

Multiview Analysis - Practical 2

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1. Introduction

In this practical projective transformation from one viewpoint to another is tested using manual and automatic correspondence. First manual correspondence will be used to perform the transformation after which automatic correspondence with VLFeat library will be used.

2. Projective Transformation by Manual Correspondance

The following pictures are chosen for the calculation of the displacement matrix. The circled points are hand-picked.

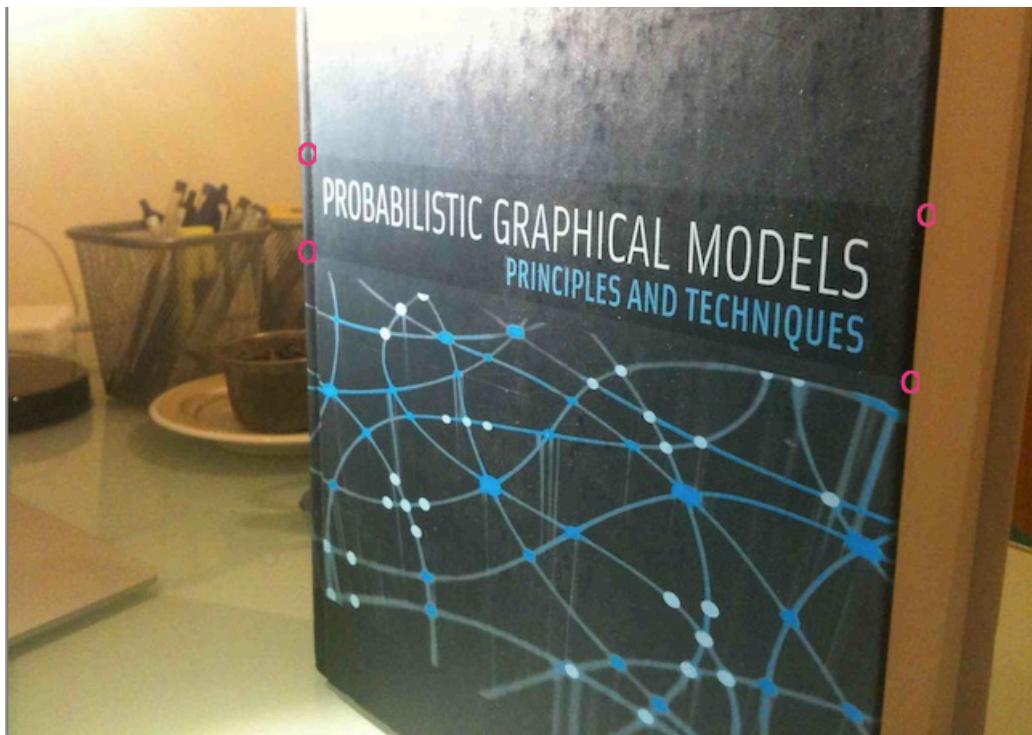


Figure 1 - Source Picture

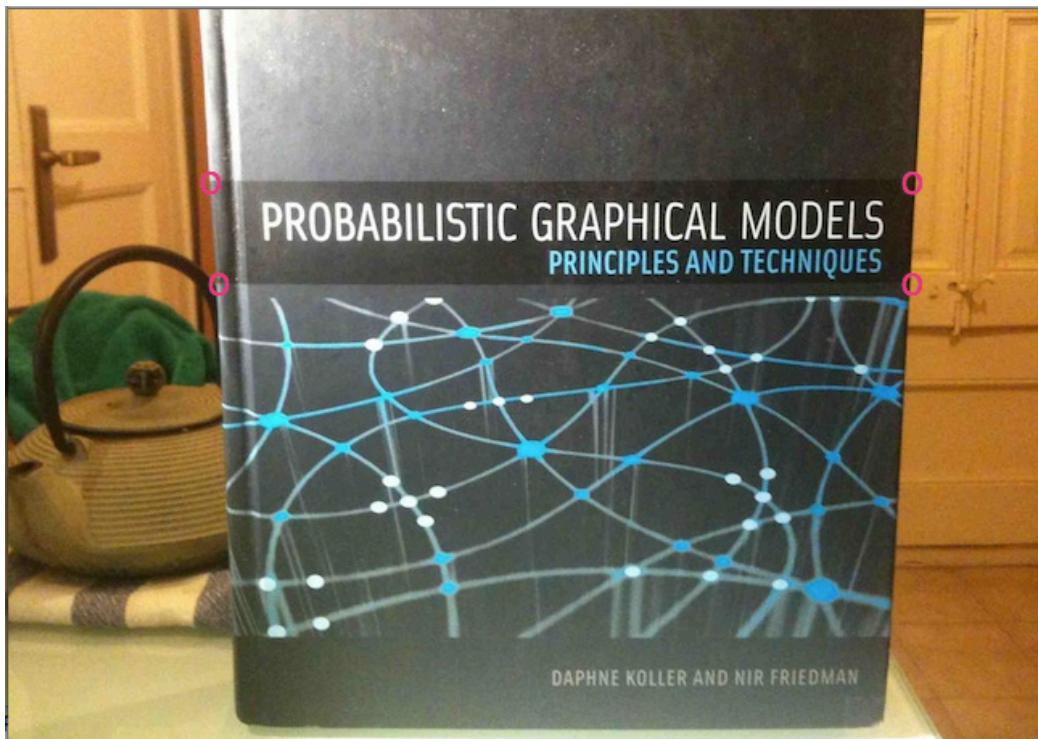


Figure 2 - Target Viewpoint

The result of the automatic transformation from the source viewpoint to the target viewpoint by the hand selected matching points is as follows. Here inverse transformation is used.

