Stationery Recognition System Using Dual Cameras

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Abstract. In order to improve the recognition accuracy of stationery placed in two layers in the material box and overcome the influence of different depth of field on the recognition accuracy of stationery, one stationery recognition system using dual cameras is proposed in this work. In this mode, we employ two cameras, one has a shallow depth of field, which is mainly used to identify the stationery placed on the upper layer of the material box. The other camera has a deep depth of field, which is mainly used to identify the stationery placed on the lower layer of the material box. When the stationery recognition system works, the two cameras works in parallel, and according to the comparison accuracy of two cameras for the same stationery, the one with higher accuracy is selected as the final output of the system. One real test has been done to verify the performance of the proposed system, it shows that the proposed system is able to accurately identify stationery at different levels.

Keywords: Stationery recognition · Two layers · Dual cameras

1 Introduction

Image recognition technology is the ways to identify the image automatically according to the image color characteristics, texture features, shape features and spatial relationship features, which employs the computer vision, pattern recognition, machine learning and other technical methods [4,5]. The earliest image recognition technology can be traced back to the 1960 s [1,3], With the development of computer technology and artificial intelligence, image processing has gradually developed to target recognition, target recognition, fingerprint recognition, etc. The image recognition technology used has also evolved from the earliest template matching and prototype matching to deep learning and support vector machine methods [2].

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In this paper, in order to improve the recognition accuracy of stationery placed in two layers in the material box and overcome the influence of different depth of field on the recognition accuracy of stationery, one stationery recognition system using dual cameras will be designed and investigated. In this mode, we employ two cameras, it is mainly used to identify the stationery placed on the upper layer of the material box. The other camera has a deep depth of field, it is mainly used to identify the stationery placed on the lower layer of the material box. When the stationery recognition system works, the two cameras works in parallel, and according to the comparison accuracy of two cameras for the same stationery, the one with higher accuracy is selected as the final output of the system. One real test has been done to verify the performance of the proposed system, it shows that the proposed system is able to accurately identify stationery at different levels.

2 Dual Camera-Based Stationery Recognition Method

In this section, we will design the dual camera-based stationery recognition method. The structure of the stationery recognition system using dual cameras is shown in Fig. 1. From the figure, we can see that the stationery recognition system includes two camera lens, which is able to overcome the influence of different depth of field on image recognition caused by storing two layers of stationery in the material box. The upper camera lens is used to identify stationery placed on the upper floor, and the lower camera lens is used to identify stationery placed on the lower floor.

The identification flow chart of the dual camera-based stationery recognition method is shown in Fig. 2. From the figure, we can see easily that the the identification flows of the upper and lower camera lens have two modes: photo mode and image mode. Firstly, when the stationery recognition system start to work, both the upper and lower camera lens are working in parallel, they carry out the following operations at the same time:

- Determine whether the camera is needed to take photos.
- If it needs the camera to take photos, the mode is photo mode, in this mode, the camera is used to take pictures of the stationery, which is used to match in the next steps.
- If it does not need the camera to take photos, the mode is image mode, in this mode, the camera gets the image template from the data base, which is built off line.
- Match the picture and the template of the stationery.

After the above operations are completed, the recognition system selects which lens should be selected as the final result of the system according to the comparison of the results of two camera lens.

3 Test

In this section, we will investigate one real test to show the effectiveness of the proposed method. In this section, the setting of the test will be introduced. And the results of the tests will be investigated.

