Computer Vision
Spring 2022
Problem Set #4

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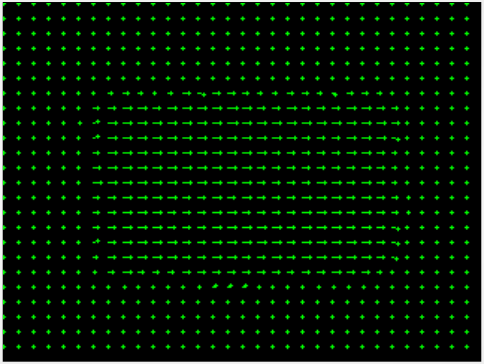
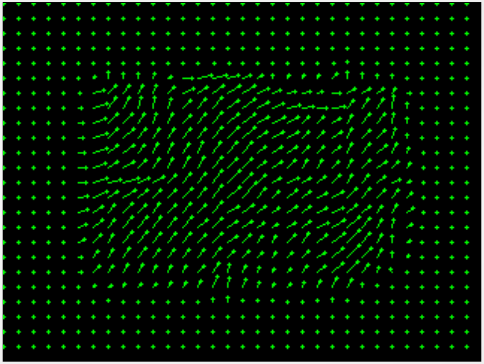
1a: Base Shift0 and ShiftR2



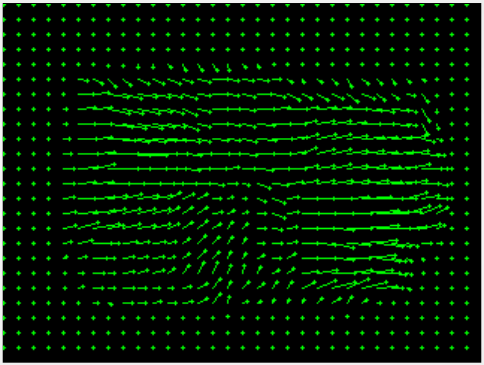
ps4-1-a-1

1a: Base Shift0 and ShiftR5U5



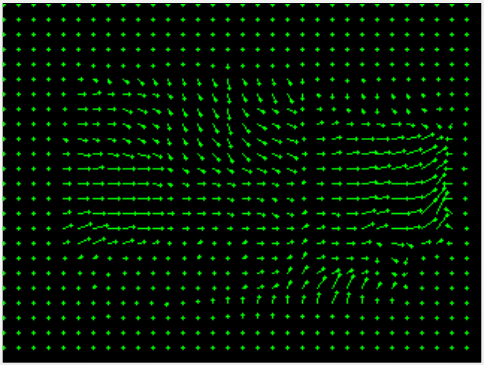
ps4-1-a-2

1b: Base Shift0 and ShiftR10



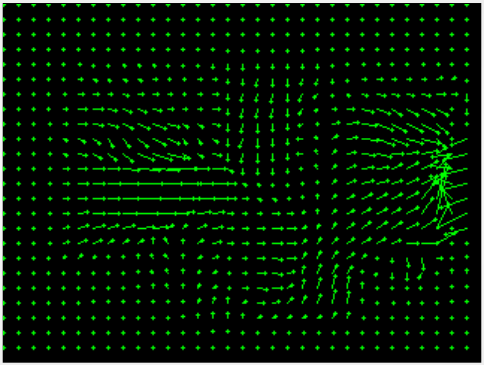
ps4-1-b-1

1b: Base Shift0 and ShiftR20



ps4-1-b-2

1b: Base Shift0 and ShiftR40



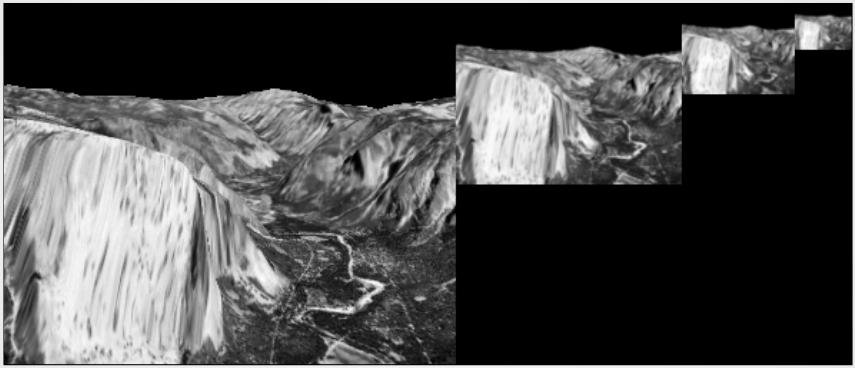
ps4-1-b-3

1b: Text Response

Does LK still work? Does it fall apart on any of the pairs? Try using different parameters to get results closer to the ones above. Describe your results and what you tried.

