Abu Butt – 3097
CSC 47100
Prof. Zhu
11/25/2017

1)
To display the position of a point in a disparity image, we can use the equation ***Z=fB/d*** where:
Z = the depth, or distance along the camera z-axis
f = the focal length
B = the baseline width between the 2 cameras
d = the disparity, or distance between 2 projected points

To determine the depth error, we must calculate the partial derivatives of Z with respect to the variable of uncertainty. If we assume the only uncertainty is in the disparity d, the depth error is equal to $Z=\partial(Z^2/fB)\ \partial d$.

If the uncertainty is focal length, then the depth error with respect to the focal length is equal to $Z=(B/d)\ \partial f$

If the uncertainty is baseline width, the depth error with respect to the baseline is equal to $Z=(f/d)\ \partial B$.

If depth error is inversely proportional to the baseline width, meaning a larger baseline with will give better depth accuracy but a smaller field of view.

If depth error is inversely proportional to the square of the depth, meaning the nearer a point is, better the accuracy is.

If depth error is inversely proportional to the focal length, meaning a larger focal length will give better depth accuracy but a smaller field of view.

2)
The motion field equation under rotation around the camera's optical center can be written as

$$\begin{pmatrix} v_x \\ v_y \end{pmatrix} = \frac{1}{f}\begin{pmatrix} xy & -(x^2+f^2) & fy \\ y^2+f^2 & -xy & -fx \end{pmatrix}\begin{pmatrix} \omega_x \\ \omega_y \\ \omega_z \end{pmatrix}$$

since Z is not included in the equation, no 3D information is carried. The disparity between any 2 images under this rotation is 0. If you extract any 3D information, some translational operation must be applied instead. If the camera is involved along the optical axis, 3D information can be obtained. Translation images are captured at different time frames. There would be no depth information need because we do not have two references points to compare. For translation along the optical axis, there is no depth information available. Because we are simply changing the focal length, when we are moving the camera forward or backward. We need some distance in the X or Y direction to obtain the 3D information.

3)
Points as entities are their own right will be denoted in italics. If these points are expressed in Euclidean coordinates, we can use bold notations, and when they are expressed in projective coordinates, they will be bold with a tilde. So a point M is 3 space might be imaged at *m* and *n* will have coordinates:

Aperture problem is solvable if the corner is visible through the aperture. If we assume that we see a corner somewhere, then we can assume the flow is locally. In example, for a 5 x 5 window, we get 25 equations.

[$I_x(p_1)$ $Iy(p_1)$]		= - [$It(p_1$]
[$I_x(p_1)$ $Iy(p_1)$]	* [u v]	- [$It(p_2$]
.		.
.		..
.		.
.		.
[$I_x(p_{25})$ $Iy(p_{25})$]		-[$It(p_{25}$]

A d = b => we will minimize $||Ad-b||^2$ and using least square the summation of overall pixels in n x n window

The corner could help to see the decoction of the whole image. It might appear to be going in a certain direction but we are not sure. In example, an edge may appear to be moving diagonally, but it will be moving up and down.