# DESCRIPTION

## VEHICLE-MOUNTED CAMERA SELF-CALIBRATION METHOD AND APPARATUS, AND STORAGE MEDIUM

The present application claims priority to Chinese Patent Application No. 201810578736.5, filed with the Chinese Patent Office on June 5, 2018, and entitled "VEHICLE-MOUNTED CAMERA SELF-CALIBRATION METHOD AND APPARATUS, AND VEHICLE DRIVING METHOD AND APPARATUS", which is incorporated herein by reference in its entirety.

### Technical Field

The present disclosure relates to the technical field of image processing, and particularly to a vehicle-mounted camera self-calibration method and apparatus, and a vehicle driving method and apparatus.

### Background

In conventional vehicle-mounted camera calibration methods, calibration needs to be performed on a specific reference object manually under a set camera model, then images are processed, calculation and optimization are carried out using a series of mathematical transformation formulas, and finally the camera is calibrated after a camera model parameter is obtained.

### Summary

The present disclosure provides a vehicle-mounted camera self-calibration technical solution.

According to one aspect of the present disclosure, provided is a vehicle-mounted camera self-calibration method, including: starting self-calibration of a vehicle-mounted camera to enable a vehicle on which the vehicle-mounted camera is mounted to be in a traveling state; acquiring, by the vehicle-mounted camera in a traveling process of the vehicle, information required for self-calibration of the vehicle-mounted camera; and self-calibrating the vehicle-mounted camera based on the acquired information.

According to one aspect of the present disclosure, provided is a vehicle-mounted camera self-calibration apparatus, including: a self-calibration starting module, configured to start

# CLAIMS

1. A vehicle-mounted camera self-calibration method, comprising:

starting self-calibration of a vehicle-mounted camera to enable a vehicle on which the vehicle-mounted camera is mounted to be in a traveling state;

acquiring, by the vehicle-mounted camera in a traveling process of the vehicle, information required for self-calibration of the vehicle-mounted camera; and

self-calibrating the vehicle-mounted camera based on the acquired information.

2. The method according to claim 1, wherein starting self-calibration of the vehicle-mounted camera comprises at least one of:

if it is detected that an angle of view or a focal length of the vehicle-mounted camera changes, starting the self-calibration of the vehicle-mounted camera;

if it is detected that a mounting position and/or a photographing angle of the vehicle-mounted camera changes, starting the self-calibration of the vehicle-mounted camera;

determining an accumulated mileage of the vehicle on which the vehicle-mounted camera is mounted, and if the accumulated mileage is greater than a mileage threshold, starting the self-calibration of the vehicle-mounted camera; and

starting the self-calibration of the vehicle-mounted camera according to a self-calibration start instruction.

3. The method according to claim 1 or 2, further comprising:

providing acquisition progress information, the acquisition progress information comprising progress information of the vehicle-mounted camera in acquisition of the information required for self-calibration,

wherein self-calibrating the vehicle-mounted camera based on the acquired information comprises:

if it is determined according to the acquisition progress information that the acquisition of the information required for self-calibration is completed, self-calibrating the vehicle-mounted camera based on the acquired information.

4. The method according to any one of claims 1 to 3, further comprising:

providing acquisition condition prompting information, the acquisition condition prompting information comprising prompting information about whether the vehicle-mounted camera satisfies an acquisition condition, and the acquisition condition comprising a condition under which the vehicle-mounted camera acquires the information required for self-calibration,

wherein acquiring, by the vehicle-mounted camera in a traveling process of the vehicle, information required for self-calibration of the vehicle-mounted camera comprises:

if it is determined according to the acquisition condition prompting information that the vehicle-mounted camera satisfies the acquisition condition, acquiring, by the vehicle-mounted camera in the traveling process of the vehicle, the information required for self-calibration of the vehicle-mounted camera.

5. The method according to any one of claims 1 to 4, wherein acquiring, by the vehicle-mounted camera in the traveling process of the vehicle, information required for self-calibration of the vehicle-mounted camera comprises:

if the lens pitch angle of the vehicle-mounted camera falls within a photographing pitch angle range, acquiring, by the vehicle-mounted camera in the traveling process of the vehicle, the information required for self-calibration of the vehicle-mounted camera.

6. The method according to any one of claims 1 to 5, wherein the information comprises lane lines on the vehicle traveling road, and acquiring, by the vehicle-mounted camera in the traveling process of the vehicle, information required for self-calibration of the vehicle-mounted camera comprises:

if the vehicle-mounted camera captures the lane lines on the vehicle traveling road, acquiring, by the vehicle-mounted camera in the traveling process of the vehicle, the information required for self-calibration of the vehicle-mounted camera.

7. The method according to claim 6, wherein acquiring, by the vehicle-mounted camera in the traveling process of the vehicle, information required for self-calibration of the vehicle-mounted camera comprises:

if the vehicle-mounted camera captures a horizon line on the vehicle traveling road or a vanishing point of the lane lines, acquiring, by the vehicle-mounted camera in the traveling process of the vehicle, the information required for self-calibration of the vehicle-mounted camera.

