Computer Vision Project

6D Object Pose Estimation

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Best Method -RANSAC

For every object in every image, the 3d points were normalized at first since they were un-normalized. For n number of iterations, The minimalCameraPose function to generate new cameras from a random set of 3 points , which gave a set of possible camera position. Using these camera matrices the projected 2d points were calculated with which the error between the projected image points and the actual image points was calculated . The points that had an error less than the 0.01 was considered as inliers for the camera matrix. The camera matrix with the best sum of inliers was considered the best camera for that particular image object. For the best model n was set to 1000.

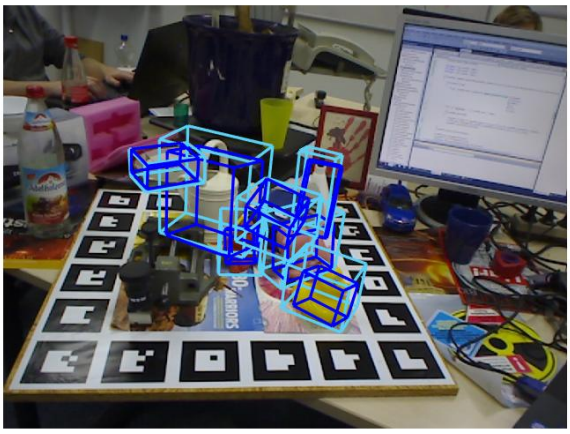

Figure 1: Best Results Image 1

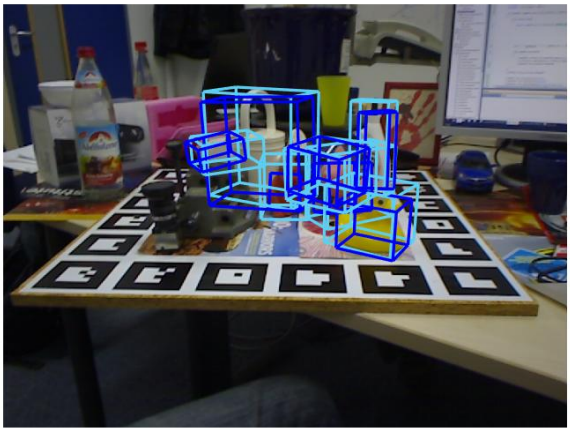

Figure 2: Best Results Image 2

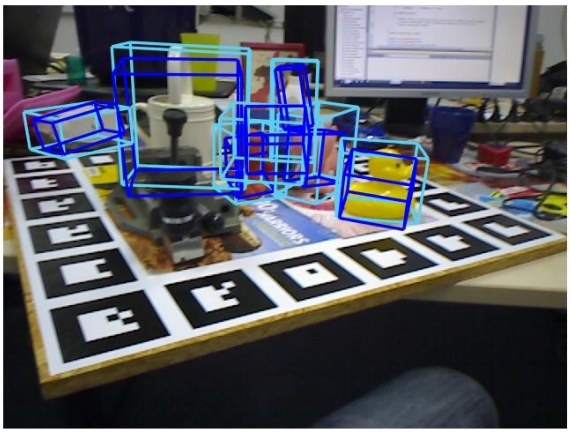

Figure 3: Best Results Image 3

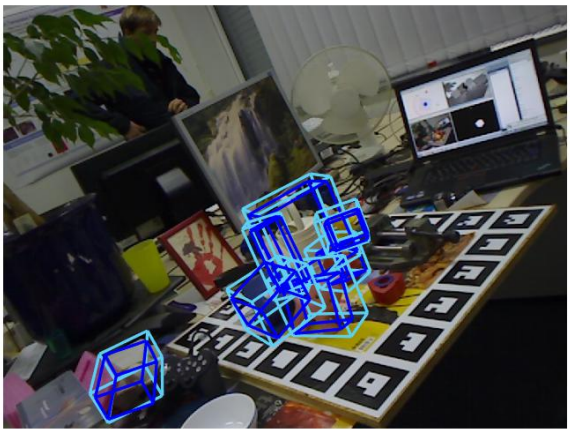

Figure 4: Best Results Image 4

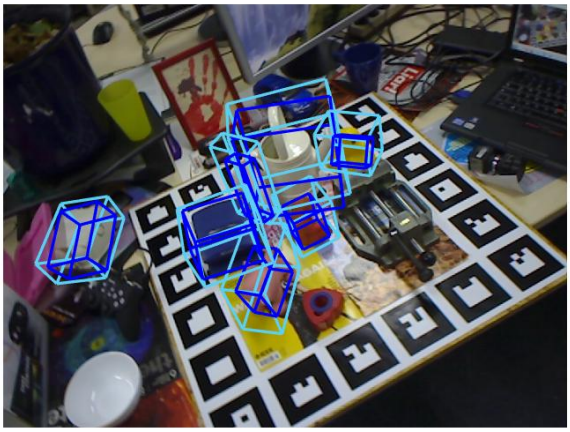

Figure 5: Best Results Image 5

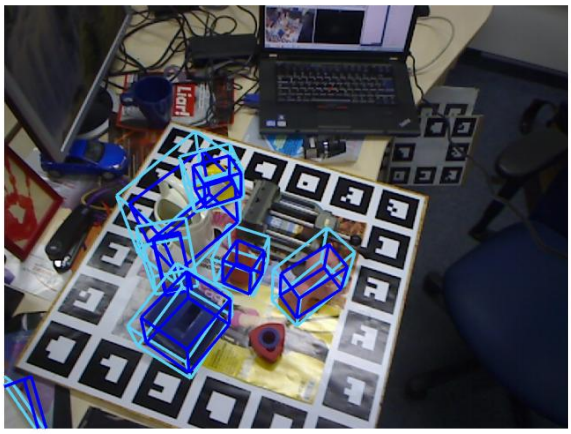

Figure 6: Best Results Image 6

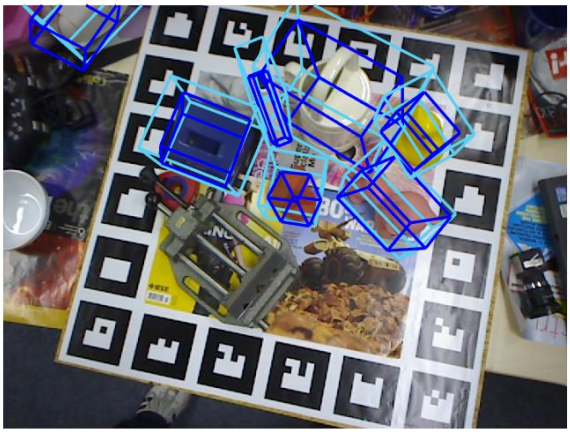

Figure 7: Best Results Image 7

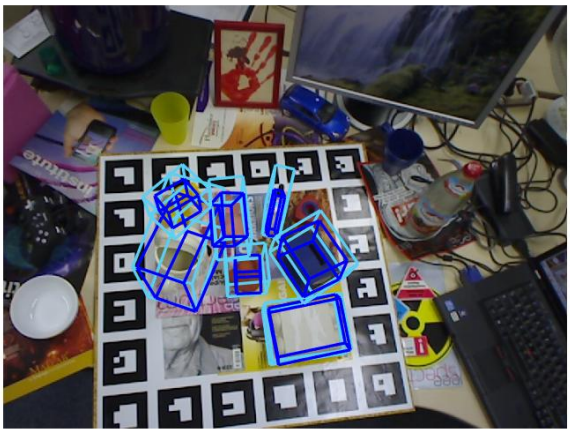

Figure 8: Best Results Image 8

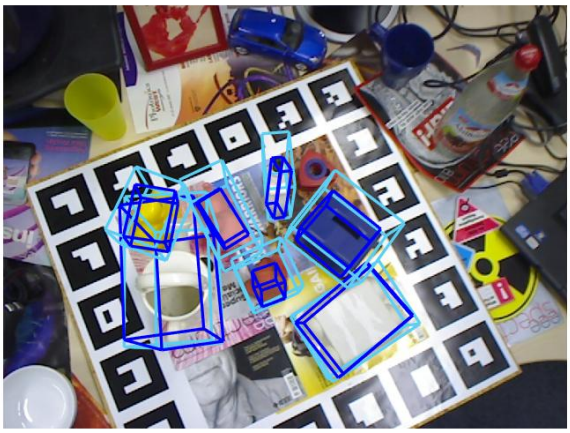

Figure 9: Best Results Image 9

Other Methods