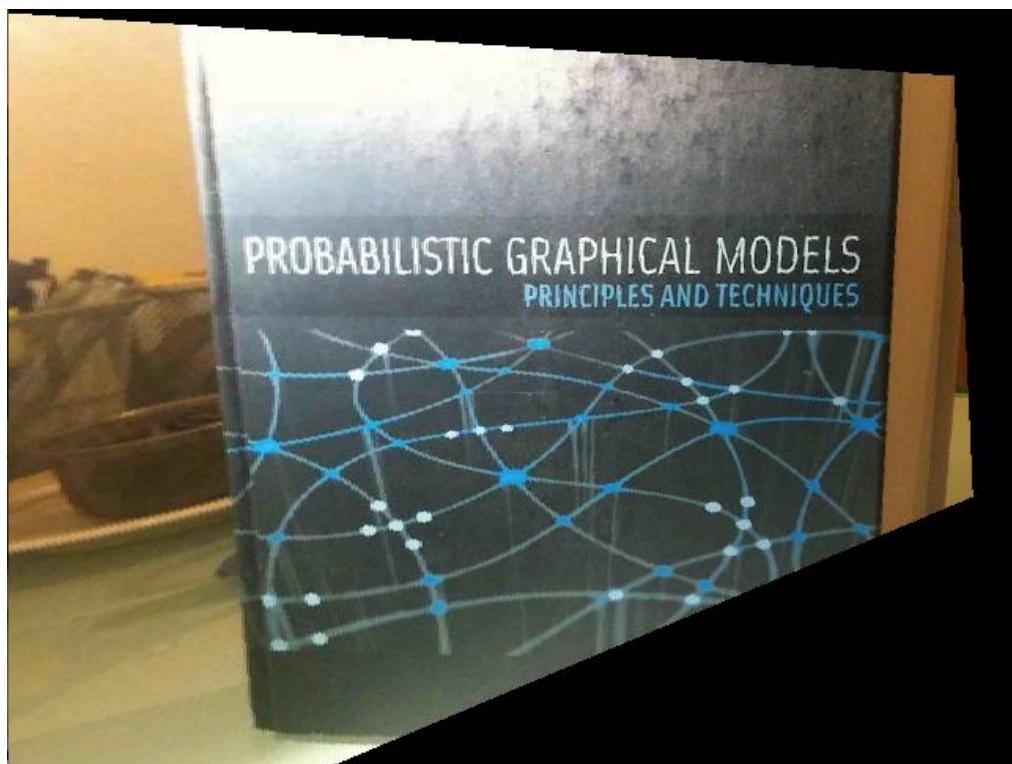


Figure 3 - Projection with Inverse Transformation

I have performed inverse transformation since otherwise some pixels for the target picture will not be filled from any pixels from the source picture. So it is preferable to determine where each pixel for the target picture comes from the source picture. The result with forward projection would be as follows full of gaps in the picture:

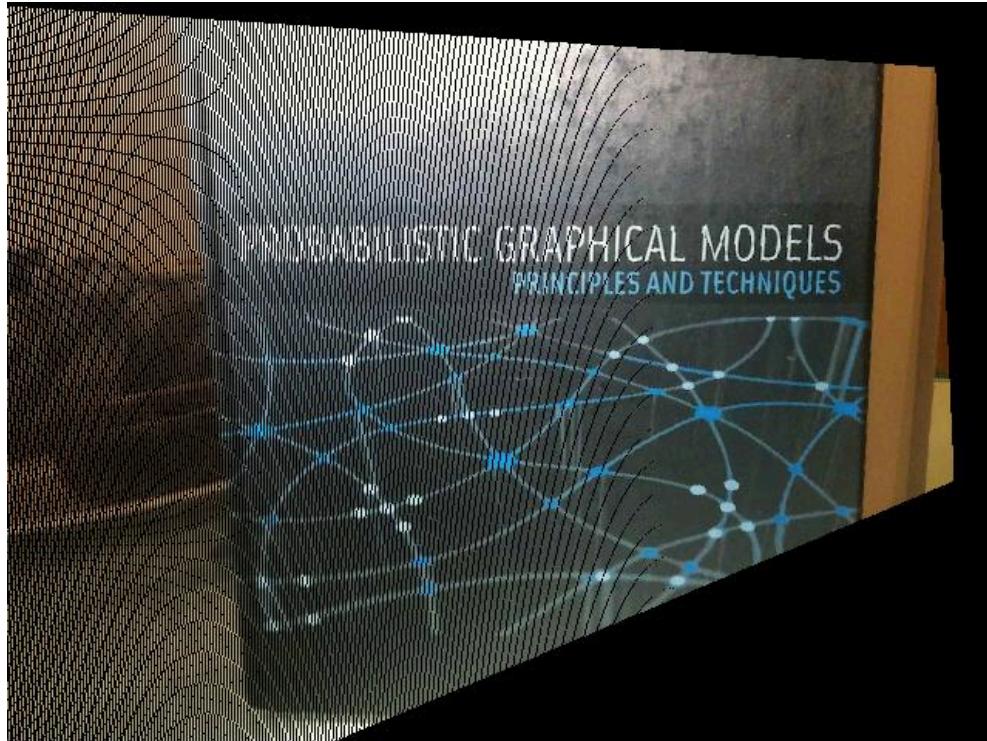


Figure 4 - Result with forward projection

3. Projective Transformation by Automatic Correspondance

Using the VLFeat Library the following top matching 8 points are picked and used for the projection of the first picture into the second viewpoint. The matching performance was quite poor in this case. As a result, the projection was unsuccessful as can be seen from the next picture.

