Computer Vision I

Project 3
Given: November 21, 2017, Due on December 1, 2017

Dense Optical Flow

In this project you will implement the Lucas-Kanade method for estimating dense optic flow from a pair of images. The input is a pair of greyscale images taken from a video sequence, and the output will be two matrices containing the x and y components of the flow vector at each pixel.

To summarize the LK algorithm for computing flow:

1. Read image1 and image2, and convert to double flow greyscale image frames.
2. Compute the spatial intensity gradients I_x and I_y of image2. Recall that it is a good idea to smooth before taking the derivative, for example by using derivative of Gaussian operators.
3. Compute the temporal gradient I_t by subtracting a smoothed version of image1 from a smoothed version of image2.
4. For a given window size W, form a system of linear equations at each pixel by summing over products of gradients in its neighborhood, as specified by the Lucas-Kanade method. That is, at each pixel, you will have a set of equations:

$$\begin{bmatrix} \sum I_x^2 & \sum I_x I_y \\ \sum I_x I_y & \sum I_y^2 \end{bmatrix} = - \begin{bmatrix} \sum I_x I_t \\ \sum I_y I_t \end{bmatrix}$$

5. Solve for the flow vector $[u, v]$ at each pixel. It is convenient to represent this vector field by two images, one containing the u component, and the other the v component of flow.
6. Display the flow vectors overlaid on the image. You can use matlab "quiver" to show the flow field.

1. **Project Requirements:**
   (a) Write a program to implement the above algorithm. Create a two level pyramid and for each level of the pyramid compute the optical flow independently. Sample sequences to test your program will be available in blackboard.
   (b) **Write a report.** The report should include:
      i. Abstract, description of algorithms, experiments, values of parameters used (How does the size of W affect your results?), observations and conclusions.
      ii. A FLOWCHART, input and optical flow images.
      iii. An appendix with your source code