7 Computer Vision – Pierre Beckmann

7.1 Feature extraction and initialization with epipolar geometry

First we chose the two pictures with a large baseline but a big enough overlap. Let's call the image 1 and image 2. We extracted sift features, computed the E matrix using 8-point ransac and plotted the matches and epipolar lines on both images. To plot the epipolar lines we get the F matrix: $F = K^T * F * K$ (with K the camera matrix) and plot $F * matches$.

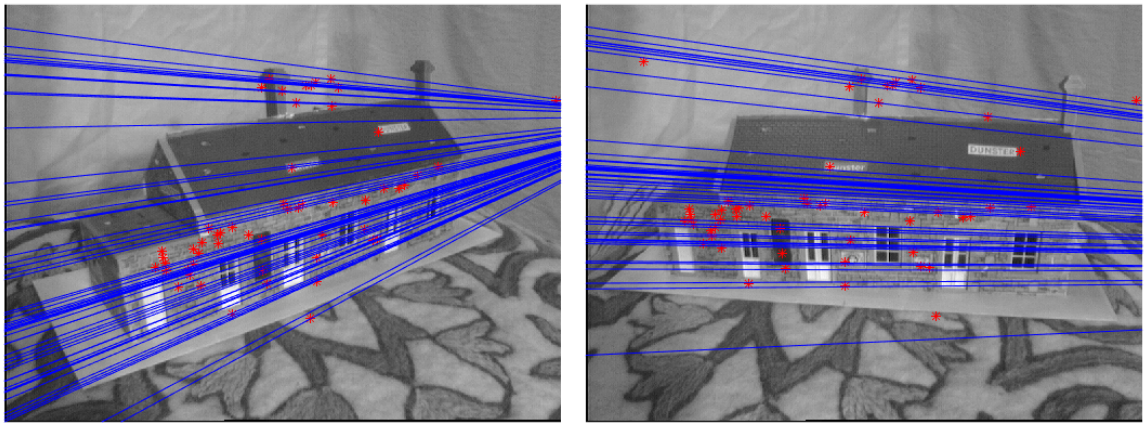

Figure 1: **Matches using vlfeat and corresponding epipolar lines on images 1 and 2.** Matches in red, epipolar lines in blue.

The results are not very good because most of the matches are on the same plane.

Next we plot the matches before and after the ransac. The projection matrix of the second view is obtained by decomposing the E matrix.

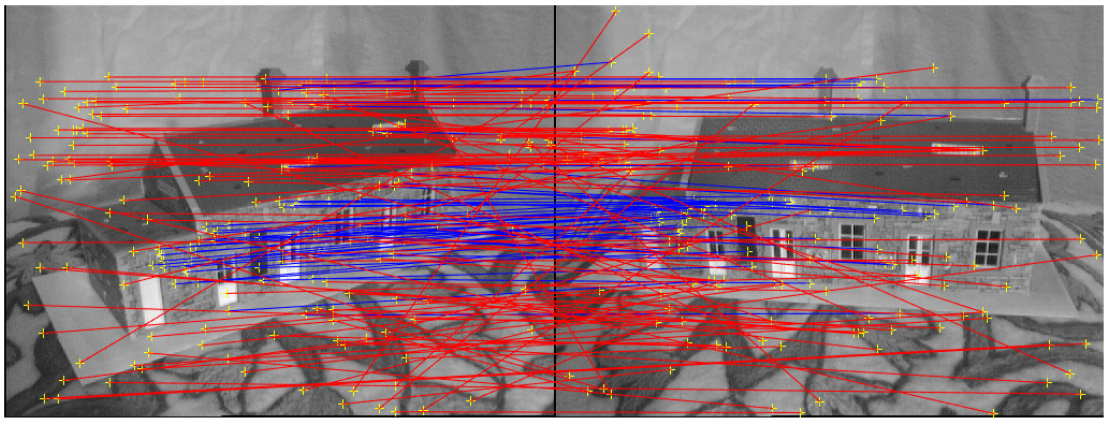

Figure 2: **Matches between image 1 and image 2.** Ransac inliers connected in blue and ransac outliers in red.

Finally we triangulate the matched inliers and store the as 3D points as XS_{12}.

7.2 Triangulation and adding new views

Now we add additional views of the same scene. We match the features of new images 3, 4 and 5 with image 1. To find the pose of each new camera we use 6-point DLT and filter with 6-point ransac to compute the new camera matrix P with the 2D matches in niew view and the corresponding 3D points taken from the triangulated points XS_{12}.

