ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202110_4(10).0029

Research and Design of Target Detection Classification Crawl Based on Deep Learning

Qingcheng Yang

School of computer and communication, Lanzhou University of technology, Gansu, 730050, China

Abstract

With the continuous development of the level of science and technology, it is a development trend for machines to do simple and tedious work instead of people. Considering the potential of classification work that can be applied to different scenes, this paper designs an all-in-one intelligent interactive robot that can capture, grab and classify image objects through camera and robotic arm.

Keywords

Visual tracking; Image recognition; Item classification; Deep learning; YOLOv3.

1. Introduction

At present, the target detection algorithm mainly includes the traditional target detection technology and the deep learning target detection technology. The traditional recognition technology mainly uses sliding window to achieve the target search in the picture, the detection accuracy is low, and the robustness is poor. YOLOv3 is a fast and accurate deep learning target detection technology, which has good comprehensive performance in detection speed and detection accuracy, so it is widely used in near-field target detection. In this paper, a kind of intelligent interactive robot control system based on Raspberry Pi is proposed, and the visual interaction system of the robot is composed of the camera by the Raspberry Pi, which uses YOLOv3 for target recognition, and combines the deep learning algorithm with the intelligent interactive robot technology, which has certain innovation and research value.

2. The Overall Design of the System

2.1. System Body Structure

The main structure of the system consists of the following sections: Raspberry Pi camera, Raspberry Pi, STM32 system board, six-rudder robotic arm, regulator module, drive module, motor, model.

2.2. How It Works

The overall control structure of the system is shown in Figure 1.

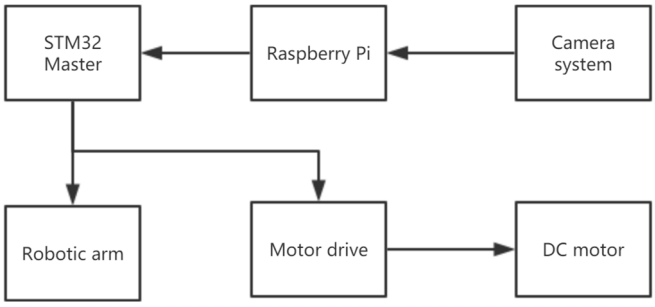

Figure 1. Intelligent interactive robot control system block diagram

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202110_4(10).0029

The Raspberry Pi uses YOLOv3 to identify the image read by the camera, identify the location of the object and send STM32 through a serial port. The STM32 microcontroller then controls the car for movement, and after many identifications and movements, when the object is located within the range that the robot arm can capture, the car stops moving and controls the robot arm to catch it. After the capture is successful, the robot arm places the object in a given sub-category area to complete a capture classification task.

3. System Structure Design

The overall structural design objectives of the robot are as follows:

(1) Intelligent interactive robots can efficiently operate independently when no one can intervene for external factors.

The mechanical structure and control system of the (2) intelligent interactive robot adopts a modular design to facilitate disassembly, repair and maintenance.

(3)The design of the mechanical arm adopts series structure, and different joints will not affect each other, which can complete better transmission accuracy and design requirements of transmission stability.The large torque steering machine ensures the rotation accuracy, and the single steering machine controls the single joint, making the mechanical arm movement simple and easy to control.

(4) Four direct motors can be directly controlled simultaneously by the PWM.The input signal is isolated by optical coupling and has an under-voltage protection function.At the same time, the electrostatic discharge circuit is designed to fully meet the requirements of the motor drive.

(5) STM32F103 microand raspberry pie 4B, can meet the control needs of the system.

(6) The car body adopts aluminum chassis, with good insulation, low center of gravity and strong load capacity, to ensure the small and lightweight mechanical structure of the intelligent interactive robot and the stable performance in operation.

4. System Software Designsystem Structure Design

4.1. Software Process

The program flow chart is shown in Figure 2.The system software design adopts modular program design methods, including the system initialization program, camera recognition program, mechanical arm control program, and gray scale tracking program.After the raspberry pie turns on, first start the system initialization operation, and then run the corresponding program file.The STM32 MCU controls the DC motor to the target recognition area through grayscale tracking, and then the Raspberry Pi runs the YOLOv3-based deep learning image recognition algorithm to identify the target object in turn.When the target object is detected, the Raspberry Pi sends a grab command through the serial port, controls the robotic arm to complete the grab action, and places the items in a predetermined classification area, and then the intelligent interactive robot returns to its initial position.

4.2. YOLOv3 Target Detection Algorithm

YOLOv3 is a fast and accurate deep learning object detection technology with good comprehensive performance in terms of detection speed and detection accuracy. For image feature extraction, YOLOv3 uses the Darknet network structure [3]. It works similar to the residual network, both arranging fast links between layers and layers.YOLOv3 uses three features of different scales, including 3 2-fold reduction sampling, 16-fold reduction sampling, and 8-fold reduction sampling, and detection on multi-scale feature map is similar to SSD.YOLOv3 calls the shallow features through the route layer, splices the shallow feature map obtained after 4 downsampling with the feature map obtained from 16 x drop sampling,

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202110_4(10).0029

learning the deep and shallow features while the deep learning network, and has a better expression effect. The YOLOv3 network structure is shown in 3.

