Corner Location Errors

Adam Yedidia, Vickie Ye, Katie Bouman

March 12, 2017

One important source of error in the edge camera is the *corner location error*. Corner location errors occur when the corner of the wall is erroneously chosen to be the wrong place, introducing systematic error into the scene's reconstruction.

Exactly how bad are corner location errors? To answer this question, we consider the following situation: a dark scene with a single bright object. We want to find the angular position of the bright object in the scene, but we have erroneously measured the corner, which lies at $(0, 0)$, to lie at (d_x, d_y) instead. We can compare the true angular position θ to the reconstructed angular position $\hat{\theta}$, for a variety of different values of θ, d_x, and d_y. (The radius of the measured projection plane, r, we set to 1).

First, we study the behavior in the edge camera case. Let d_x and d_y be random variables drawn from Gaussian distributions with standard deviations σ_x and σ_y. Fig. 1 shows the behavior of the error as a function of θ.

What about in the stereo camera case—how much error in depth estimation will corner location errors introduce? To answer this question, we presume a stereo camera setup in which there is a thin doorway between $x = 0$ and $x = 1$, lying along the $y = 0$ line. If both corners in the doorway are subject to independent corner location errors, what is the behavior of the reconstructed y-coordinate of an object at as a function of its x-coordinate and its true y-coordinate? Fig. 2 plots the answer to this question.

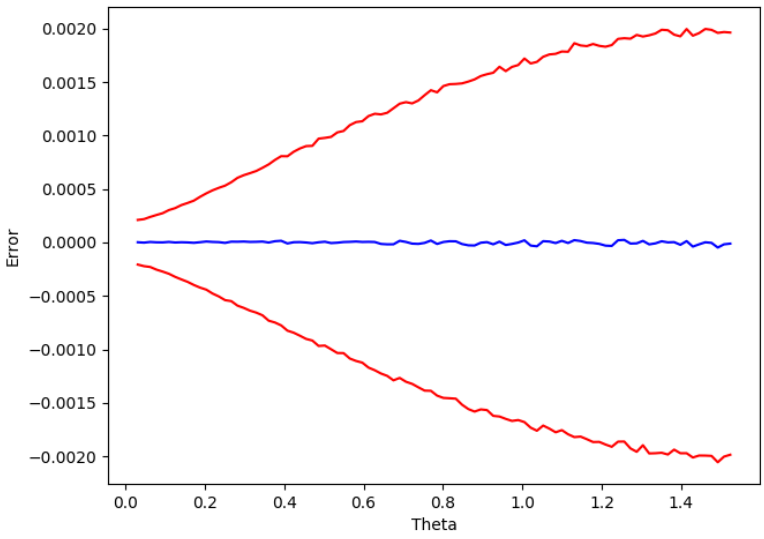

Figure 1: This plot shows the empirical mean (in blue) plus or minus one standard deviation (in red) of the error as a function of θ. Here, $\sigma_x = 10^{-4}$ and $\sigma_y = 10^{-3}$.

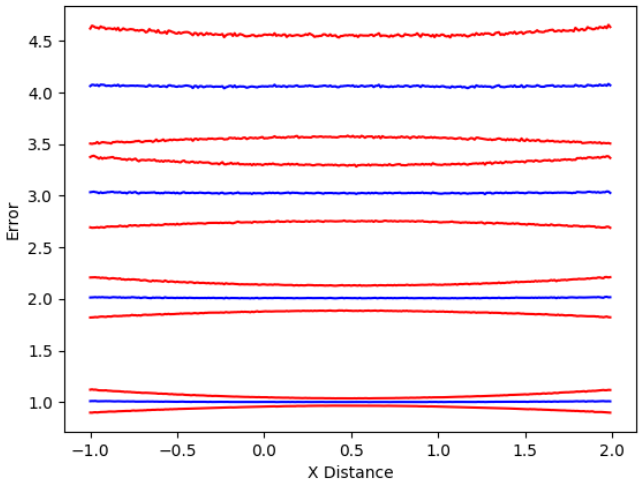

Figure 2: This plot shows the empirical means (in blue) plus or minus one standard deviation (in red) of the reconstructed y-coordinate of an object as a function of its x-coordinate, assuming true y-coordinates of 1, 2, 3, and 4. Here, the two corner location errors at each of the boundaries of the doorway are independent and subject to ($\sigma_x = \sigma_y = 0.01$).