CS498Q/698Q – Introduction to Computer Vision

Time: Winter 2001, TR 1:30–3:00, EL209. Tutorial TBA.
Instructor: Richard Mann
Grading: 4 Assignments (60%), Project (40%).
Prerequisites: Numerical Computation (CS370), Matlab experience.
Text: Trucco and Verri, *Introductory techniques for 3D Computer Vision*
References: Horn, *Robot Vision*; Castleman, *Digital Image Processing*.
Details: http://www.cs.uwatleroo.ca/˜mannr

Vision: "To know *what* is *where* by looking" – *Aristotle*

Computational Vision:

- *Where* – scene reconstruction (shape, depth, motion)
- *What* – object recognition (object categories, person/object identity)
- *Why* – event recognition, action description

Applications:

- *Industrial systems:* quality control, surveillance, ...
- *Mobile rototics:* landmark detection, navigation.
- *User interfaces:* user identification, gesture recognition.
- *Image & Video databases*
- ...

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- *Introduction and overview (1hr)*
- *Image Formation (2hrs)*
  Optics; Cameras and imaging; Shading and reflectance.
- *Linear Systems and Fourier Theory (4.5hrs)*
- *Image Registration (3hrs)*
  ⇒*Assign.#1: Image composites*
- *Feature detection (1.5hrs)*
- *Fitting models to data (4.5hrs)*
  Least squares; Robust estimation; Mixture models.
  ⇒*Assign.#2: Line/surface fitting*
- *Optical flow (3hrs)*
- *Structure from motion (3hrs)*
  Scene reconstruction from image flow field: Factorization method, Direct methods.
- *Stereopsis (6hrs)*
  ⇒*Assign.#3: Stereo: matching vs. dynamic programming*
- *Object Recognition (6hrs)*
  View based methods: principle components analysis, factor analysis; Regonition by linear combinations of views; Model-based approaches.
  ⇒*Assign.#4: Object Recognition by Principle Components Analysis*
- *High-level vision (3hrs)*
  Selected topics: Feature grouping; Object recognition based on function; Event recogntion.

Assignments: 60%
Project: 40%