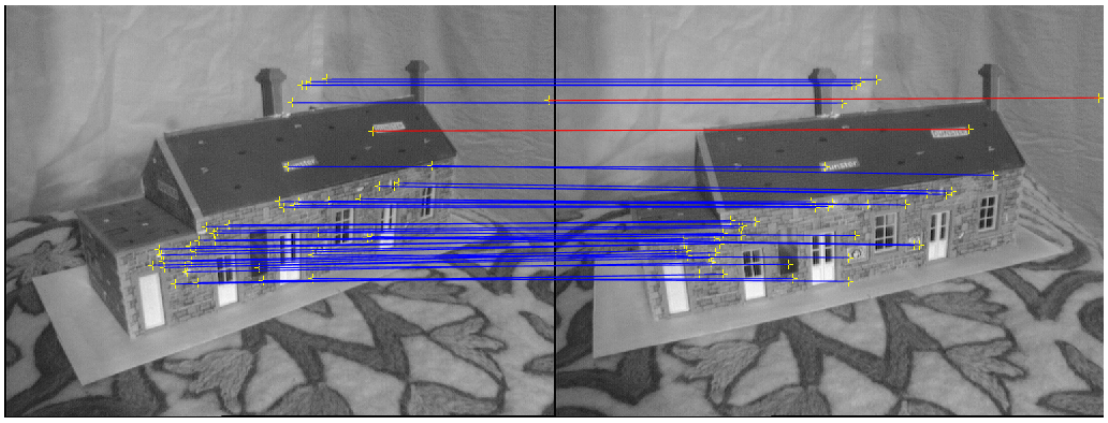

Figure 3: **Matches between image 1 and image 3 from correspondences of initialization.** Ransac inliers connected in blue and ransac outliers in red.

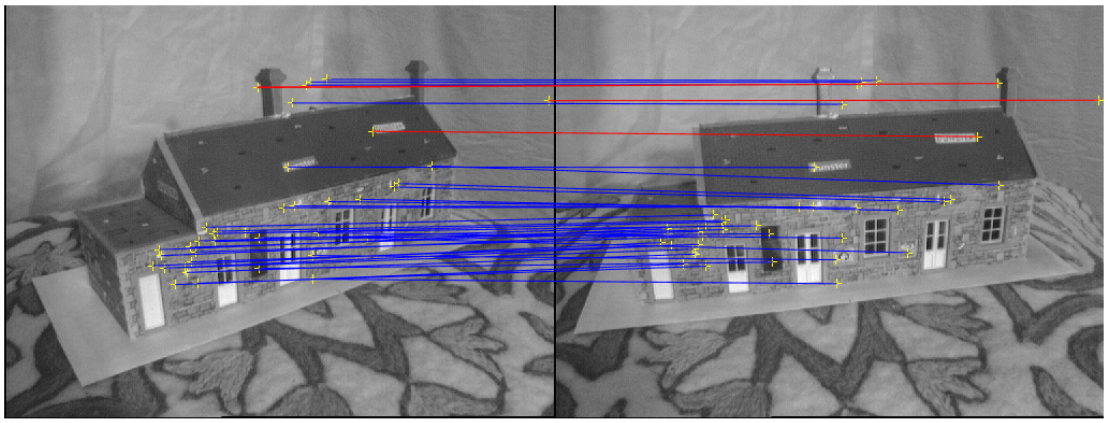

Figure 4: **Matches between image 1 and image 4 from correspondences of initialization.** Ransac inliers connected in blue and ransac outliers in red.

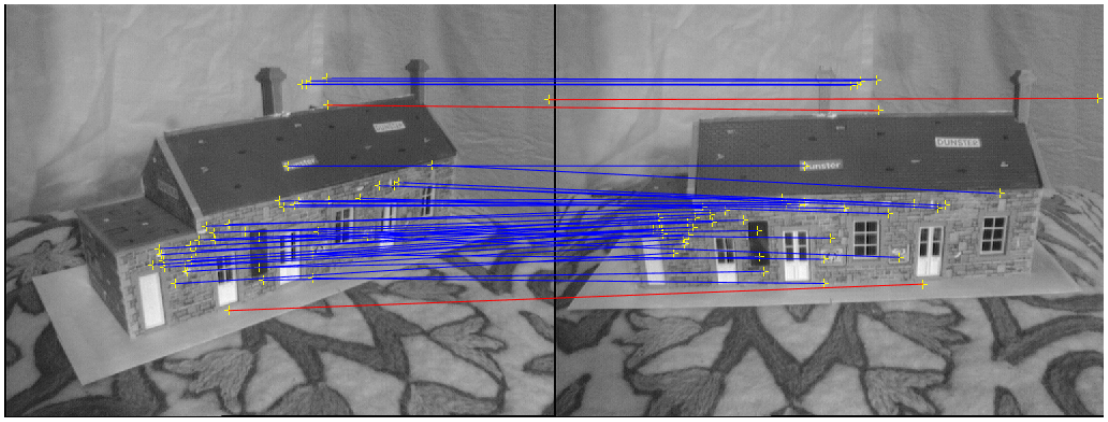

Figure 5: **Matches between image 1 and image 5 from correspondences of initialization.** Ransac inliers connected in blue and ransac outliers in red.

Using triangulation we also get the corresponding 3D points to the matches: XS_{13}, XS_{14} and XS_{15}.

