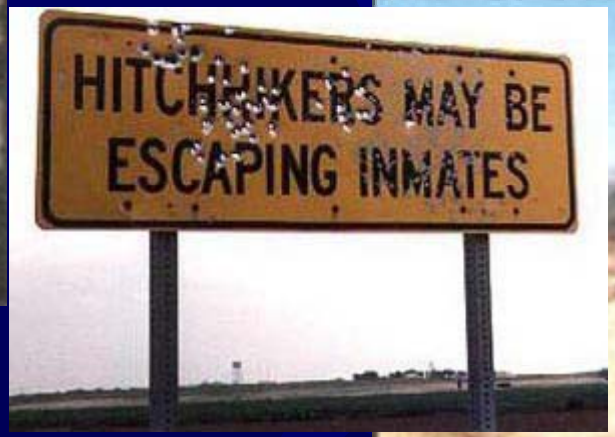
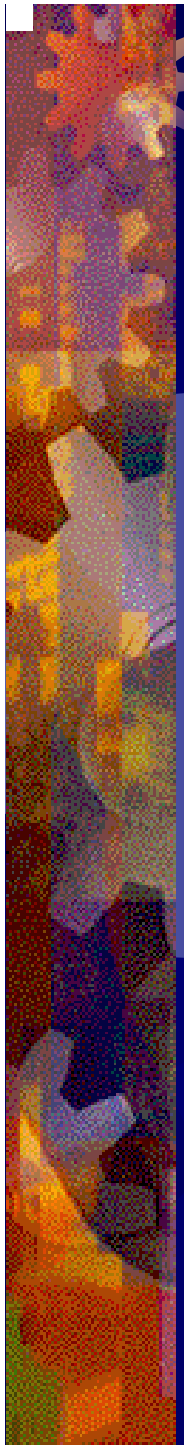
SSIP 2011
Project suggestions
July 2011

Afghanistan
Terrorist
School
HUMAN
BOMB
CLASS
Pay attention, because I'm only going to do this once, ok?