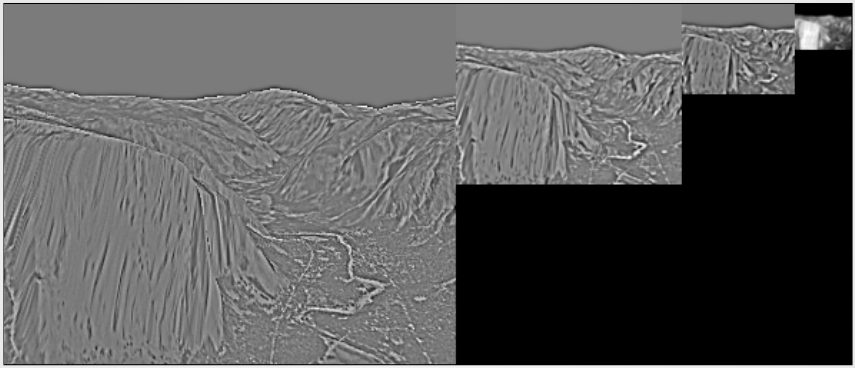
LK is derived based on the assumption that the changes between frames is minimal or not significant. we can that the optical flow in ps4-1-a1 and ps4-1-a2 gave a decent results, but as the changes increased, LK found it difficult to provide a decent the result (as it is seen in part b). To capture an okay optical image for 1b, much efforts was put in tuning the parameters such as the minimum eigvalue, eigvalue ratio, and different blurring techniques etc.

2a: Gaussian Pyramid



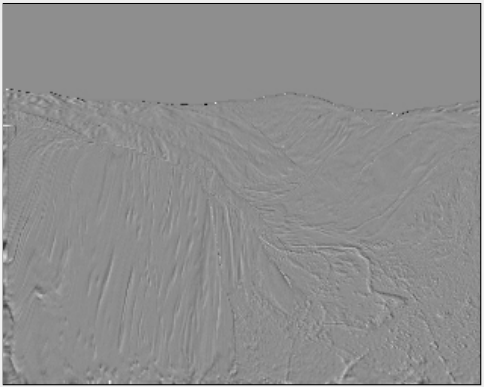
ps4-2-a-1

2b: Laplacian Pyramid



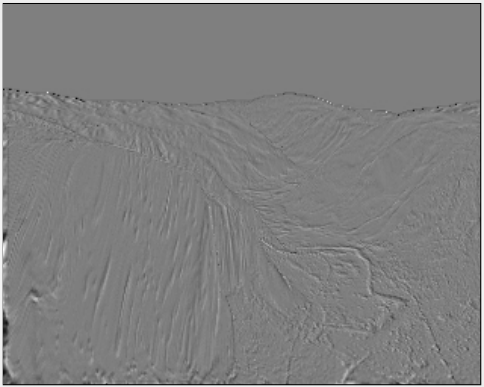
ps4-2-b-1

3a: Difference images



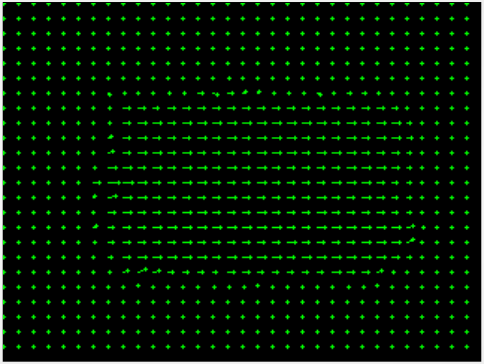
ps4-3-a-1

3a: Difference images (cont.)



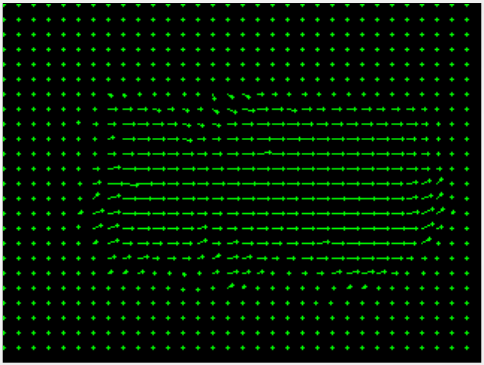
ps4-3-a-2

4a: Hierarchical LK



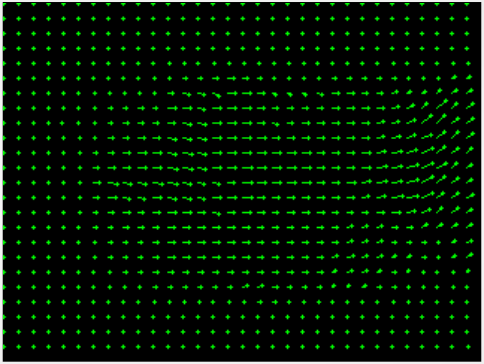
ps4-4-a-1

4a: Hierarchical LK (cont.)



