Final Projects CS 6643 Computer Vision, Spring 2018

Timeline and Deliverables:

- **Tue April 10**: Project start
- **Tue April 17:** Draft title, student group and short description of project, methods, data to be used, expected results.
- **Tue April 24:** Update on project: Progress so far, obstacles, eventual changes to plan, achieved so far.
- **Tue May 7**: Final report and video and full package of code and image/video data:

Organization and Coverage:

- Groups of 3-4 students
- Project includes:
    - Design and planning (what problem to be solved? Defining basic methodologies and tools. What data to be used, application area?)
    - Development phase: Programming and assembling of image processing tools
    - Testing & Validation, refinement
    - Generation of Results

Deliverable:

- Package of image/video data used, of complete code, scripts
- Instructions how to use and run the code
- Comprehensive written report (5-6 pages) describing motivation, approach, data used, results, critical discussion, future work if more time
- List of key contributions for each member of the group
- Short 2-3' video summarizing the goal, data and results

Coverage of Scoring:

- Design and planning of project, division of work among group members
- Software engineering efforts, choice of solutions to individual parts, good use of image processing as discussed in this course
- Difficulty of project, Challenges
- Testing and validation efforts (robustness, failures, break-down)
- Quality of results, goal achieved
- Creativity, Innovation
- Quality and comprehensiveness of report (highly significant)
- Quality of Video

Proposed Methods/Application areas

The following are guidelines to pick project that will use existing knowledge from the course (histograms, thresholding, filtering, edge detection, template matching, HT, geometric transformations, and more) but then bring it to the next level by solving specific applications. The choice of an application area is the creative/innovative part where students have choices.

1. **Segmentation/finding of objects** in images using voting scheme (Hough transform, generalized Hough transform GHT, extension subtemplates rather than edges):
    a. See slides on GHT and additional options
    b. Project will include building of templates, and applying those to images to find and identify objects in images.
    c. Application domain is up to
2. **Mapping images by nonlinear geometric transformations**
    a. Using the concepts of linear followed by nonlinear image transformations based on radial basis functions:
    b. Nonlinear alignment of images via landmarks to overlay/morph images
    c. Alignment of groups of images to form geometric templates (averages): E.g. mapping different faces into a norm template, aligning images taken at different timepoints etc.
3. **Object motion by Optical Flow (OF)** to estimate moving objects in sequential images or video sequences:
    a. Estimate flow field of moving objects in image sequences using OF with regularization Horn&Schunck, Schunck, Lucas-Kanade)
    b. Find moving objects to segment those from a static background, e.g. as user-interface to display a synthetic object
    c. Measure object motion path (speed, trajectory) with application to sports, traffic, surveillance or else.
4. **Eventual other projects:** Eventual other projects need a close relationship to the 3 topics, eventually a combination thereof. E.g., finding objects in video sequences, e.g. dynamically moving ball, may include a HT for circles coupled with OF, or testing of these two methods versus combining them.