10 Avatar/ dancer

- Aim: to place some avatars in a street scene
- Input: Street scene
- Aim generation of some realistic human figures walking about is street scene. Can you add facial expression.
- Output: video clip with avatars moving
- Alternative, avatar walking up stairs, dancer dancing
- Remarks: Difficulty variable



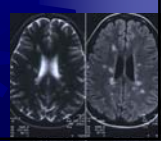
Some oldies but goodies



Project 11

- 2-D edge detection using cost minimization/ snakes.
- Input: Medical and/or other images
- Operation: Compute gradient image. Define a transform, for example polar, a cost function, for example circumference and gradient. Minimize path in transformed data by cost minimization. Alternative, use a snake for example using Greedy algorithm. The object is to find an algorithm to link the points identified on a gradient map to give continuous enclosing contours. Think out extension to 3d. Include if possible Active Appearance Model...
- Output: Image with contour. Algorithm to identify organ, for example
- left ventricle of heart, without manual intervention.
- Coding: In C/C++ in form which could be used in package
- Remarks: Difficulty medium. Problem is robustness

A ballooning snake



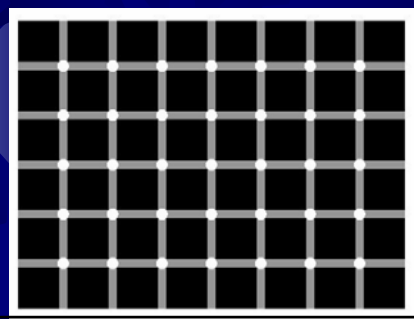
Project 12 Casino

- Simulation of playing card (/input of real video images) to generate image from which score determined and cheats detected.
- Input: Digital/ Video input of playing cards on surface at random position
- Operation: Identification of cards and scores automatically- No manual intervention
- Output: Score (and detection of cheats)
- Coding: as desired
- Remarks: Difficulty quite hard

Project 13

- User interface and game representation for 3D GO, played by robot.
- Input: none
- Operation: Creation of 'game' including GUI and rules! for extension of Japanese game GO to 3D, pieces moved by robot arms. [Alternative –novel flight simulator.]
- Output: playable game
- Coding: as desired
- Remarks: Difficulty depends on project team

How many black spots?

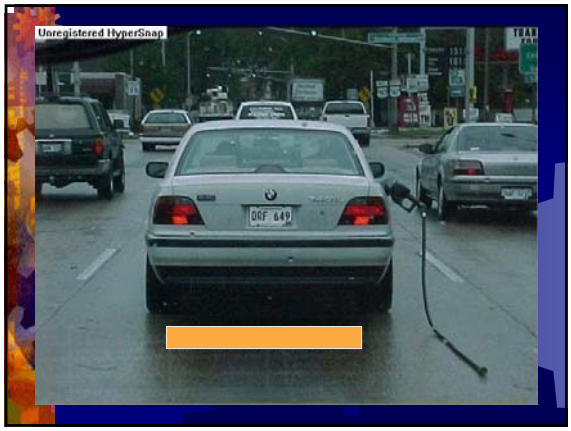


Project 14

- Binary tomography reconstruction from limited angles.
- Input: Binary tomograms in 2d/ 3d (values only 0 and 1)
- Method: Generate projections and add some noise. Reconstruct original image by methods as described in lecture.
- Output: Information about speed, robustness and uniqueness of solution. [Consult Attila Kuba.]
- Difficulty: Medium

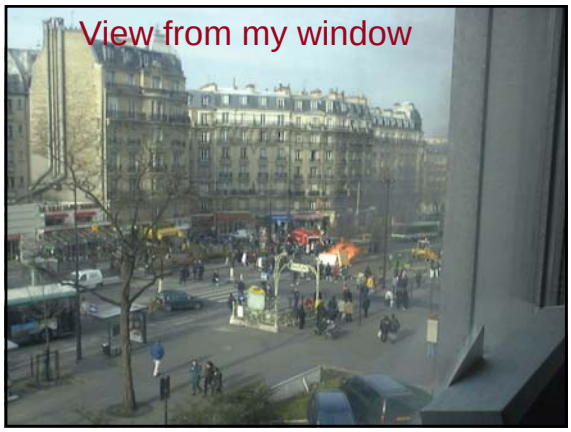
Project 15

- Number plate identification
- Input: Blurred images of number plates (with motion)
- Method: Determine motion and correct for blur.
- Output: Text decoding of number plate plus information of limit of blur (speed) to working of algorithm
- Difficulty: Easy to medium



Project 16

- 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 roofs in the image, give every roof a unique id (number)
- Output: identifies roofs.
- Difficulty: hard

Project 17 Money, money money

- Counting money.
- Input: Photo of coins (Euro\Cent perspective view, non-uniform lighting, eventual partial covering)
- Task: Recognise the coins and count the total sum.
- Output: The sum, and also the recognition statistics (accuracy / false positive rate etc) of the implemented method.
- Difficulty: Medium

18. OCR with a difference

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Summary

1. World cup (goals and fouls)
2. Terrorists (disguise)
3. Group photo (facial recognition)
4. Grim grins (emotion)
5. Top model (facial characteristics)
6. Flags
7. Keys (edge matching)
8. Texture (segmentation)
9. Robot driver
10. Avatars (or dancers)

Cont.

11. Edge detection (snakes, AAMs)
12. Casino (playing cards)
13. Robot 3d GO
14. Binary tomography
15. Numberplate deblurring
16. Counting windows (or roofs)
17. Money
18. OCR (Korean pronunciation)