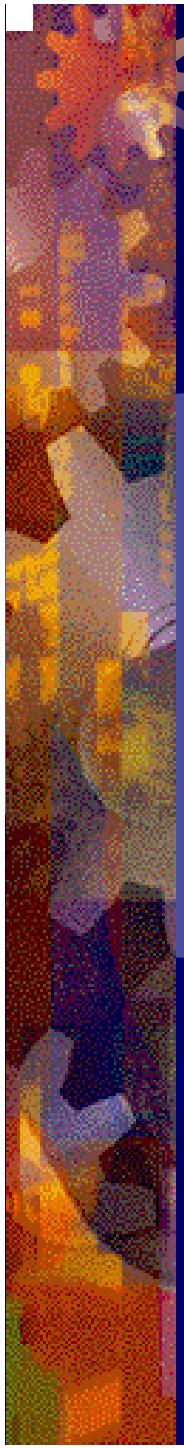
Guidelines -> Roadmap





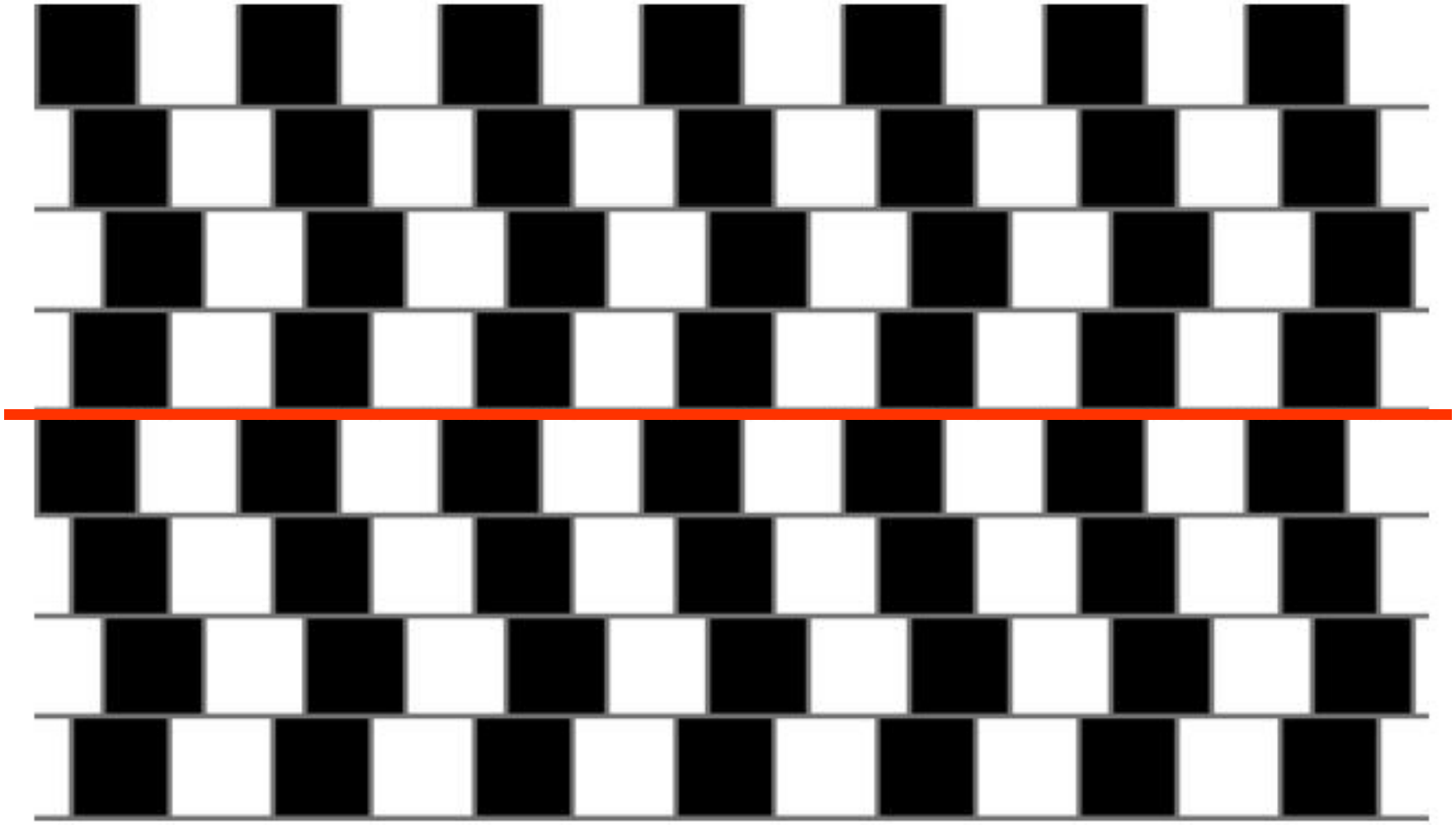
Team work

- 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

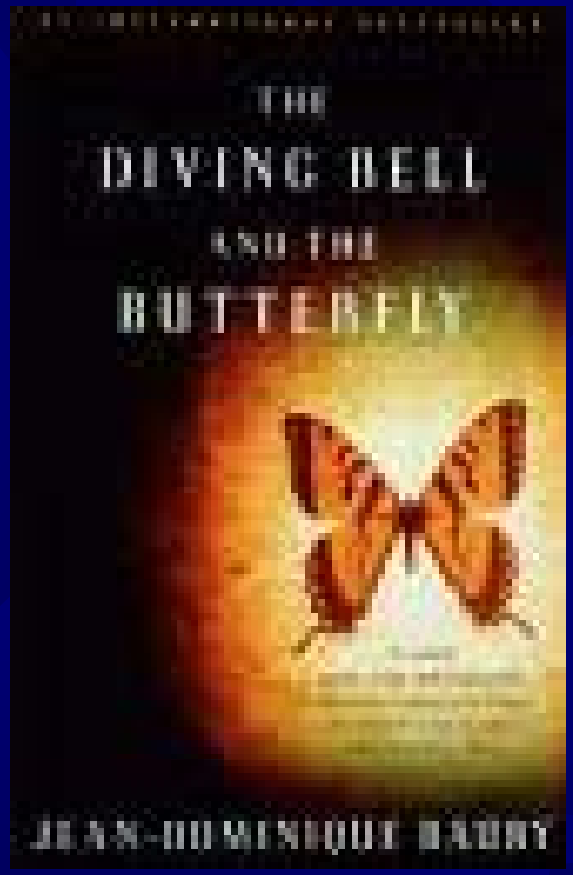


Are the horizontal lines parallel or do they slope?

