

CISC-472: Course Contents

Refresher from CISC-330

- Coordinate systems
- Transformations matrices
- Frame transformations
- Trackers
- Calibration

Marker Registration

- Examples and Applications
- Point Marker Registration
- FLE, FRE and TRE
- Least Square Minimum
- Arun's method / SVD
- Correspondence, ambiguity
- Line Registration
- Plane Registration
- Multiple Object Registration

Medical Images

- Image Modalities (X-ray, CT, MRI, US)
- Representations: Bitmaps, Encoding, Metadata, etc.
- DICOM
- Image Viewers

Image Filters

- Thresholding, histograms, window/level
- Morphology Operators
 - Structuring element
 - Basic operators: Erosion, Dilation, Opening, Closing
 - Top-hat transform

Marker Segmentation

- Partial volume, centroid, ROI
- Shape priors (circles and ellipses)

Curve Segmentation

- Cunny filter
- Sobel filter
- Edge blurring, Gaussian filter
- Edge tracing
- Shape priors: circles, ellipse, lines, etc..

Anatomical Segmentation

- Examples and Applications
- Manual segmentation
- Contour propagation
- Watershed algorithms
- Gradient tracing algorithms
- Model-based segmentation

Model Reconstruction and Display

- Contours and ribbons
- Contour conversions
 - Contour to mesh (Delaunay triangulation and more)
 - Contour to labelmap 2D
 - Labelmap to contour
 - Labelmap to 3D mesh (Marching Cube)
- Metrics (volume, surface, etc.)

Point Cloud to Surface Registration

- Examples and Applications
- Iterative Optimization
- Head & Hat

Iterative Closest Point Registration

- Examples and Applications
- Classic ICP
- Variants of ICP

Image Registration

- Examples and Applications
- 2D registration
 - Iterative optimization
 - Error functions
 - SSD, CC, NCC, MI
 - Iterators
- 3D registration