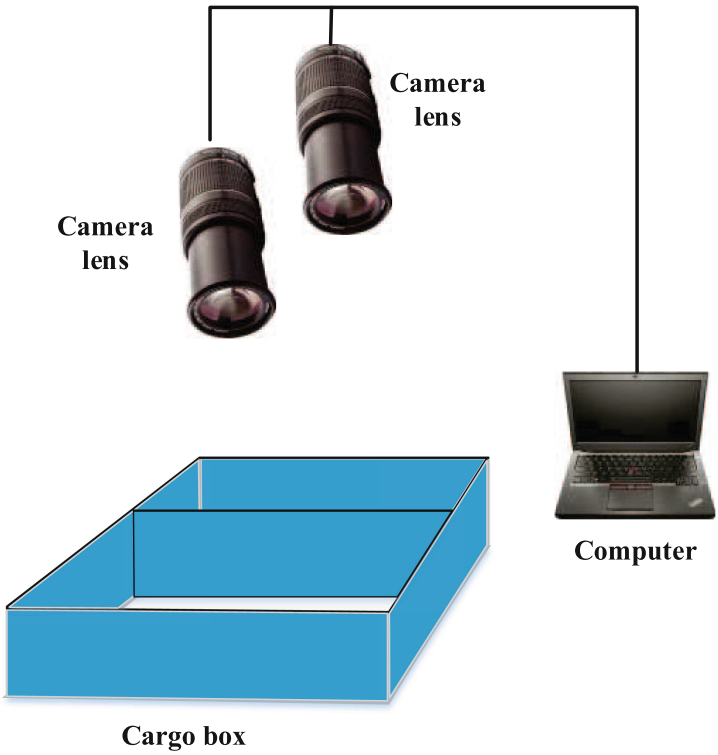


Fig. 1. The structure of the stationery recognition system using dual cameras.

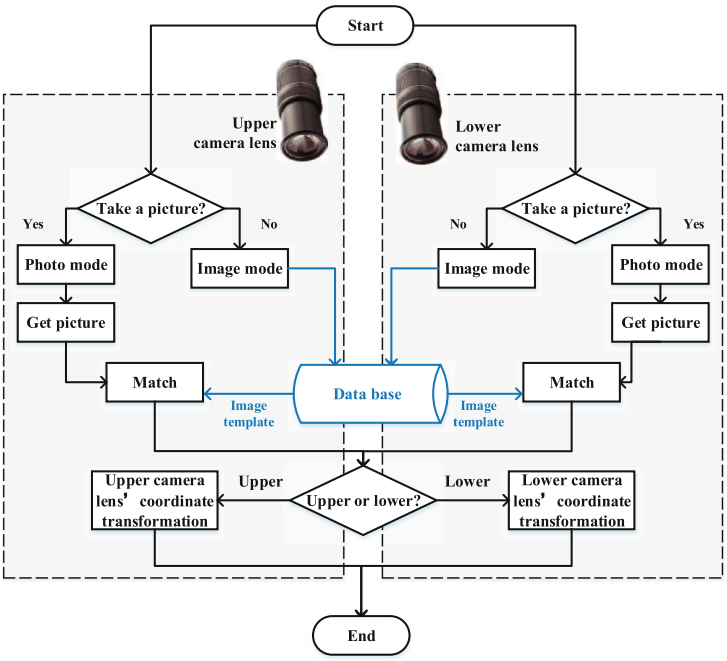


Fig. 2. The identification flow chart of the dual camera-based stationery recognition method.

3.1 The Setting of the Test

The real test has been done in the engineering training center of the Qilu University of Technology, Jinan, China. Figure 3 shows the real environment of the test. In this work, the test employs two industrial lenses: one is used as the upper lenses, the other one is used as the lower lenses, the two lenes can meet the requirements of different depth of field. Both the lenes are fixed on bracket. In this work, the HIKVISION MV-CE200-10GM and MV-CA050-11UM as the camera. And the computer is LAPTOP-OGCH3AJG, its CPU is Intel (R) Core(TM) i7-8550U CPU @ 1.80 GHz 2.00 GHz, and its RAM is 8.00 GB.