Project 1

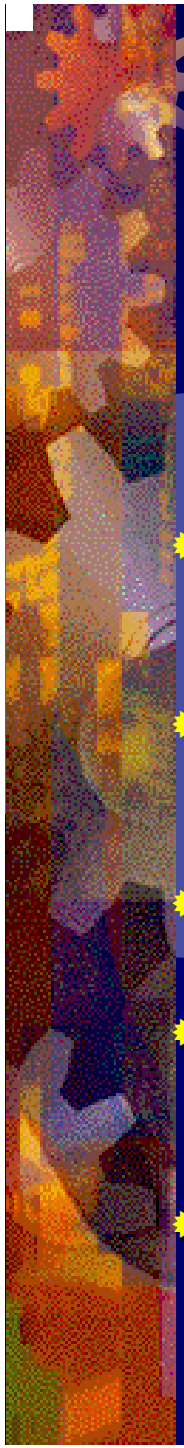
- Paint by finger
  (using the Kinect sensor)

Project 2



Using eye motion as a mouse

- Input live images from a webcam
- Using blinking and hopefully eye motion
- To drive application as a substitute mouse
- In principle not too hard
- Project can evolve to additional features



Project 3 Tracking of a ball (or moving person) against background

- Input: video sequence of for example of part of football match or golf)
- 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’

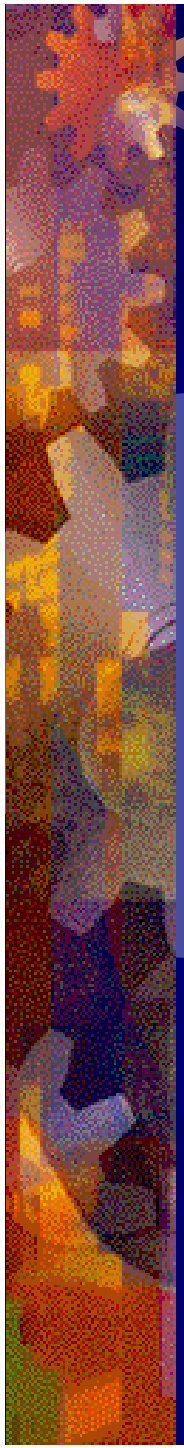
Football matches in history

Project 4 Tree and leaf detection

- Detect several types of trees: e.g. oak tree, elm tree, …
- By means of:
  - Leaf or/and
  - Tree bark
- See for example:
  - www.baumkunde.de
- Difficulty: medium

Project 5. Recognition of doors and steps

- Help blind people navigate by using images from their mobile phone (or webcam) by recognizing d… s… etc.
- Build object database
- Consider invariance
- Difficulty: medium to h…



Project 6. Bi-modal emotion recognition from face and gesture/pose

- Input: videos of a person, in front of the computer; a webcam can be used if available
- Objective: recognize emotional state using face and pose or gesture or body movement; integrate the two modalities. Not much emphasis on initial feature detection, but rather on tracking, feature selection, feature classification. Try to see if indeed using the two modalities can lead to higher accuracy in emotion recognition?
- Tasks to do:
  - find a set of suitable features for face emotion recognition; track them in the video
  - find a procedure for pose or gesture recognition – extract all you think is useful… to describe the emotions by pose and/or gestures and/or body movements (ANY ideas will be appreciated!)
  - find some classifiers to recognize the emotions in both modalities
  - integrate the two modalities in emotion recognition
  - analyze the performance of each modality and the result of their integration; is it better in classifying correctly the emotions?
- Result: an emotion recognition engine
- Remarks:
  - difficulty – high;
  - alternatively to gestures – can investigate the bi-modality in the form of emotion recognition from face and audio data

Some samples… (FABO database)

Some samples… (FABO database)

Alternative: Facial emotion recognition based on mouth analysis

- Input: videos or static color images of a persons' 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 7. Colour image processing for shadow removal