7.3 Triangulated points and camera poses

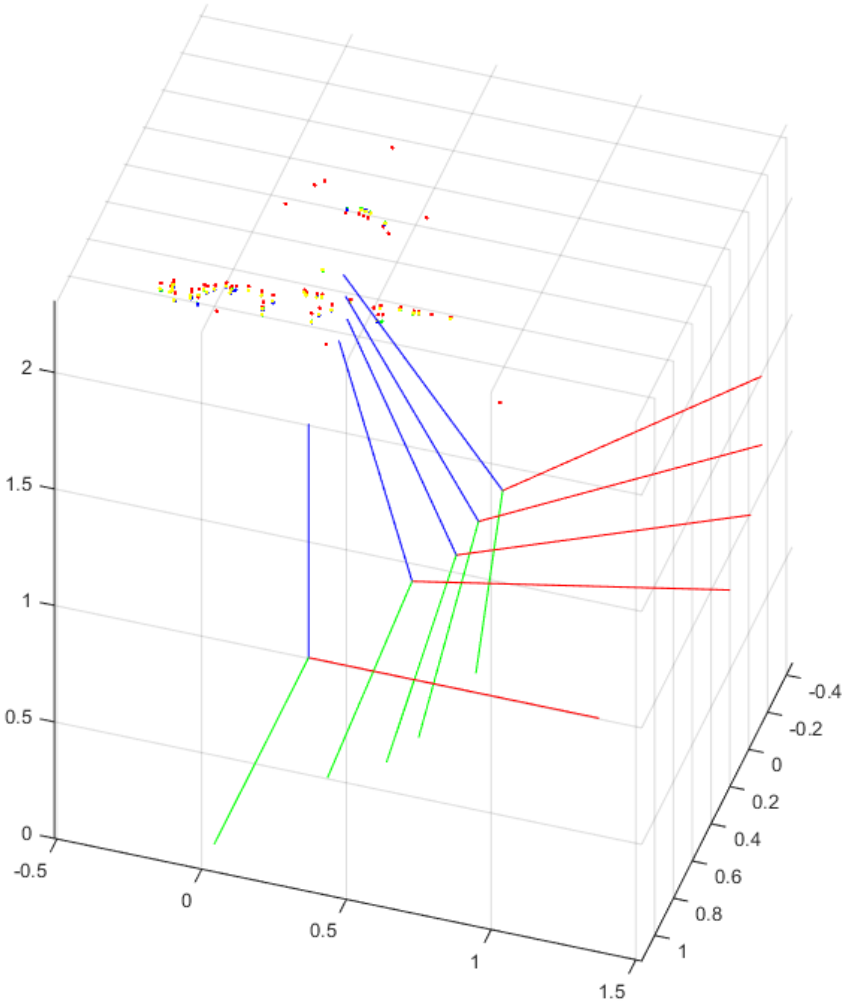

Figure 6: **Triangulated points and camera poses in a 3D plot.** XS_{12} in red, XS_{13} in green, XS_{14} in blue and XS_{15} in yellow.

7.4 Dense reconstruction

After computing a depth map between image 1 and image 5 on the corresponding inliers we plotted it using the given *create*3*DModel* function.

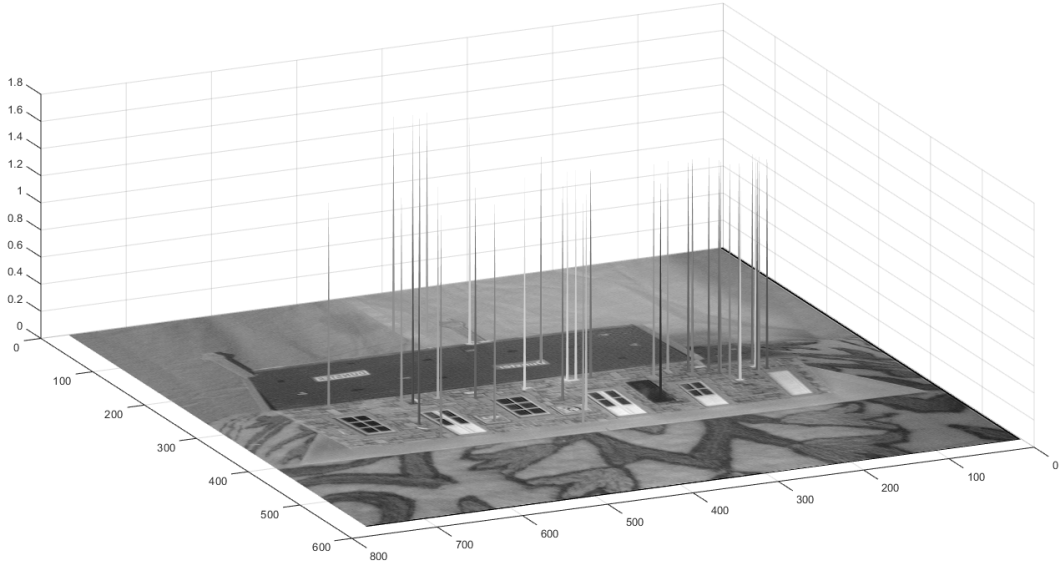

Figure 7: **Dense reconstruction on image 5.**