Detection of vertical lines for the estimation of vanishing point in order to extract 3D information

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***Abstract*— We propose to estimate camera orientation angles from a single view image. We use the geometric content from human-made objects present in the scene. In particular, straight lines are detected in order to estimate vanishing point (VP).**

I. Introduction

In a mobile mapping field, having a precise estimation of the camera orientation is crucial for the further exploitation of 3D data extracted from 2D image. The positioning and measurement object in the scene is highly affected by the camera orientation errors.

The goal of this work is to improve the accuracy of the camera position by obtaining information from images. With the detection of the vertical lines of the scene (i.e. lines which determine the normal to the horizontal plane called Up), the VP of the image can be found and hence the roll and pitch angles associated to the camera can be estimated (Fig.1).

II. Proposed algorithm

The first step of the proposed algorithm is lines detection using Sobel derivatives combined with the Hough transform. These lines are projected on the Gaussian space which enables the computation of the intersection of two parallel lines that in a classic Euclidean space would be infinite.

A VP is defined in a perspective representation as the focal point of the projections of parallel lines in the scene. In practical cases, the intersection will not be restricted to a point but by an incertitude area. Moreover, as false detections can occur, we try to eliminate them by a method such as the well known algorithm of RANSAC presented in [1].

In this way the vertical VP provide a local Up on the image scene and allow the computation of the roll and pitch angles. Figure 2 shows a resume all those steps.

Fig. 1. Roll and pitch angles of the camera orientation.

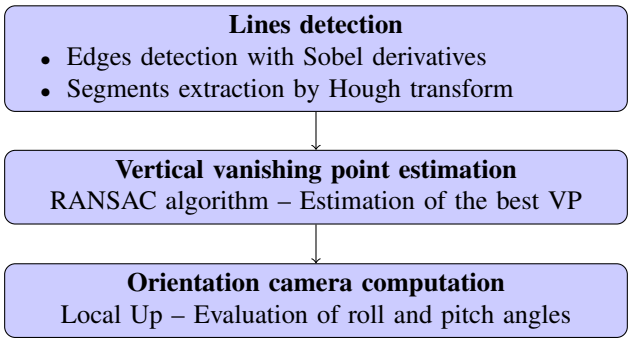

Fig. 2. Main steps of the proposed algorithm.

III. Experimentals results

This agorithm has been tested on a large corpus of various images (different context, lighting...) provided by the imajing's data base. Fig. 3 shows projection of the local Up (orange lines) and numerical values such as roll and pitch angles.

For the validation of the results, other information sources are used: one absolute (obtained from a magnetometer) and two relatives (estimated from image optical flow and measured with gyrometers).

IV. Conclusion

Obtained performances show to be dependent on the scene geometry. Promising results were obtained for urban dense scenario where the detected vertical line distribution on the image shows an important standard deviation.

References

[1] M. Fischler and R. Bolles, "Random Sample Consensus: A Paradigm for Model Fitting with Applications to Image Analysis and Automated Cartography," *Comm. of the ACM*, vol. 24, pp. 381–395, 1981.

[2] A. Almansa, A. Desolneux and S. Vamech, "Vanishing point detection without any a priori information," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 25, pp. 502–507, april 2003

Fig. 3. Results from road and train scene.