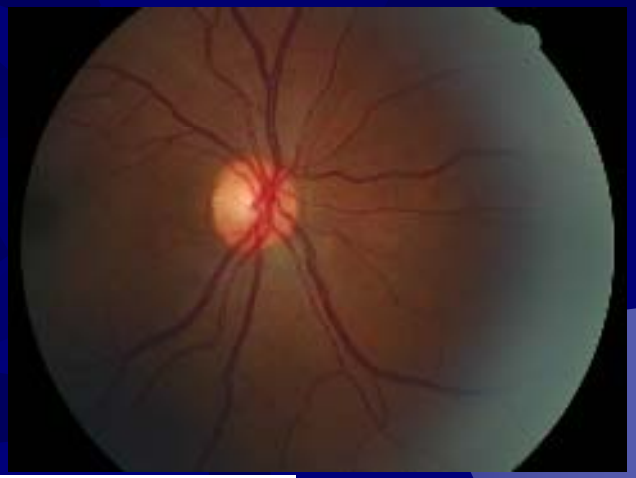
- Input: still color images with shadows
- Objective: recognize the shadow region and remove the shadow, i.e., correct the appearance of the shadowed region to preserve the texture but correct the color, with minimal artifacts
- Tasks to do:
  - find procedures to identify the shadow (ideally – fully automatic; if not possible – at least with minimal user interaction)
  - find the suitable transformation to produce a smooth image without shadows, to look perceptually as natural as possible
  - can start with grey scale images, if it seems simpler…
- Result: the application for shadow removal; prove the performance on shadow corrected images
- Remarks:
  - difficulty – medium;

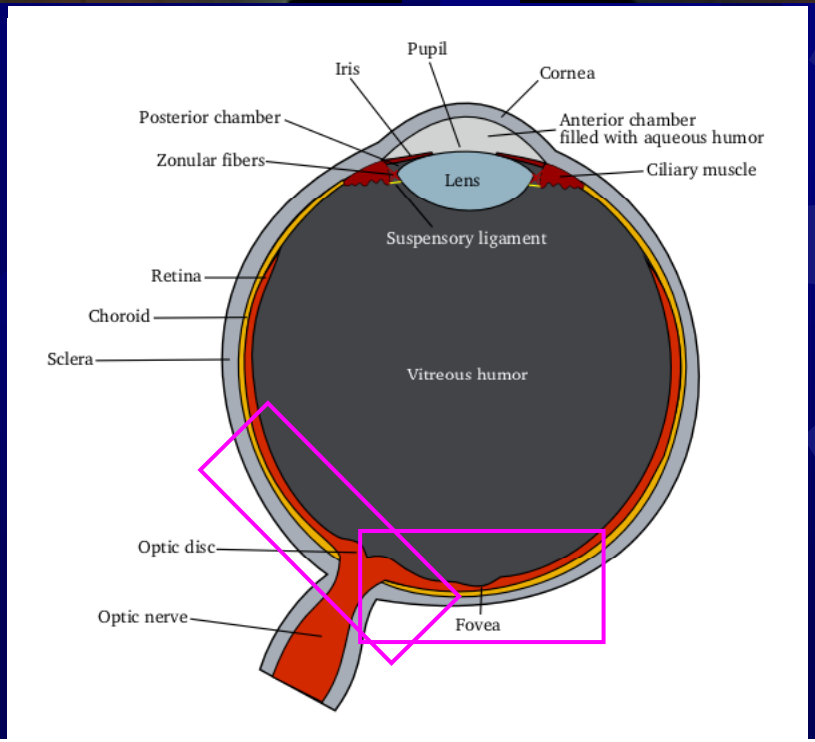
Some examples…(before – after)

Project 8. Registering retinal images

- Input: still color retina images with focusing on different part of the retina
- Objective: to find correspondence between the anatomical parts based on which the images can be registered (aligned)
- Tasks to do:
  - Try to locate special anatomical elements that help registering the images (hint: use optic disc or vascular system)
  - Find coreelation between the images also in consideration with the perspective distortion between the two images (hint: we can assume that the two images were captured from a sphere-like scene).
- Remarks
  - difficulty – difficult;

Some examples…





Project 9: 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

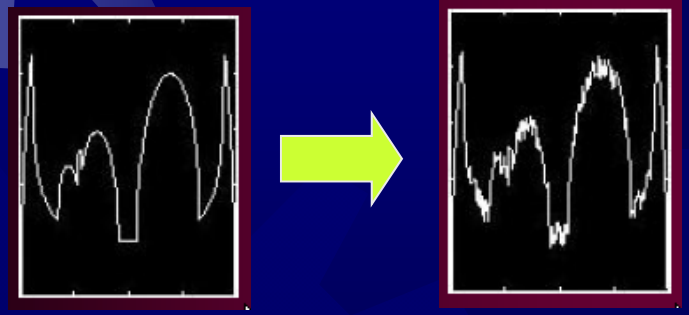
Project 10: Male or Female?

