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ESTIMATION OF VEHICLE WHEELBASE IN A CIRCULAR FISHEYE IMAGE USING TWO-STEP DETECTION METHOD OF TIRE-ROAD CONTACT POINTS

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Abstract. *For traffic monitoring systems, vehicle classification is very important. Accurate estimation of wheelbase can provide a useful cue for vehicle classification. In this paper, we propose a new method for detecting accurate wheel's center points and estimating the wheelbase of a vehicle taking the distortion in the circular fisheye image into consideration. Our proposed method consists of two steps, considering distorted shape of the wheel in a circular fisheye image. At the first step, tire-road contact points are roughly detected based on the centroids of extracted the wheel regions. At the second step, the wheel areas are calculated based on detected tire contact points, and the wheel's center points are accurately estimated by position matching of calculating the wheel areas and extracting the wheel regions. Then, the tire-road contact points are redetected base on corrected wheel's center points, and the wheelbase is estimated by contact points of front and rear tires. Through experimental results, the effectiveness of our proposed method is confirmed.*

Keywords: Wheel's center point, Distortion of two concentric circles, Circular fisheye, Wheelbase

1. **Introduction.** In traffic monitoring and surveillance systems, there have been many vision-based works related to such applications as vehicle counts, vehicle classifications and vehicle-type identifications [1-14]. However, most of these works have focused on the front or the rear of vehicles imaged from a distance [1-9]. There have been relatively few works focused on side images of vehicles [10-14]. Because most of these works have used normal cameras, it has been required that the distance between the camera and the vehicle has been over several meters. When a target image is a close vehicle's side, it requires multiple cameras or a camera with super wide angle lens to get a wide field of view. We have studied the method for detecting a close vehicle to driver's vehicle using a fisheye camera with a wider field of view [15, 16]. Meanwhile, there are various works using fisheye cameras for displaying surrounding images of a driver's vehicle [17, 18] and for detecting lane marking [19], but also few studies to detect close vehicles and estimate their positions. And, as other works that targeted range of wide angle, T. Gandhi et al. [20] effectively obtained wide range information of vehicles' sides using omni-directional cameras that gave panoramic view of surrounding. However, it is not designed for detecting close