Advanced topics in Image Processing

- Image Registration (Topics / Algorithms of Interest - AIR, FLAIR, etc.)

Image registration is the process of matching two images taken from different sensors, at different times, or from different viewpoints.

General transformations:

1) Affine:
2) Projective:
3) Perspective:
4) Polynomial:
5)

Registration Methods

1. Correlation and Sequential Methods
2. Fourier Methods
3. Point Mapping
    a. Control Points
    b. Global Methods
    c. Local Methods
4. Elastic Model-Based Methods

Image Databases - Techniques in Organization and Retrieval of Visual Data

- Computer Vision
- Content Based Image Retrieval

What is Machine Vision?

Machine Vision - The use of devices for optical non-contact sensing to automatically receive and interpret an image of a real scene, in order to obtain information and/or control machines or processes. (-)

What is a radiometric transformation?

Under what circumstances would you typically use an intensity transformation?

When the image is

What does it mean to say a computationally intensive feature is '**moment invariant**'?

What is the difference between an edgelet and edge?

How does one compute the **center of mass** of an image?

What does the center of mass tell us about an image?

What is the water-filling algorithm? (http://www.ifp.uiuc.edu/~qitian/e_paper/acmm00/acmm00_pfa.pdf)

What method(s) can be used to discover the fractal dimension of an image?

- a Variation of the box-counting procedure.
- Calliper Method
- Pixel-Dilation Method

- Hausdorff Method
- Self-similiarity Method
- Mass-radius Method

What do frequencies mean in an image?

If an image has large values at ***high*** frequency components then the data is changing rapidly on a short distance scale. ***e.g.*** a page of text
If the image has large ***low*** frequency components then the large scale features of the picture are more important. ***e.g.*** a single fairly simple object which occupies most of the image.

http://www.microscopy.fsu.edu/primer/java/digitalimaging/processing/fouriertransform/

Power Spectral analysis of Vertebral Trabecular Bone Structure from Radiographs.
http://www.mrsc.ucsf.edu/bone/people/SM_pubs/21.power%20spectral%20anal.pdf

What is multi-scale edge detection?

What is backmapping (Hough Transform)?

What are Voronoi Tessellations?

A voronoi tessellation is a

What is the pairwise-histogram approach?

What are the types of metrics, or "distances", one can use to measure in his/her object classification project?

1. Euclidean
2. Manhattan Distance
3. Mahalonobis Distance

http://www.engr.sjsu.edu/~knapp/HCIRODPR/PR_simp/metrics.htm

What is the box counting method?

Fractal dimension

What are gabor filters?

Gabor filters are used for contour analysis.

- What is Stereo Vision?

Stereovision is a passive technique used to determine the depth of an object or a point in a scene using a pair of stereo images. The depth information is essential in many applications such as robotics, remote sensing, and medical imaging.

- Are there other methods to use for determining the depth of field in an image?

- What is the radon transformation?

The radon transform is related to the Hough transform in that each can be used to detect lines in an image. The Radon Transform lends itself well to images with noise.

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Newsgroup Q & As

Subject: Image Tracking

Hi,

I am a final year college student, and have a big final year project upcoming. I have chosen to look into creating an app to track moving images from video, probably from maybe an mpeg, as that comes straight from a digital camcorder. I am then going to process this, and display it in a virtual 3d world.

Can anybody suggest links to good web sites, or good books that I might get hold of to help me. I have read a little about the mean shift algorithmn, but more info or alterative algorithmns would be helpful.

Also I am still trying to decide about what language to implement all this in. I have a little c/c++ and just read a book all about directshow stuff, however I am far more comfortable with java and know about the java3d and media api's available. Any suggestions???

RE:
Well, there are several methods to track moving images (look for "image registration"): you can minimize the squared difference, you can use motion

vectors (if you use mpeg) or phase-correlation (or mellin-transformation).
If you want to use a more complex model (e.g. projective), there's Kanade-Lucas-Tomasi-tracking. For my thesis I wrote in C/C++ (for a MPEG-library, you can use http://libmpeg2.sourceforge.net). But maybe you can use directshow instead (look for DirectX or Adobe Premiere library). You can search these keywords on google.

Goodluck,

Hiep Quang Luong

RE:

Try googleing for "motion segmentation", a name to look for is "Daniel Cremers" who has done some work about that.

- What is phase-correlation?

- What is the mellin-transformation?

SUSAN
http://www.fmrib.ox.ac.uk/~steve/susan/

DIP @ Uiowa -
http://www.icaen.uiowa.edu/~dip/LECTURE/Segmentation1.html#multi

Pattern Recognition
http://cgm.cs.mcgill.ca/~godfried/teaching/pr-web.html

CBVIR: Texture Features
http://www.cs.auckland.ac.nz/compsci708s1c/lectures/Glect-html/lect4c708FSC.htm
Great Website: Talks about Texture Features and Co-occurance Matrices.

[1] Brown, Gottesfeld, "*A Survey of Image Registration Techniques*", Dept. of Computer Science, Columbia University, Jan. 1992.