

CAP6835 – Visual Simulation

Course Syllabus

Visual Processing

- Image filtering, convolution: applications
- Image hierarchy
- Image warping: transformations, resampling
- Segmentation: snakes, normalized cuts
- Texture synthesis

Image Composition

- Mosaics
- Mosaic representations
- Blending
- Scene rendering with mosaics
- Registration: spatial domain, transform domain

Motion Estimation

- Optical flow
- Model fitting: parametric estimation
- Feature-based methods
- Correlation-based methods
- Multi-scale representation
- Compression

Single-View Geometry

- Projective geometry: projective bases, infinite entities, vanishing points, homographies, stratification, geometric invariants
- Modeling and calibrating cameras
- 3D modeling from a single view

Multi-View Geometry

- Epipolar geometry: the fundamental matrix
- Rectification
- The trifocal tensor
- Robust estimation techniques: RANSAC

Pose/Structure Estimation

- Auto-calibration
- Structure from motion (SFM)
- Bundle adjustment (nonlinear optimization)
- Scene augmentation: inserting synthetic objects into a scene

Depth/Shape Recovery

- Stereo
- Space carving
- Voxel coloring
- Shape from X
- Level sets

Layers, 2.5D, and 3D

- Layer representations
- Layer extraction: video, stereo
- Layered rendering

Image-based Rendering

- Photogrammetric techniques
- Light field and Lumigraph
- View morphing
- 3D warping and interpolation
- 3D textures

Light

- Plenoptic function
- Reflectance models and the Bi-directional Reflectance Distribution Function (BRDF)
- Intrinsic images
- Color constancy
- Photometric invariants