CSC664: Final Presentation

Determining Motion Fields Using Optic Flow

A Presentation by Jair Gonzalez

Introduction

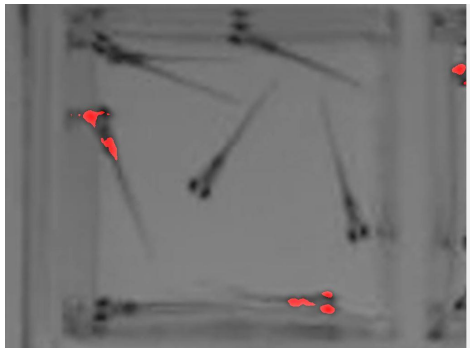
- Optic flow is the pattern of motion relative to an observer and the scene in which motion is being created.
- In video processing, it is possible to calculate Optic Flow using a mathematical approach.
- Optic flow can be achieved by tracking pixels and grey scale values across different periods of time (within video processing we call frames)

Optical Flow Estimation

$$I(x,y,t)=I(x+dx,y+dy,t+dt)$$

Problem Specifications

- Using the general Optic flow estimation equation, we are not able to calculate a very effective optic flow pattern that would enable to use.
- Problems incurred when there is change in lighting and multiple faucets in motion
- Previously, not all motion could be quantified across different frames, given the same grey scale value to track



Review on prior research

"WormAssay: A Novel Computer Application for Whole-Plate Motion-based Screening of Macroscopic Parasites" (Marcellino, Gut, Lim, Singh, McKerrow, and Sakanari)

"Block-Matching based Optical Flow Estimation with Reduced Search Space based on Geometric Constraints" (*Kilt, Ranft, Lategahn)*

http://www.sci.utah.edu/~gerig/CS6320-S2013/Materials/CS6320-CV-S2012-OpticalFlow-I.pdf

https://www.caam.rice.edu/~zhang/caam699/opt-flow/horn81.pdf

https://medium.com/@nabil.madali/introduction-to-optical-flow-77c8f61b04c4

https://youtu.be/5AUypv5BNbI

https://link.springer.com/chapter/10.1007/978-3-642-25975-3_34

http://www.inf.fu-berlin.de/inst/ag-ki/rojas_home/documents/tutorials/Lucas-Kanade2.pdf

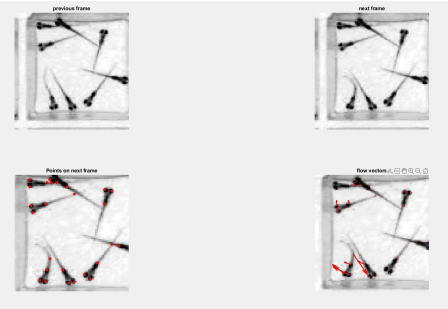
Proposed method

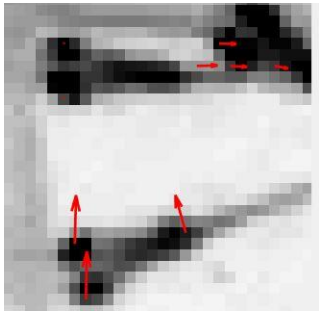
- Using a neighborhood / local approach, called the Lucas-Kanade method, we are able to track a set of pixels rather than individual pixels.
- This approach gives us a leverage on being able to process video with less noise and gives us better linear vectors

- I have created a set of 3 demos in progression of optic flow using lucas-kanade method

Demo 1

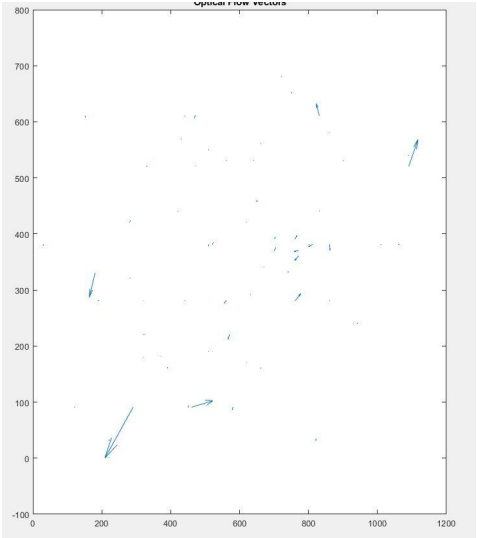
- Applying the lucas-kanade method in 2 frames
- First step is finding pixels / corners to track also did this by using Harris Corner detection
- Then implementing the lucas-kanade method, I was able to extract the vectors from the 2 frames.
- With those vectors calculated, I showed a arrow depicting those changes





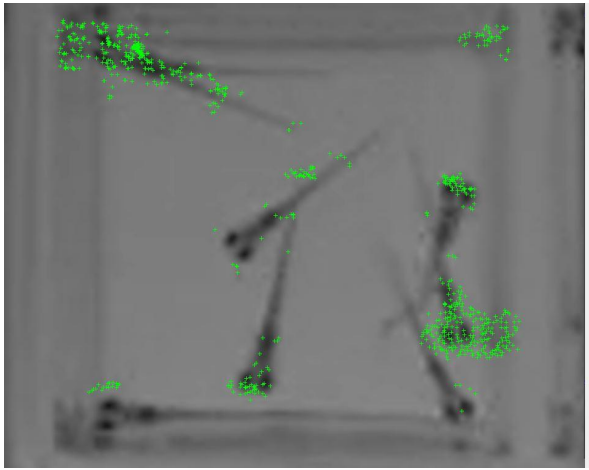
Demo 2

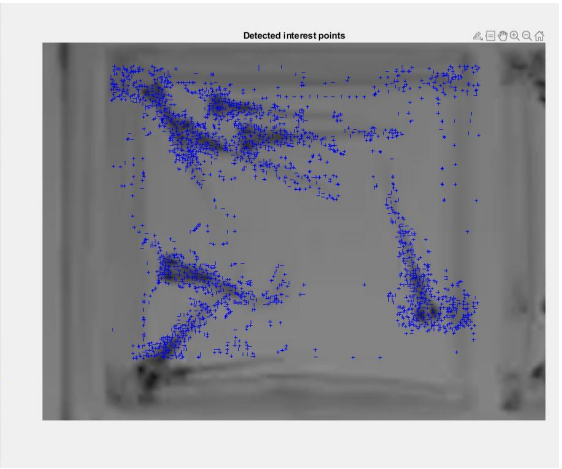
- Being able to apply both methods and overlay them in video processing had to be a different approach.
- Using Matlab Computer Vision Toolbox, I was able extract the vectors within the video and then apply them to a graph.



Demo 3

- Optic flow using lucas-kanade method to map corners
- Unable to calculate vectors
- Optic flow using local approach





Conclusions

- The Lucas-Kanade algorithm makes a ”best guess” of the displacement of a neighborhood by looking at changes in pixel intensity which can be explained from the known intensity gradients of the image in that neighborhood.

- The Lucas-Kanade algorithm is an efficient method for obtaining optical flow information at interesting points in an image

The End