- Created a point could of the 3d points and using the pcfitcloud function to find good points. Various permutations of using the good points and the actual points for the generating the camera matrices and calculation of inliers. All the trials had result of average pixel error around 20-25.

- After the calculation of the camera matrices in the all the above methods, Levenberg-Marquardt method was used to update the camera matrix based on the normalized 2d and 3d points , unlike the computer assignment, the 3d points were not updated, but kept a constant during every iteration in Levenberg-Marquardt method. The lambda was was set close to $e^{-}14$ and trails were made for various Levenberg-Marquardt iterations, The second best results were obtained when the Levenberg-Marquardt iterations were set to 5 and the Ransac iterations were set to 1000 (only normalized 2d and 3d points were used to calculate the camera matrices and the inlier calculation.

Results For RANSAC (1000 iterations)

	Ape	**Can**	**Cat**	**Duck**	**Eggbox**	**Glue**	**Holepuncher**
Image 1	16.09	17.90	13.62	18.75	6.34	11.22	16.64
Image 2	16.91	11.59	22.03	15.64	16.09	11.37	8.85
Image 3	17.80	18.49	22.87	19.14	11.65	29.53	21.34
Image 4	14.03	7.43	15.66	9.62	10.20	9.52	14.93
Image 5	12.69	14.12	19.87	19.96	10.20	16.52	8.94
Image 6	13.74	15.59	12.08	12.36	‘52.55	17.24	12.55
Image 7	25.31	23.77	18.32	18.53	36.64	35.60	19.02
Image 8	16.18	15.33	14.77	13.20	9.07	21.48	11.99
Image 9	25.14	11.05	24.39	15.43	12.55	25.42	19.40
Average	22.55	19.32	23.37	20.37	23.61	25.41	19.09

Table 1: Rms reprojection error in pixels for the RANSAC best trail and the overall average over the averages of all the rms error of each object was 21.96(average of the last row)