- Find faces in images.

Project 11: Binary/ discreteTomography

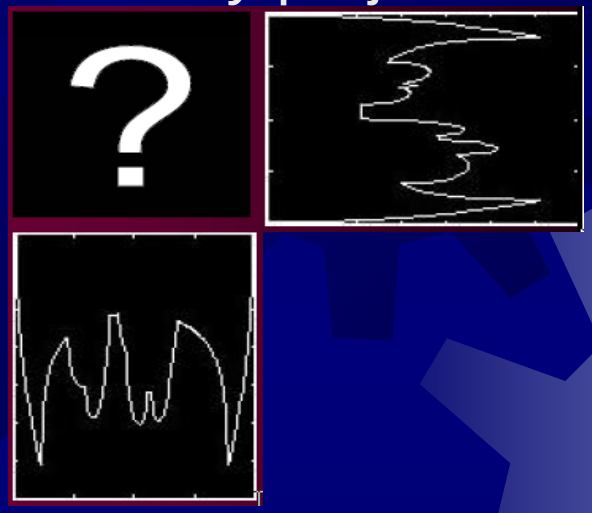
- Calculate projections of binary images

- Add noise to the projections



Test also in 3D

- Reconstruct the image from noisy projections



- Test accuracy and speed depending on
  - size of the image
  - number of projections
  - characteristics of noise

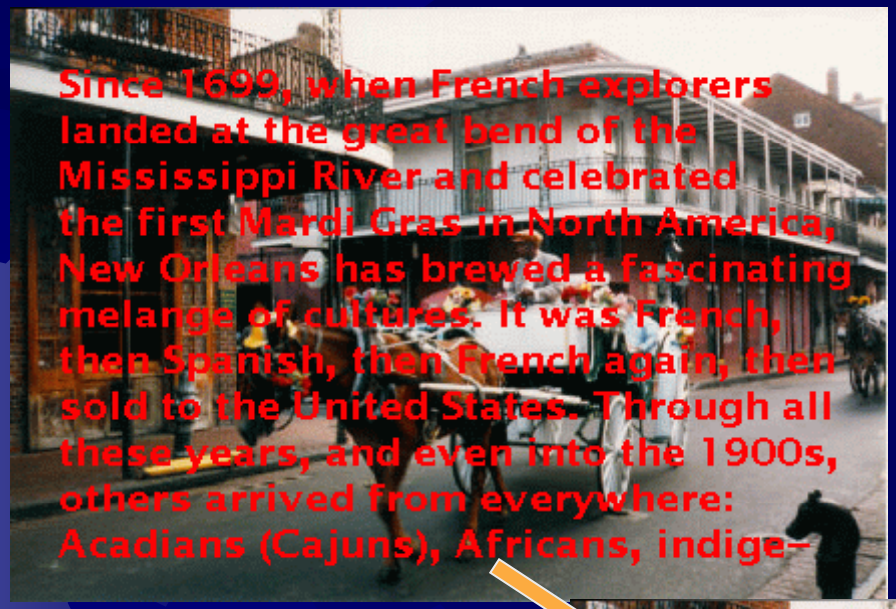
Project 12: Photographs restoration for scratch removal and date superposition removal

- 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):

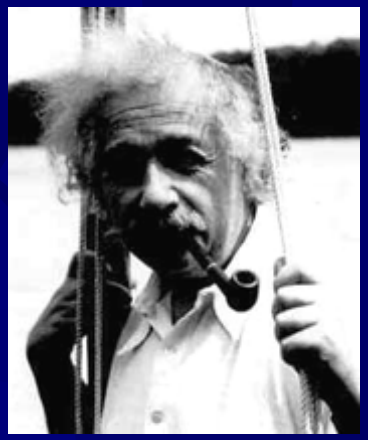
After restoration

Example photographs to be restored (2):