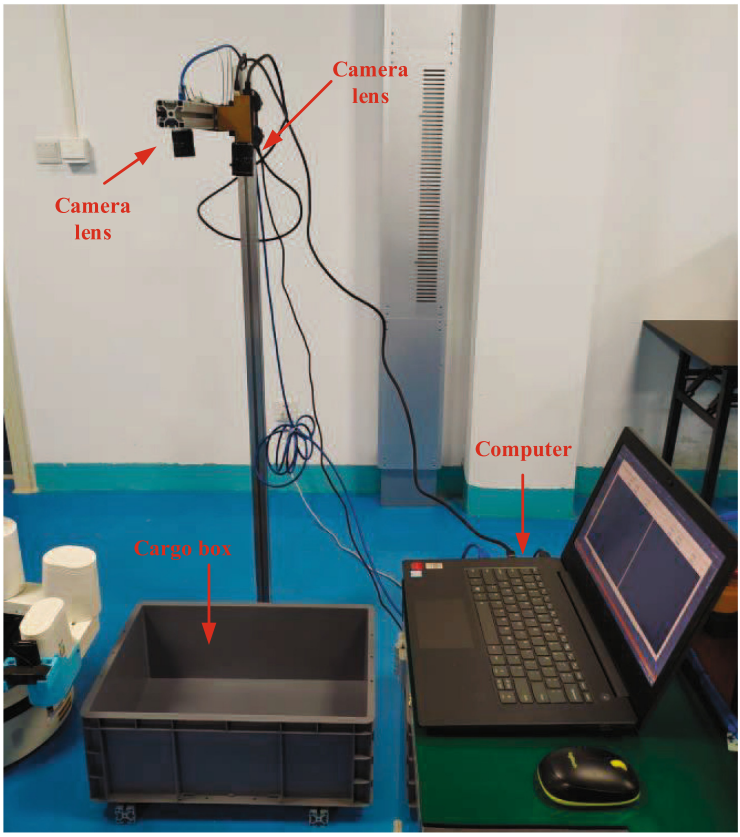


Fig. 3. The real environment of the test.

3.2 The Software of the System

In this work, we develop one software of the system, which is used to control the system to get the picture and identify the type of stationery. The Fig. 4 shows the main interface of software. From the figure, one can see easily that the main interface obviously includes the image display of two different lenses. The software of this system mainly includes camera debugging, template maintenance, network configuration and other functions. Before the system is enabled, we first need to complete the camera calibration using the software, which is shown in Fig. 5.

Fig. 4. The main interface of software.

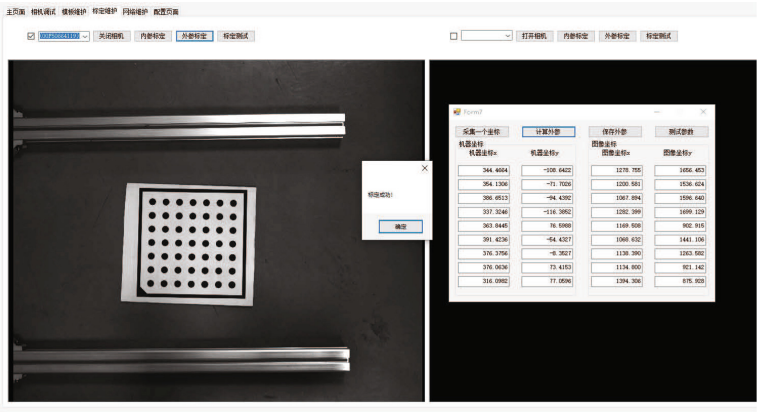
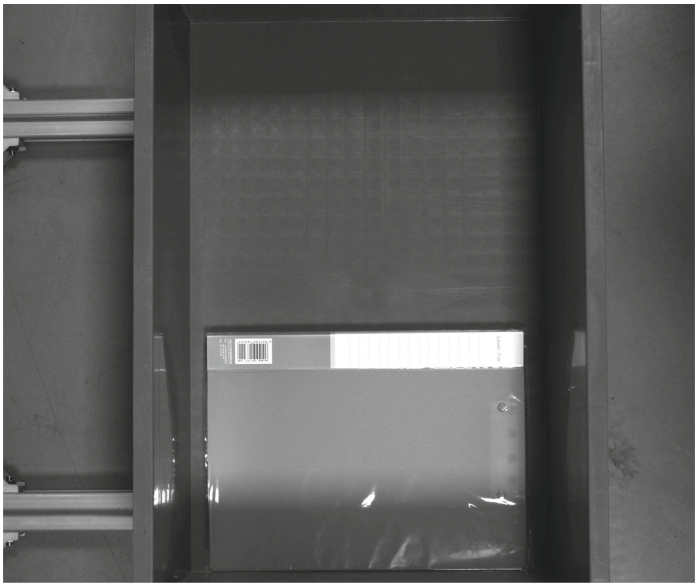