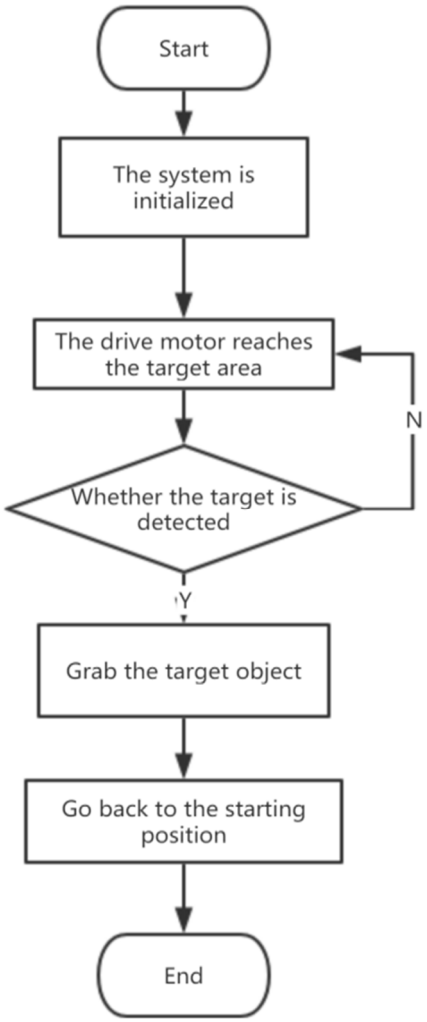

Figure 2. Program flowchart

	Type	Filters	Size		Output	
	Convolutional	32	3	3	256	256
	Convolutional	64	3	3 / 2	128	128
1	Convolutional	32	1	1		
	Convolutional	64	3	3		
	Residual				128	128
	Convolutional	128	3	3 / 2	64	64
2	Convolutional	64	1	1		
	Convolutional	128	3	3		
	Residual				64	64
	Convolutional	256	3	3 / 2	32	32
8	Convolutional	128	1	1		
	Convolutional	256	3	3		
	Residual				32	32
	Convolutional	512	3	3 / 2	16	16
8	Convolutional	256	1	1		
	Convolutional	512	3	3		
	Residual				16	16
	Convolutional	1024	3	3 / 2	8	8
4	Convolutional	512	1	1		
	Convolutional	1024	3	3		
	Residual				8	8
	Avgpool		Global			
	Connected		1000			
	Softmax					

Figure 3. The YOLOv3 network structure

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202110_4(10).0029

YOLOv3 through multi-scale detection [4-6] significantly improves the detection accuracy of mAP and small objects and forms a deeper network hierarchy through residual networks.YOLOv3, if COCO mAP50 is used as an evaluation indicator, performs quite surprisingly.It is detected many times as faster as other models.The actual recognition renderings are shown in 4.

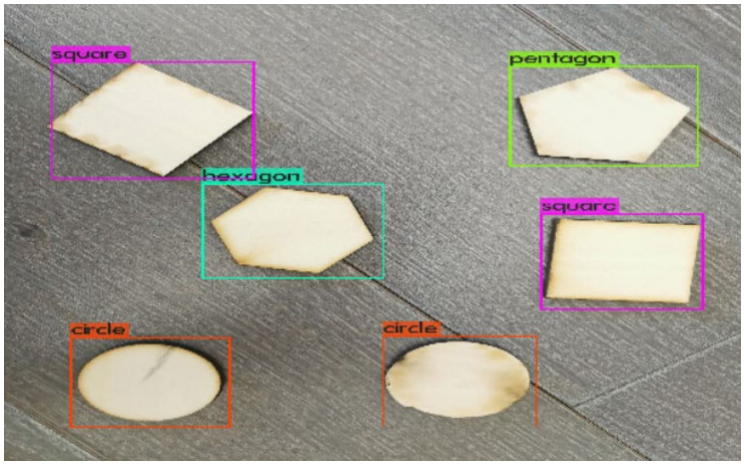

Figure 4. YOLOv3 recognition renderings

5. Conclusion

The intelligent interactive robot studied in this paper mainly uses the YOLOv3 deep learning algorithm to automatically detect the location of objects in the picture and classify the classification information of objects in the boundary frame.It is mainly used to make a reasonable classification of goods, and a variety of different goods are accurately placed in the appropriate area.With this deep learning, the system can not only adapt the robot to a variety of different scenarios, but also facilitate the accuracy and high speed of the YOLO algorithm.

References

[1] Li Haoxuan, Wu Dongdong.Real-time multi-face detection in natural scenarios based on deep learning.Test Technical Journal, 2020,34 (01): 41-47.

[2] Liu Jun, Zhang Wenyi.Highway fire detection based on the YOLOv3 algorithm.Journal of Shanghai Shipping Transportation Science Research Institute, 2019,42 (04): 61-65, 83.

[3] Guo Mingyu, Liu Shi.Optimization and implementation of the YOLOv3 image recognition and tracking algorithm.Electronic test, 2019 (15): 65-66, 86.

[4] Gong'an, Zhang Yang, and Tang Yonghong.Electric energy representation number identification method based on YOLOv3 network.Computer System Applications, 2020,29 (01): 196-202.

[5] C.Pos,s etal..Application of open Source Deep Neural Networks for Object Detection in Industrial Environments//2018 17th IEEE International Conference on Machine Learning and Applications (ICMLA), Orlando, FL, 2018: 231-236.

[6] C.Wang, D.Du.Research on logistics autonomous mobile robot system//2016 IEEE International Conference on Mechatronics and Automation, Harbin, 2016: 275-280.