After restoration

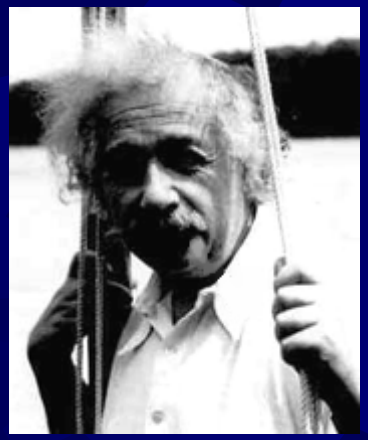
Example object removal from a photograph:



Original image

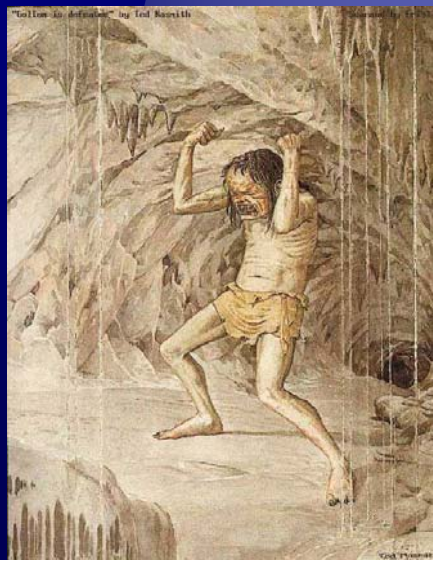
Object to remove

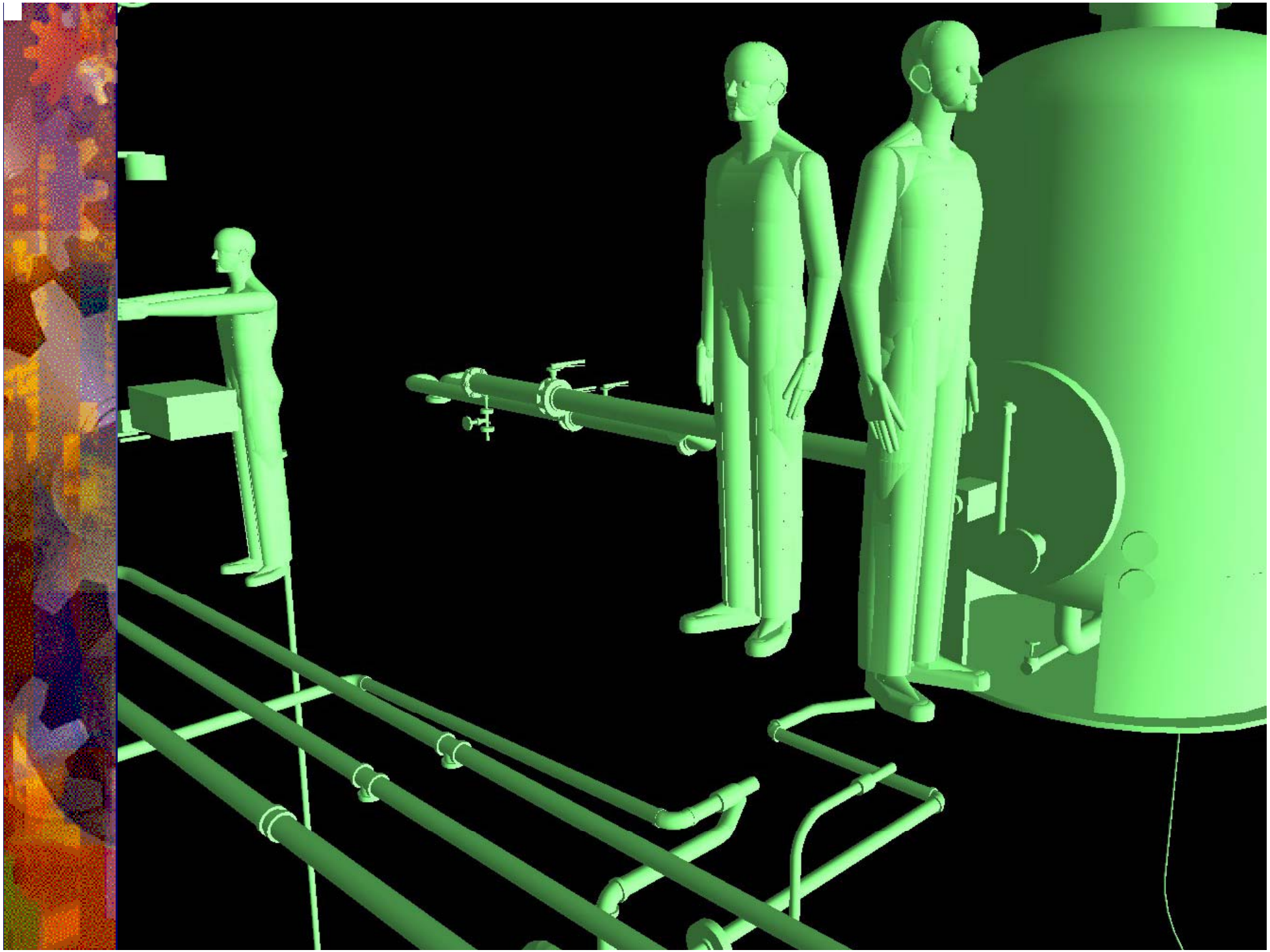
Result after removal

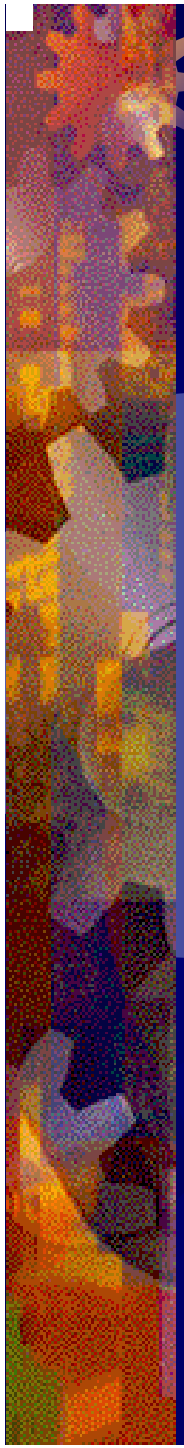


Project 13 Avatar/ dancer

- 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







Project 14 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

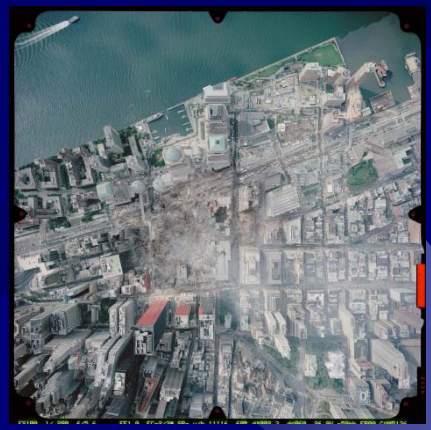
- Counting roofs.
- Input: a digital photo of roofs
