CS 565 Computer Vision – Assignment 3

Dr. Nazar Khan

Assigned	Wednesday, January 3, 2018
Due	Wednesday, January 10, 2018 before 5:30 pm.

1   Programming

1. **(10 marks): Visualising optic flow vectors**. Like any other vector, an optic flow vector $[u, v]^T$ represents two quantities:

   - direction $\theta = \tan^{-1}(v/u)$
   - magnitude $m = \sqrt{u^2 + v^2}$

   Therefore, one method of visualising optic flow vectors is to map their direction onto the Hue (H) channel of the HSV color space and map their magnitude onto the Value (V) channel. The resulting HSV image can then be converted to RGB space for visualisation.

   (a) Incomplete code for drawing the HSV color wheel shown in Figure 1 is available in the file **colorwheel.m**. Wherever the file contains the following line

   ```
   ------------ADD_CODE_HERE------------
   ```

   add the missing code. To verify correctness, you can compare your result with Figure 1.

   (b) Incomplete code for visualising an optic flow field via the HSV color space is available in the file **visualise_optic_flow.m**. Wherever the file contains the following line

   ```
   ------------ADD_CODE_HERE------------
   ```

   add the missing code.

2. **(10 marks): Lucas & Kanade**. Incomplete code for computing an optic flow field via the local method of Lucas & Kanade is available in the file **compute_optic_flow_lk.m**. Wherever the file contains the following line

   ```
   ------------ADD_CODE_HERE------------
   ```

   add the missing code.

3. **(10 marks): Horn & Schunck**. Incomplete code for computing an optic flow field via the global method of Horn & Schunck is available in the file **compute_optic_flow_hs.m**. Wherever the file contains the following line

   ```
   ------------ADD_CODE_HERE------------
   ```

   add the missing code.

2 Generating Results

Run the scripts

1. **color_wheel.m** to generate the HSV color wheel.

2. **get_results_lk.m** to generate results for your Lucas & Kanade implementation for $\rho = \{1, 4, 8\}$ on the 4 pairs of image sequences shown in Figure 2. The resulting image for each pair shows the flow classification and false coloured optic flow as ρ is increased (top-to-bottom).

3. **get_results_hs.m** to generate results for your Horn & Schunck implementation for $\alpha = \{0.01, 0.1, 1, 10\}$ after $\{1, 100, 600\}$ iterations on the 4 pairs of image sequences shown in Figure 2. The resulting image for each pair shows the effect of increasing α (top-to-bottom) and the effect of increasing the number of iterations (left-to-right).