Fig. 5. The software completes the calibration of the camera.



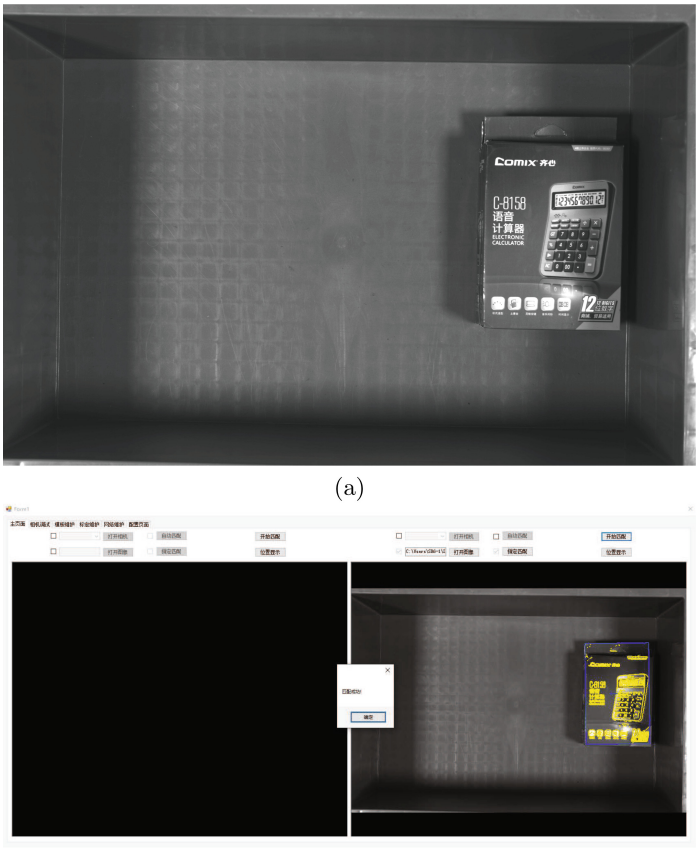
(a)

(b)

Fig. 6. The identification of the document bag at the lower level of the material box (a) the photo taken and (b) the identification result.

3.3 Stationery Identification

In this section, we will show the performance of the designed stationery identification system. In this section, we select two kinds of stationery: the file bag and the calculator. To the lower layer of material box, the identification of the document bag at the lower level of the material box is shown in Fig. 6. Here, Fig. 6 (a) is the photo taken and Fig. 6 (b) is the identification result. From the figure, we can see that the proposed system is useful to complete the identification of the document bag at the lower level of the material box (Fig. 7).



(a)

(b)

Fig. 7. The identification of the calculator at the upper level of the material box (a) the photo taken and (b) the identification result.

4 Conclusion

In this paper, in order to improve the recognition accuracy of stationery placed in two layers in the material box and overcome the influence of different depth of field on the recognition accuracy of stationery, one stationery recognition system using dual cameras will be designed and investigated. In this mode, we employ two cameras, it is mainly used to identify the stationery placed on the upper layer of the material box. The other camera has a deep depth of field, it is mainly used to identify the stationery placed on the lower layer of the material box. When the stationery recognition system works, the two cameras works in parallel, and according to the comparison accuracy of two cameras for the same stationery, the one with higher accuracy is selected as the final output of the system. One real test has been done to verify the performance of the proposed system, it shows that the proposed system is able to accurately identify stationery at different levels.

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