EECS 531 - Computer Vision - Assignment 4

For this assignment, you can use the image sequences provided and compare your results to the ground truth optical flow. Each sequence contains nine images so you can try different steps of Δt. For reference see the lecture slides or the textbook Chapter 8.

Exercise 1. Write a function that estimates motion with correlation by finding the location of maximum response by convolving a small $n \times n$ image patch centered on pixel (x, y) from one frame over a local region of the next frame. Use this method to compute and display an optic flow field.

Exercise 2.

a) Compute the discrete derivative components in the motion gradient constraint equation for a single pixel location of a moving image, $I(x, y, t)$.
b) Compute the matrix **A** and vector **b** representing the motion constraint equations over a (small) $n \times n$ window centered on pixel (x, y).
c) Solve the constraint equations either directly using the formula in the lecture slides or using a least-squares solver to estimate motion (u, v) at point (x, y).
d) Estimate the motion for an grid of locations covering the image.
e) Plot this optical flow field. Compare these results with those in first exercise.

Important Dates

- Wed Apr 4 - Group discussions. Discussion summaries are due by midnight.
- Wed Apr 11 - Group presentations.
- Fri Apr 13 - Final notebooks are due before midnight. Submit all notebooks (or pdfs) to Canvas.
- Mon Apr 16 - Peer evaluations are due before noon.

Requirements

- You are required to use git to manage your code and notebook and make commits regularly to show your progress. You must make a submission of your code and notebooks to canvas before each group discussion, group presentations, and the final due date.
- Use one jupyter notebook (or latex-generated pdf file) per exercise.
- Each notebook should include all necessary text, math, code, and results for clearly explaining your work to others. In addition to submitting the notebooks (the .ipynb files) you should also submit the export of the notebook to a pdf file.
- If you are using a language that does not support jupyter, you must create a pdf notebooks using latex. Use separate pdfs for each notebook.
- After the discussion session, you should submit your feedback to others' work on canvas in their submission page.

Group Discussions. The goal of this discussion is for each member of the group to have a clear idea of how to approach all the exercises in the assignment. You are free to ask any questions and offer any help that helps toward completing the assignment. A good outcome would be for everyone to have gotten a good start on the first two exercises.

Group Presentations. Each member of the group will have 7-8 min to present their notebooks to the other members of the group. Group members should take notes on each presentation for peer review of the final submission (due the following Monday via Canvas). Students are expected to use the feedback from the group to improve their notebooks before final submission. An group selected moderator will ensure that everyone stays within the time limits and that feedback is constructive.

Peer Evaluations. Group members are responsible for evaluating each of the other group members on completeness, clarity and depth understanding, correctness, thoroughness, and creative exploration. As well as a brief summary. Criteria are scored on a scale of 0-3. Details are in the rubric.