Calibration method Of Stereo Camera for Vehicle

Byoung-Ik Kim¹, Jang-wook Choi¹, Kyung-jin Na¹, and Soo-Young Ha¹
¹Advanced Research Team, AJIN industrial co., LTD., Gyeongsan-si, Gyeongsangbuk-do, Korea

Abstract – Camera calibration is an important prerequisite for recognizing 3D information of scene. In this paper, we proposed a more accurate and effective calibration method of stereo cameras mounted on the vehicle. Proposed method presented high precision alignment method of stereo camera. This method represents a camera calibration method which can overcome the limitations of the alignment mechanism.

Keywords: stereo camera, alignment mechanism, camera calibration.

1 Introduction

Recently, the developed countries are competitively developing the fusion technique of advanced sensors such as radar, LIDAR and stereo camera. Especially, techniques using HD stereo camera are developed to correctly recognize pedestrians, vehicles, road conditions, etc. these fusion techniques to monitoring in real-time a situation around the vehicle to reduce traffic accidents caused by careless driving. Presently, driver assistance system using stereo camera were some commercialization and were focused on research and development to meet the laws of safety regulation to attach obligatorily. However, a stereo camera that is employed in the driver assistance system is mounted interposed between the room mirrors inside the vehicle. in this case, these will have respectively different tilt, rotation, movement, etc. the particular feature of Images obtained from the stereo camera, which is located in front of the vehicle should be positioned on the same horizontal line. Because, these data the distance estimated by the stereo image analysis is characterized by having a high precision. However, it is very difficult to accurately align the right and left cameras mechanically. In particular, the mechanical alignment of high-precision in the stereo vision greatly increases the time and cost. Because this operation is required the skill of the operator and the machining precision of the mechanism [1].

In this paper, we proposed a more accurate and effective calibration method of stereo cameras mounted on the vehicle. The proposed method contribute to align mechanically prior to installing the stereo camera to a vehicle. At same time, this method represent stereo camera calibration method and apparatus to can be overcome mechanism alignment problem.

2 Proposed calibration method

Figure 1 shows the proposed method for stereo camera calibration. Proposed method consist of six steps, the first is to acquire left and right image, the second is to extract feature point, the third is to do monocular camera calibration, the fourth is to do mechanical alignment of left and right camera, the fifth is to make distortion-free image, and the final is to perform alignment of left and right image.

Image acquisition using left and right cameras are performed for chess board having variety posture. Chess board is flat plate to be used for correction. This step should acquire a lot

Fig. 1. Proposed method for stereo camera calibration.

Fig. 2. Chess board images; (a) left images, (a) right images.
of images having variety posture to ensure more accurate correction. Feature point in images is detected analyzed each of the left and right image, as shown in Figure 2. Monocular camera was calibrated respectively cameras using a monocular camera algorithm based on the extracted feature point while the distortion parameters and the internal and external parameters of the each cameras were acquired and were saved [2],[3].

Mechanical alignment of camera was performed for using the result which was calculated relative movement and rotation of between right and left camera using the external parameters calculated by calibration algorithm of monocular camera. If each cameras are calibrated using 10 of image pairs, movement and rotation are calculated for each image pair. Initial value is selected median value among the calculated values. And this method optimizes the movement and rotation by the LM method to minimize re-projection error of the feature points on a chess board. Finally, the right and left cameras are aligned mechanically using the Euler angle that was computed from the elements of the calculated rotation matrix R.

The distortion free images is produced by removing the radial and tangential distortion using distortion parameter and internal/external parameter acquired and stored through the monocular camera calibration. Finally, left and right images are rectified using the relative rotation and movement of the camera calculated through a mechanical alignment, it takes place the vertical position of the left and right images of a non-distorted image.

3 Experiments

The experiment was conducted according to the following procedure. 1) The base plate is mounted on the optical axis calibration equipment, 2) is to adjust the focus of the monocular camera to have a uniform resolution, 3) is to acquire chess board images having variety posture for calibration, 4) Calibration results confirmed. Experiment results could confirm that mechanism alignment problem overcomes.

4 Conclusions

In this paper, we proposed a more accurate and effective calibration method of stereo cameras mounted on the vehicle. The proposed method contribute to align mechanically prior to installing the stereo camera to a vehicle. At same time, this method represent stereo camera calibration method and apparatus to can be overcome mechanism alignment problem.

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5 References

