

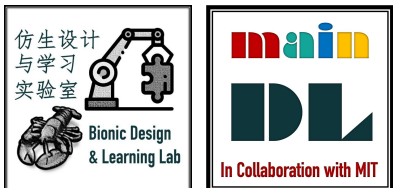
Garbage Classification and Recognition Capture Based on Deep Learning

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Proposed Project Title Summary

Garbage visual recognition classification, attitude control, and capture based on deep learning. With the deepening of the concept of environmental protection, people are paying more attention to the importance of garbage recycling. In the process of automatic garbage collection, visual identification classification is an important step. At the same time, in the grasp based on the robot arm, attitude control will directly determine the success and efficiency of the grasp. Therefore, we want to study the above two points to complete the entire workflow of automated garbage collection.

According to the first article, we learned about the development process and theoretical basis of advanced robot learning technologies such as visual recognition. According to the second article, we learned that we can extract target contour features and positioning through image recognition, and distinguish different objects as the theoretical basis for implementation. And from the third article, we realize Densenet121 architecture by using pytorch and using adam as the optimizer can get better classification results

Since garbage visual recognition classification and item depth information recognition is not a new field, we can take some public data sets that have added labels already. The data sets of training garbage classification and capture can be independent of each other, and the amount of training set data available for us to choose in these two fields is very large, such like the works by Sun, Alan, and Harry Xiao^[4]. When the project requires us to obtain the training set by ourselves, images will be obtained using binocular cameras, etc., and we will add labels to them according to the scene.

Proposed Project Title Summary

After deep learning of the found data set, the candidate region box is obtained based on the SSD detection algorithm, and the detection reliability of possible objects is predicted, and then the object recognition result with the maximum reliability in the region is obtained by using the non-maximum suppression method. After that, the grasping area of the object was identified based on the multi-object grasping model of the Faster RCNN network. Finally, based on the grasping boundary information of the target object, the candidate grasping rectangle was calculated, and the grasping rectangle was mapped into the grasping posture of the robot in three-dimensional space by using the coordinate mapping relationship.

- [1]Lake, B. M., Ullman, T. D., Tenenbaum, J. B., & Gershman, S. J. (2017). Building machines that learn and think like people. *Behavioral and brain sciences*, 40, e253.
- [2]张方超,董振,张栋,武涛 & 李卫国.(2019).基于图像视觉的垃圾分类机器人识别控制系统算法设计. *电子测量技术* (20),63-67. doi:10.19651/j.cnki.emt.1902979.
- [3]Aral, R. A., Keskin, Ş. R., Kaya, M., & Hacıömeroğlu, M. (2018, December). Classification of trashnet dataset based on deep learning models. In *2018 IEEE International Conference on Big Data (Big Data)* (pp. 2058-2062). IEEE.
- [4]Sun, Alan, and Harry Xiao. "ThanosNet: A Novel Trash Classification Method Using Metadata." *2020 IEEE INTERNATIONAL CONFERENCE ON BIG DATA (BIG DATA)*. NEW YORK: IEEE, 2020. 1394–1401. Web.

Our Motivation Towards This Project

Why is it interesting?

- Garbage visual recognition classification, attitude control, and capture based on deep learning.
- With the deepening of the concept of environmental protection, people are paying more attention to the importance of garbage recycling. In the process of automatic garbage collection, visual identification classification is an important step. At the same time, in the grasp based on the robot arm, attitude control will directly determine the success and efficiency of the grasp. Therefore, we want to study the above two points to complete the entire workflow of automated garbage collection.

What Reading Will You Examine?

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Data Source

From shareable libraries to self-collecting

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The Problem Faced to Be Investigated?

Approach and Algorithm

- After deep learning of the found data set, the candidate region box is obtained based on the SSD detection algorithm, and the detection reliability of possible objects is predicted, and then the object recognition result with the maximum reliability in the region is obtained by using the non-maximum suppression method.
- After that, the grasping area of the object was identified based on the multi-object grasping model of the Faster RCNN network.
- Finally, based on the grasping boundary information of the target object, the candidate grasping rectangle was calculated, and the grasping rectangle was mapped into the grasping posture of the robot in three-dimensional space by using the coordinate mapping relationship.

Score Constitution

| TARGET ACCOMPLISHED | SCORE |
|---|-------|
| Establishing the found data set and realizing the candidate region box by means of deep learning | 60 |
| Identifying the grasping area of the object based on the Faster RCNN network | 75 |
| Establishing the simulation environment of manipulator successfully | 90 |
| Combining all the function above to finishing independent visual based grasping within simulation environment | 100 |