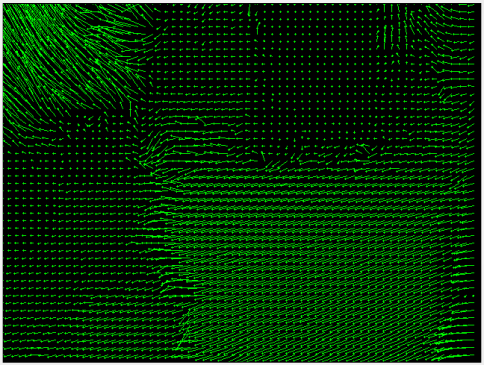
ps4-4-a-2

4a: Hierarchical LK (cont.)



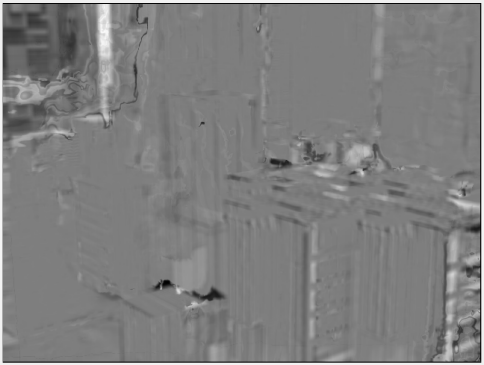
ps4-4-a-3

4b: Hierarchical LK (cont.)



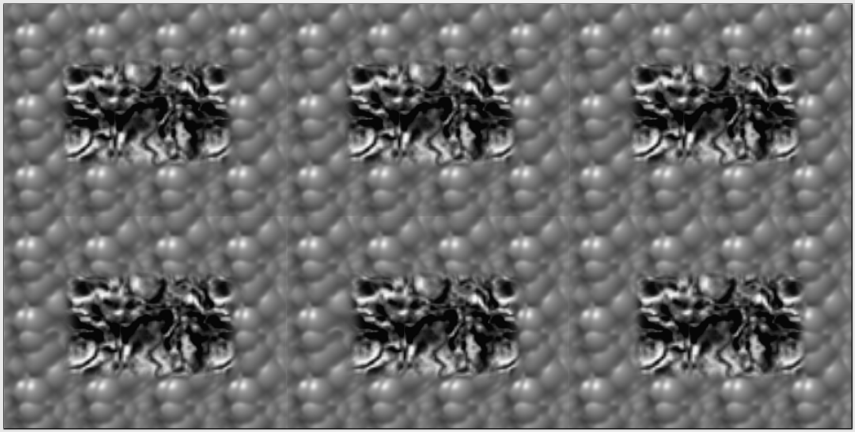
ps4-4-b-1

4b: Hierarchical LK (cont.)



ps4-4-b-2

5a: Frame Interpolation



ps4-5-a-1

5b: Frame Interpolation

ps4-5-b-1

5b: Frame Interpolation

ps4-5-b-2

6: Challenge Problem

Features used to train the Decision tree classifier

	positive x speed	negative x speed	positive y speed	negative y speed
Running 1	5.0	-1.4	15.2	-0.02
Walking 1	0.05	-0.015	2.23	-0.04
Handclapping 1	2.68	-0.017	1.74	-0.006

Features used to evaluating the Decision tree classifier (Test only)

	positive x speed	negative x speed	positive y speed	negative$_{y\,speed}$
Running 2	2.96	-0.75	10.04	-0.009
Walking 2	0.96	-0.1	2.4	-0.04
Handclapping 2	1.55	-0.009	4.06	-0.0058

6: Challenge Problem (cont.)

Method used:
I have used the optical flow values to estimate the average positive and negative speed in x and y from about 30 frames. The speed was normalized based on the area of moving pixels. This is because closer object may appear to move faster where in reality it is just due to the fact that they are much closer to the camera.
Therefore, four features are calculated from each video which are: positive speed in x, negative speed in x, positive speed in y, negative speed in y. These four features are feed to a decision tree that was trained on only 3 videos, 1 per class. The other 3 videos were purely used for testing.

The performance of the Decision varied from 4 correct prediction out of 6 to 6 correct prediction out 6. This is because of the inherent randomness of decision tree especially given the small training dataset. I have set the seed of the randomness to 2 which gave me a consistent 6 correct prediction out of 6.

6: Challenge Problem (cont.)

Optical flow is only one approach to activity recognition and classification. Many modern methods do not require optical flow at all, but simply learn to classify actions directly from the pixels. Can you think of a situation in which calculating the optical flow would be a vital part of action classification? What about a situation in which optical flow might be unhelpful in action classification?

There many deep learning approaches for activity recognition. However, it could be argued that optical flow is still useful for any activity where motion is a vital element in that activity. For instance, the deep learning based algorithms is able to recognize activity such as running, and walking. However, finding the direction in which the person is heading is a challenging problem for the deep learning based algorithm whereas much easier when optical flow is used.

In the contrary, optical flow is not very useful in detecting activities that does not involve much motion such as sitting or sleeping.

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