8. The method according to any one of claims 1 to 7, wherein acquiring, by the vehicle-mounted camera in the traveling process of the vehicle, information required for self-calibration of the vehicle-mounted camera comprises at least one of:

acquiring, by the vehicle-mounted camera in the traveling process of the vehicle, the information required for self-calibration of the vehicle-mounted camera within an acquisition duration range; and

acquiring, by the vehicle-mounted camera in the traveling process of the vehicle, the information required for self-calibration of the vehicle-mounted camera if a traveling distance of the vehicle falls within a traveling distance range.

9. The method according to any one of claims 1 to 8, wherein self-calibrating the vehicle-mounted camera based on the acquired information comprises:

updating a homography matrix of the vehicle-mounted camera according to the acquired information, the homography matrix of the vehicle-mounted camera reflecting the pose of the vehicle-mounted camera; and

self-calibrating the vehicle-mounted camera based on the homography matrices of the vehicle-mounted camera before and after the update.

10. The method according to claim 9, wherein the information comprises the lane lines on the vehicle traveling road, and updating the homography matrix of the vehicle-mounted camera according to the acquired information comprises:

detecting the lane lines in an image captured by the vehicle-mounted camera to obtain detected position information of the lane lines; and

updating the homography matrix of the vehicle-mounted camera according to the detected position information of the lane lines.

11. The method according to claim 10, wherein self-calibrating the vehicle-mounted camera

based on the homography matrices of the vehicle-mounted camera before and after the update comprises:

obtaining known position information of the lane lines according to the homography matrix of the vehicle-mounted camera before the update;

determining a calibration parameter of the vehicle-mounted camera according to the detected position information of the lane lines and the known position information of the lane lines; and

self-calibrating the vehicle-mounted camera based on the calibration parameter.

12. The method according to claim 11, wherein detecting the lane lines in the image captured by the vehicle-mounted camera to obtain detected position information of the lane lines comprises:

detecting the lane lines in the image captured by the vehicle-mounted camera; and

determining key points on the detected lane lines to obtain detected coordinates of the key points; and

determining the calibration parameter of the vehicle-mounted camera according to the detected position information of the lane lines and the known position information of the lane lines comprises:

determining the calibration parameter of the vehicle-mounted camera according to the detected coordinates of the key points and known coordinates of the key points.

13. The method according to any one of claims 10 to 12, wherein detecting the lane lines in the image captured by the vehicle-mounted camera to obtain detected position information of the lane lines comprises:

performing lane line detection in images captured by the vehicle-mounted camera to obtain lane lines to be fitted in the images; and

fitting the lane lines to be fitted in the images to obtain the lane lines and the detected position information of the lane lines.

14. The method according to claim 12 or 13, wherein the lane lines comprise a first lane line and a second lane line, and determining key points on the detected lane lines to

obtain detected coordinates of the key points comprises:

determining points of intersection between the first lane lines and the second lane lines in the images according to the detected first lane lines and the detected second lane lines in the images;

determining horizon lines according to the points of intersection in the images; and

determining key points according to the horizon lines, the first lane lines, and the second lane lines to obtain detected coordinates of the key points.

15. The method according to claim 14, wherein determining key points according to the horizon lines, the first lane lines, and the second lane lines to obtain detected coordinates of the key points comprises:

determining detection lines parallel with the horizon lines and separately intersecting the first lane lines and the second lane lines; and

determining cross points between the detection lines and the first lane lines, and cross points between the detection lines and the second lane lines as the key points to obtain the detected coordinates of the key points.

16. The method according to any one of claims 12 to 15, wherein determining the calibration parameter of the vehicle-mounted camera according to the detected coordinates of the key points and known coordinates of the key points comprises:

determining a conversion parameter of the camera according to the detected coordinates of the key points and the known coordinates of the key points, the detected coordinates of the key points comprising coordinates of the key points in a driving photographing angle of view, and the known coordinates of the key points comprising coordinates of the key points in a known angle of view; and

determining the calibration parameter of the camera according to the conversion parameter and a known parameter.

17. The method according to claim 16, wherein the known coordinates of the key points comprise:

first known coordinates of the key points in an image coordinate system in the known angle

of view, and

second known coordinates of the key points in a world coordinate system in the known angle of view; and

determining the calibration parameter of the camera according to the conversion parameter and the known parameter comprises:

determining the known parameter according to the first known coordinates and the second known coordinates; and

determining the calibration parameter of the camera according to the conversion parameter and the known parameter.

18. The method according to any one of claims 11 to 17, further comprising:

correcting the calibration parameter using a perspective principle or a triangle principle according to a correction parameter of the vehicle-mounted camera.

19. An electronic device, comprising:

a processor; and

a memory configured to store processor-executable instructions;

wherein the processor executes the method according to any one of claims 1 to 18 by calling the executable instructions.

20. A non-transitory computer readable storage medium, having computer program instructions stored thereon, wherein when the computer program instructions are executed by a processor, the method according to any one of claims 1 to 18 is implemented.