- Task: count all of roofs in the image, give every roof a unique id (number)
- Output: identifies roofs.
- Difficulty: hard

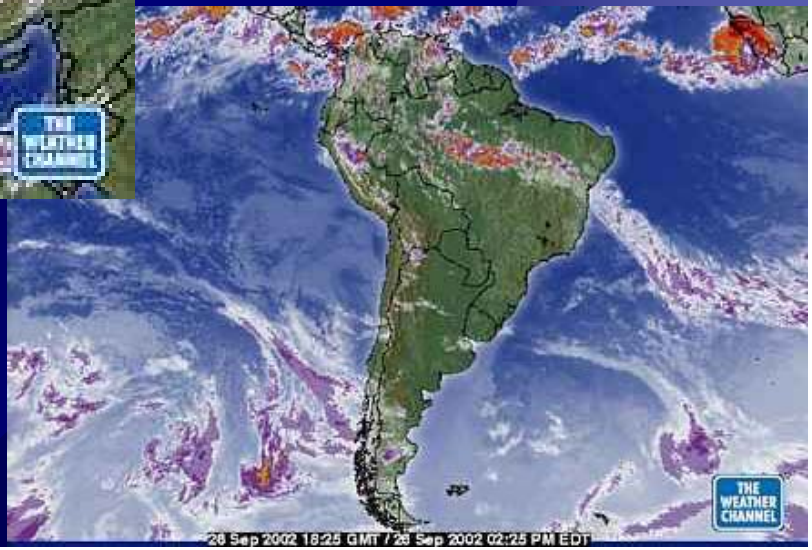
BCE ECB EZB EKT EKP 2002
20 EURO
20

Project 15 Landsat classification

- Input: Landsat images of terrain, plus sample images of fields/ sea, forest etc preferably low level from aircraft
- Aim: segmentation of scene based on texture (and colour) including registration and matching of mutiple scenes
- Additional goal: intenfication of key features such as cave openings, tanks etc
- Output: labeled scene
- Remarks: Difficulty – medium