For verification of results, Figure 3 shows optic flow results on the sphere image pair using Lucas & Kanade's method and using Horn & Schunck's method. If your results are not like these then your implementation is incorrect.
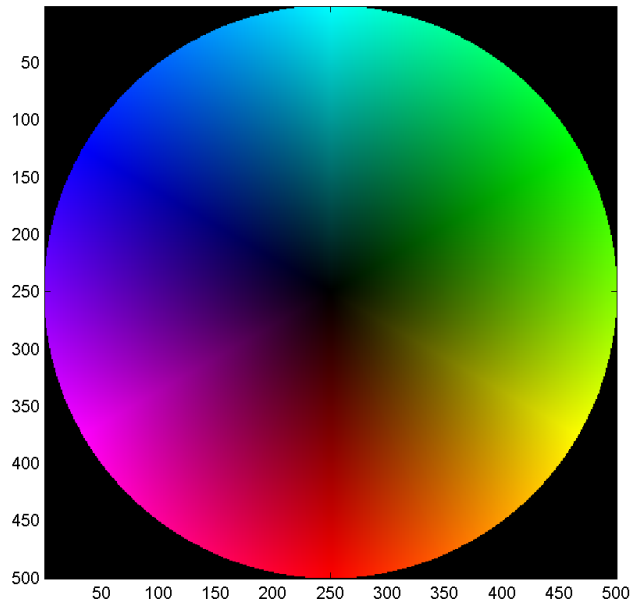
Figure 1: Color wheel after mapping direction to Hue and magnitude to Value of the HSV color space.
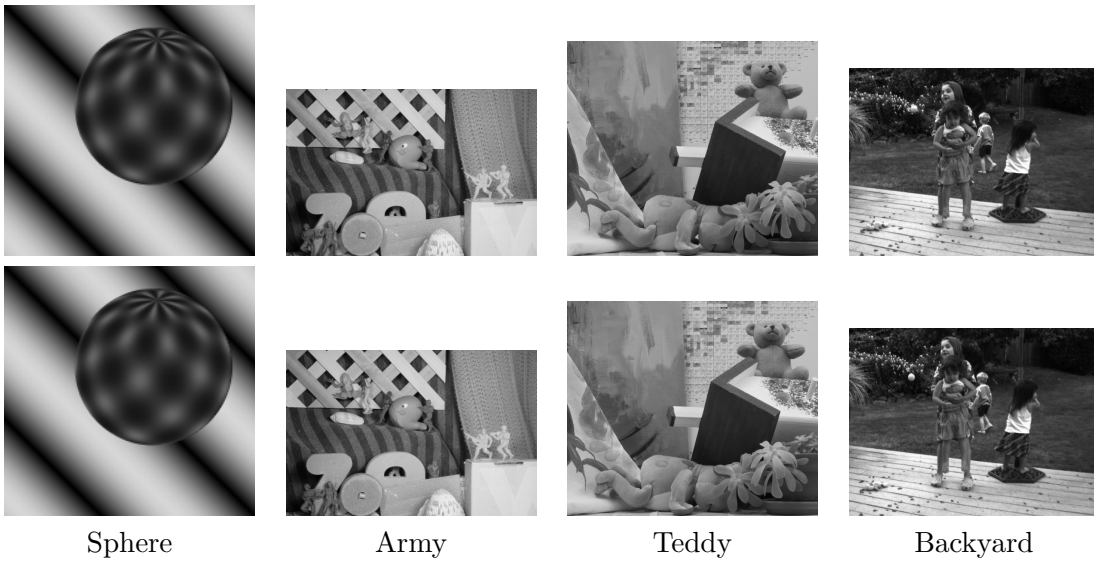

