Research Log - Week 11

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July 25, 2016

Started woring on implmentation of *disparity estimation using dynamic programming* in `MatLab`. So far I have completed the *dynamic programming* aspect only. I need to work on:

- Seperation of image into seperate scanlines, where number is based on window size.
- Conversion of window values to values used in the dynamic programming.

The generic method (summary below) seems to be a little different than method described in [Karathanasis1996] [1].

SUMMARY: A left image L and right image R each contain many *scanlines*, each at the same vertical position. Though each image's scanline is 1-*dimensional*, each point in the scanline is a $k \times k$ square matrix of *normalized* pixel values (commonly referred to as a *Window*). The window centered at pixel i in L is denoted by vector $\mathbf{L}(i,k)$, and similarly the window centered at pixel j in R is denoted by vector $\mathbf{R}(j,k)$.

A feature at i in L is closely matched to the feature at j in R if the *sum of square differences* $SSD(i,j,k) = ||\mathbf{L}(i,k) - \mathbf{R}(j,k)||_2$ is minimal (ideally 0). The dynamic programming approach to disparity estimation attempts to minimize the sum of $SSD(i,j,k)$ over all possible i and j, by including a constant *occlusion cost* (OC) for instances when a window centered at i in L does not have a matching feature at j in R, and simlarly a window centered at j in R does not have a matching feature at i in L. The *matching cost* ($MC(i,j,m)$) at for the windows centered at i in L and j in R is then assigned to be the *minimum* of:

- $MC(i-1, j-1, m) + SSD(i,j,k)$
- $MC(i-1, j, m) + OC$
- $MC(i, j-1, m) + OC$

to a $(m+1) \times (n+1)$ table (where m is the number of window values (*image width* less $(k-1)$) in L, and n is the number of window values in R. In addition to the above assignments, we let

- $MC(0,0,m) = 0$ for the initial cost.
- $MC(s \cdot OC, 0, m)$ (for all $s \leq m$) to denote first s windows in L are occluded from R.
- $MC(0, t \cdot OC, m)$ (for all $t \leq n$) to denote first t windows in R are occluded from L.

July 27, 2016

Continued reading [Karathanasis1996] [1]

Made additional changes to python Demo using OpenCV and OpenGL. Still a long way from finished.

July 28, 2016 Resumed work on *disparity estimaion using dynamic programming* in `MatLab`. Completed seperating images into seperate scanlines, as well as windows into dynamic programming values. Calculated disparities based on this technique and included output in relative `statusreport_week11` folder.

References

[1] J. Karathanasis, D. Kalivas, and J. Vlontzos. Disparity estimation using block matching and dynamic programming. In *Electronics, Circuits, and Systems, 1996. ICECS '96., Proceedings of the Third IEEE International Conference on*, volume 2, pages 728–731 vol.2, Oct 1996.