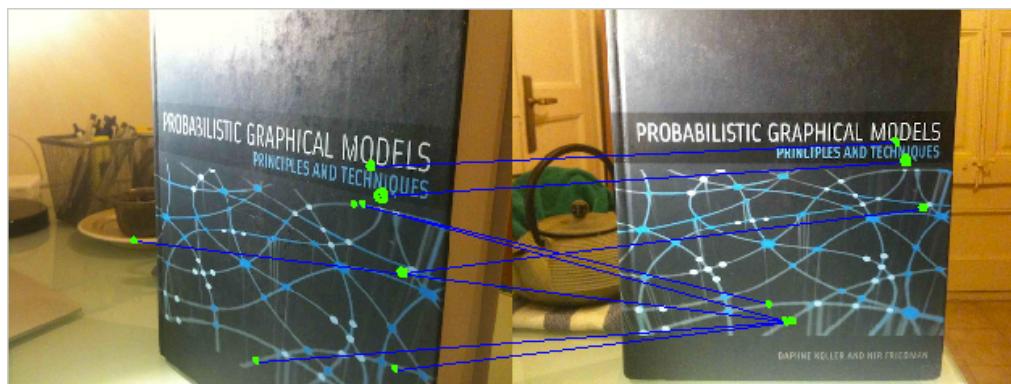


Figure 5 - Top 8 matched features

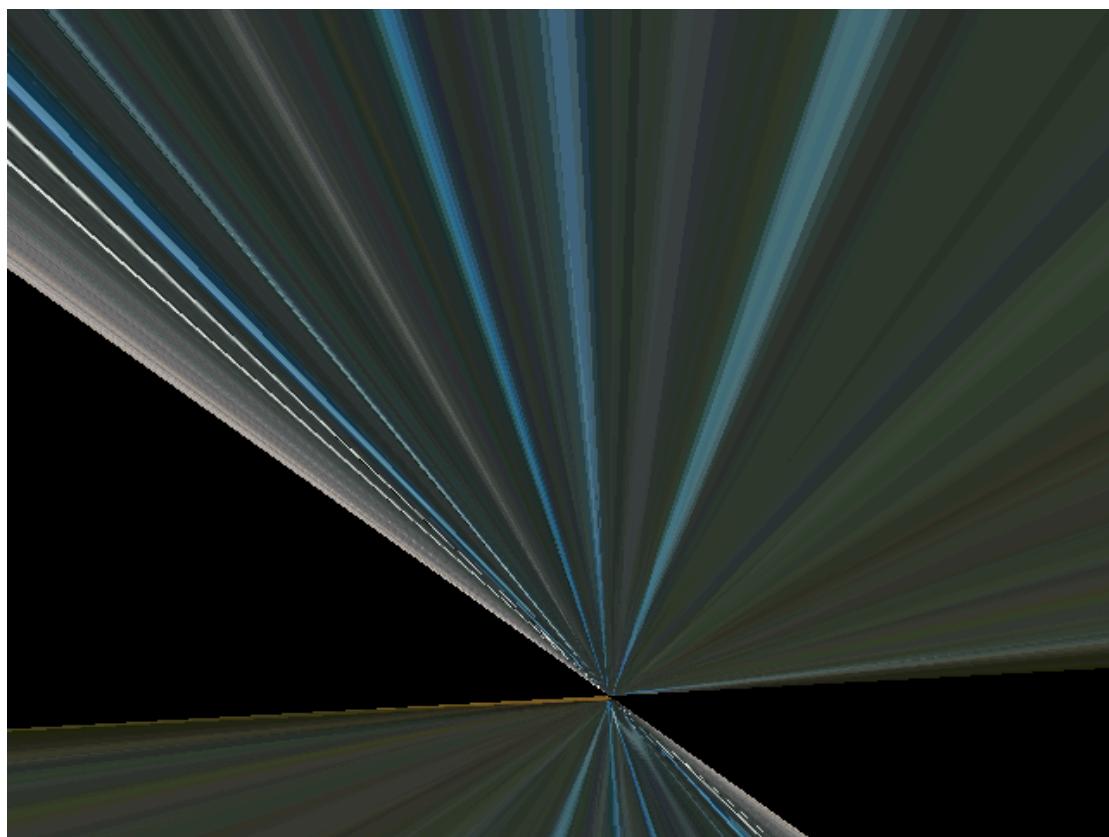


Figure 6 - Result by automatic matching

I tried automatic matching with several self taken pictures but since the top 8 matching pairs were not all correct, the result was a totally dark picture or very similar to the previous one. The following picture gave the best results with automatic matching. You can see the 8 top matched points and the results in the following images.