Satellite images





Project 16. Speech synthesizer for chinese

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Many different dialects, for example Mandarin, Taiwanese and Cantonese

- Look is up in dictionary
- Chinese is TONAL
- Difficulty variable (ask for help)
- Many dictionaries are available of web accessible
- Note Pin yin translaters also very useful

Project 17: Modelling models

- 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?

Fig. 6**: Parcels (arrows) hidden under the clothing and the girdle. Pistol under the pants. Backscatter image.

Fig. 7**: Drugs in the hem of the jacket. Backscatter image.

Fig. 8**: Drugs hidden in the hair (arrow). Backscatter image.

Fig. 9**: Pistol hidden under the clothing. Backscatter image.

of radio-opaque material/medicaments would make detection more difficult. Examinations with contrast substances may have their va addition to plain film diagnostic and CT, when the elimination of all parcels from the gastrointestinal tract has to be proven. The body's s and clothing can be the hiding place of arms, drugs and explosives. Transmission and backscatter imaging offer easy and rapid examinatic 6–9). Metal is visualised with both techniques; they produce impressive images.

Some real terrorists

Some past terrorists?

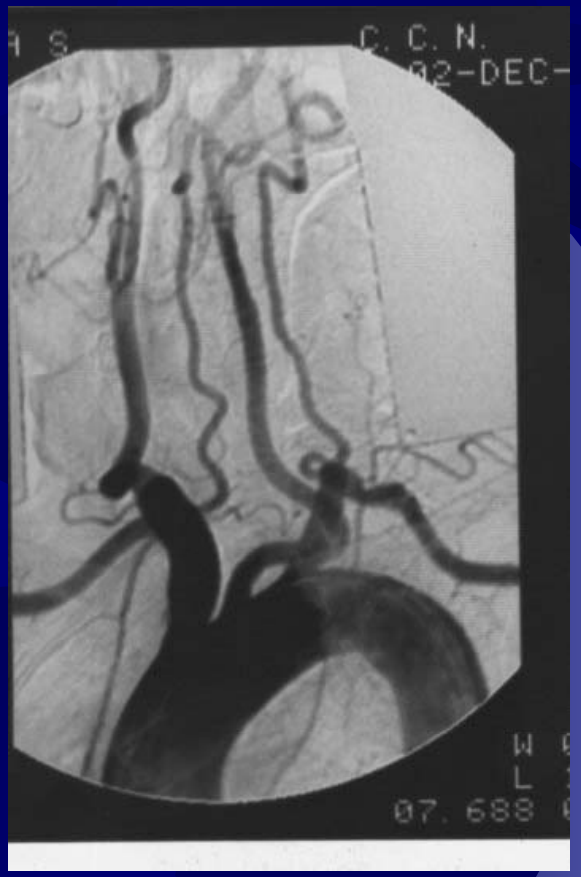
Alternative – analysis of group photograph

- Labelling each face in group photo with names of participants
- Input group photo and indicivual photos
- Matching and labelling
- Difficulty probably quite hard

Project 19. Tracking tubes

- Download images of tubes, for example a blood vessel or airway tree
- Track the tubes including bifurcations
- Define the medial axis
- Label each level of the tree
- Identify features such as obstructions of stenoses

- Remarks: Difficulty medium



Summary

1. Paint by finger
2. Eye motion as mouse input
3. Tracking ball
4. Tree and leaf recognition
5. Doors and steps
6. Emotion recognition from face and gesture/pose
7. Colour image processing for shadow removal
8. Registering retinal image
9. Ear Biometry
10. Male or female
11. Discrete Tomography
12. Photo restoration
13. Avatar/ dancer
14. Counting windows/ roofs
15. Landsat classification
16. Chinese speech
17. Modelling of models
18. Terrorist detection (disguised)
19. Tracking tubes

Micro project

20. any other suggestions?

Cont.

- 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