

Research Log

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May 2, 2016

March 30, 2016	Established research log after 3 hours of learning new \LaTeX
April 2, 2016	Added some additional comments to the Process
April 3, 2016	Have been reading [1]. Have Question for Kamangar regarding [1] about difference between: <ul style="list-style-type: none">• Camera Plane : Coordinates u,v• Focal Plane : Coordinates s,t
April 11, 2016	Reviewing blog articles located at: <ul style="list-style-type: none">• https://erget.wordpress.com/2014/02/01/calibrating-a-stereo-camera-with-opencv/• https://erget.wordpress.com/2014/02/28/calibrating-a-stereo-pair-with-python/• https://erget.wordpress.com/2014/03/13/building-an-interactive-gui-with-opencv/• https://erget.wordpress.com/2014/04/27/producing-3d-point-clouds-with-a-stereo-camera-in-opencv/ for process to get webcam up and running. Previous issues related to fine-tuning <i>block matching</i> parameters. Need to review sources at list at bottom of http://docs.opencv.org/2.4/modules/calib3d/doc/camera_calibration_and_3d_reconstruction.html to understand.
April 19, 2016	Made adjustments to python for image acquisition scripts (from blogs mentioned on April 11, 2016.) NOTE: Consider creating rig with glue to keep stereo camera placement / direction constant.
April 19, 2016	UPDATE: Error with <code>calibrate_cameras</code> python code causing linux machine to crash. If can't be resolved switch over to MacBook. NOTE: Package should be setup by calling <code>\$ python setup.py install</code>
April 19, 2016	UPDATE: Crash due to recursive shell call and was fixed. OpenCV not detecting all chessboard corners. Will try a new board.
April 20, 2016	Did small amount of work on Change of Reference section in the paper. Added a section to the intro containing a map of commonly used symbols and notation

April 29, 2016 Read following sections of [Chen93] [2]:

- Abstract
- Introduction
- Visibility Morphing

Summary: Explicit Geometry is ignored (i.e. surface mesh and 3d-points). Geometry is kept in 2-d. Whereas Image Morphing interpolates between *pixel intensity values in fixed locations* the method in this article interpolates between *pixel locations with (relatively) fixed intensity values*. **Question:** Sections read mention that pixel positions are stored in 3d (3-tuple) data structure. I'm not sure I understand this correctly, since

1. This would effectively make this structure a point cloud (but no mention of it in the paper).
2. There is no mention of special "depth-based" hardware or cameras (Far as I know this is supposed to be a regular image).

April 30, 2016 Checked understanding of *epipolar constraint* through reading of [Hartley2004] [3] and its derivation of

$$\begin{aligned} {}^t\mathbf{x}^T \cdot \mathbf{E} \cdot \mathbf{x} &= {}^t\mathbf{x}^T \cdot [\mathbf{t}]_{\times} \cdot \mathbf{R} \cdot \mathbf{x} \\ &= {}^t\mathbf{x}^T \cdot \mathbf{l} \end{aligned}$$

and creation of MatLab code verifying this.

I may have been mistaken about relation of **Fundamental Matrix** and **Essential Matrix**.

My current understanding is the *Fundamental Matrix* describes point/epipolar line correspondance for images under **scale invariant** conditions (i.e. point correspondance and Fundamental matrix does not change when one image (or both images) are scaled (uniformly or omni-directionally)).

Essential Matrix describes point/epipolar line correspondance for images under **normalized** conditions (i.e. unit-length is set equal to focal-length, and projection center is set at (0,0,1)).

References

- [1] Sing Bing Kang Heung-Yeung Shum, Shing-Chow Chan. *Image Based Rendering*. Springer Publishing, 1 edition, 2007. Available online at: <http://link.springer.com/content/pdf/10.1007%2F978-0-387-32668-9.pdf> Pages cited are **Book Page** Numbers. Formula for **PDF Page** Number is (**PDF Page Number** = **Book Page Number** + 17).
- [2] Shenchang Eric Chen and Lance Williams. View interpolation for image synthesis. In *Proceedings of the 20th Annual Conference on Computer Graphics and Interactive Techniques*, SIGGRAPH '93, pages 279–288, New York, NY, USA, 1993. ACM.
- [3] R. I. Hartley and A. Zisserman. *Multiple View Geometry in Computer Vision*. Cambridge University Press, ISBN: 0521540518, second edition, 2004.