Figure 7 - Top 8 matched features



Figure 8 - Projection with 8 top features

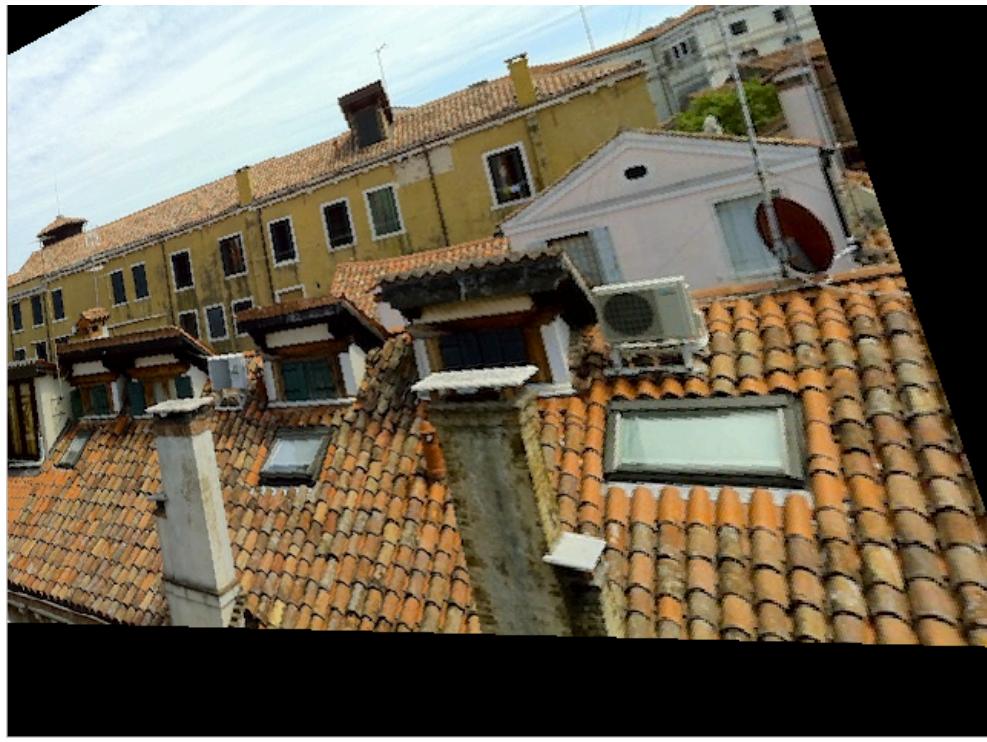


Figure 9 - Projection with another 8 features

We can see that the results are not very satisfactory possibly due to the poor set of matchings between two viewpoints. We can also see we have slightly different results with different features. The location of the matched points with relation to each other also make difference since they need to be representative enough of the transformation. In my case the selected matchings were not representative

enough to find a perfect transformation matrix and the results were not satisfactory.

On the other hand, with hand-selected matching points the following result was obtained which is far more satisfactory.



Figure 10 - Projection with Hand-Selected Features

4. Conclusion

We can see that the projection with manual correspondence performed better than automatic correspondence. Because manual correspondence is not always easy, automatic correspondence can be used by paying attention to the matching performance of the features and also the relative positions of the chosen features (they shouldn't be on the same line and the need to be representative of the transformation). Also as can be seen from the examples above, wrongly matched pairs produce bad homography matrix, which produces unsuccessful transformations.

References

- [1] R. Hartley and A. Zisserman, “Multiple view geometry in computer vision”, Cambridge.
- [2] Lowe, “Distinctive image features from scale-invariant keypoints”, International Journal of Computer Vision, 60, 2 (2004), pp. 91-110.