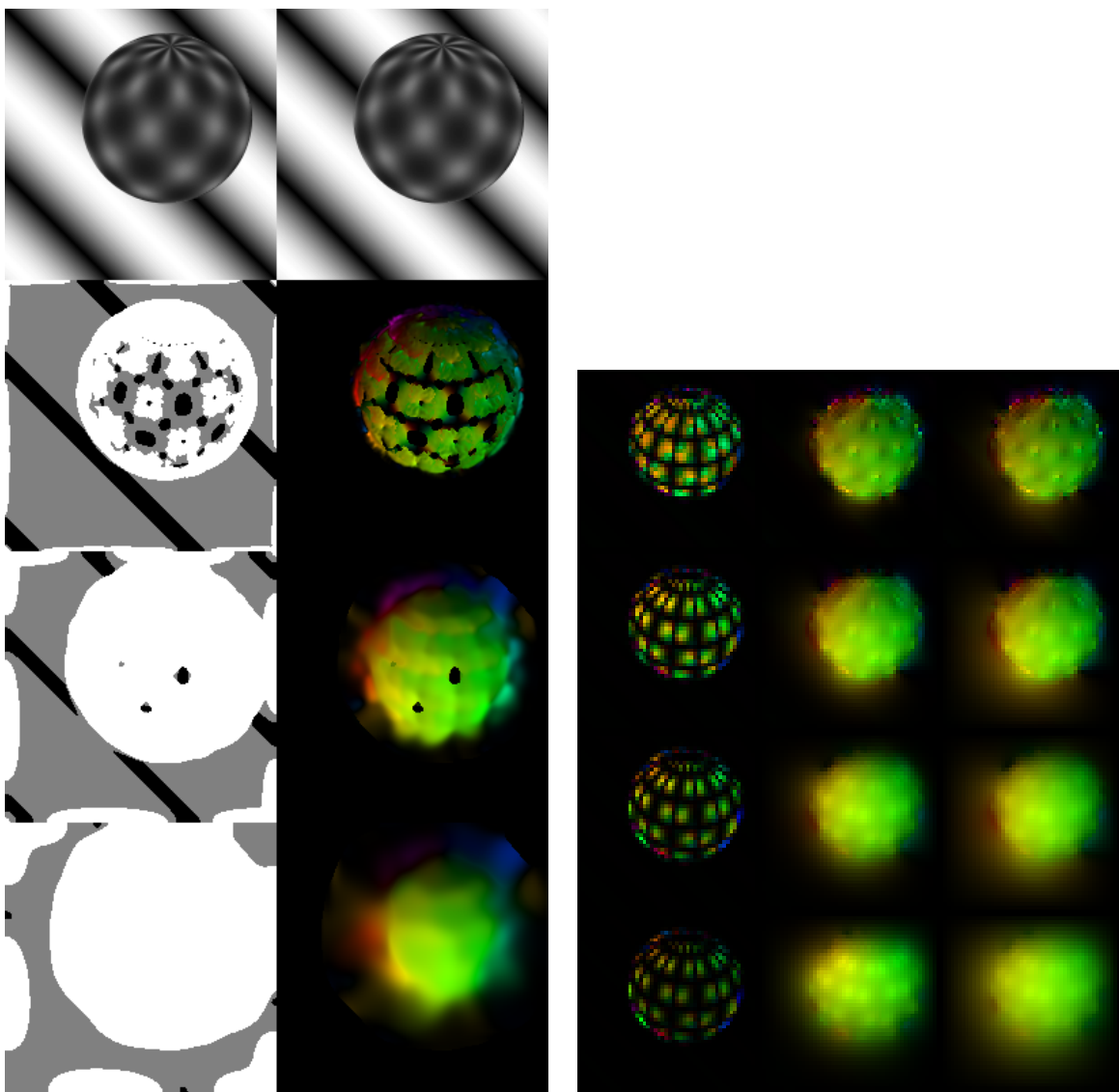| Sphere | Army | Teddy | Backyard |

Figure 2: Image pairs for computing optic flow.

Figure 3: Results on the sphere image pair. **Left**: Lucas & Kanade. **Right**: Horn & Schunck. If your code is correct, this is what your results should look like.

Submission

This assignment is to be done in **groups of 3 for undergraduate students** and **individually for graduate students**. It is highly recommended that you try this assignment individually at first and then combine your results. Paste your submission as a .zip file into the following folder on \\printsrv:

\\printsrv\Teacher Data\Dr.Nazar Khan\Teaching\Fall2017\CS 565 Computer Vision\Submissions\Assignment3\
    SECTION

where

SECTION=Morning or MPhilPhd

Write access to these folders will be disabled after the submission deadline.

The .zip file should have the following naming convention

`RollNumber1_RollNumber2_RollNumber3_Assignment3.zip`

For example, if roll numbers of your group members are BCSF11M997, BCSF11M998 and BCSF11M999, then the .zip file should be named

`BCSF11M997_BCSF11M998_BCSF11M999_Assignment3.zip`

The .zip file should contain

- completed **color_wheel.m**

- completed **visualise_optic_flow.m**

- completed **get_results_lk.m**

- completed **get_results_hs.m**

and the result files

- **color_wheel.png**,

- **sphere_results_lk.png**,

- **army_results_lk.png**,

- **teddy_results_lk.png**,

- **backyard_results_lk.png**,

- **sphere_results_hs.png**,

- **army_results_hs.png**,

- **teddy_results_hs.png**,

- **backyard_results_hs.png**.

Please follow naming conventions. If conventions are not followed, you will not receive any credit.