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M A S T E R ' S T H E S I S
for
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Model-free and real-time multiple object tracking with an RGBD camera

Problem description:

In human-robot collaboration tasks, most of objects are new to the robot, especially in complex and unstructured environment. Despite the lack of object knowledge, the robot must be able to keep tracks of the objects in order to learn or perform manipulation tasks such as grasping and placing. For all its clarity of importance, the model-free object tracking has not been investigated robustly and efficiently enough to be realized in real-time human-robot interaction. The ultimate goal of this project is to enhance the performance of the existing model-free approach [1] to the extent of model-based approach which shows feasible robustness and real-time performance [2]. One of the difficulties in the model-free approach is originated from the multiple-object case: segmentation issues in the boundary if they are contacted or stacked. Furthermore, real-time requirement prohibits to use future information, thus requiring on-line segmentation algorithm. One promising solution is to use tracking-based segmentation approach, which extract object movement information from historical data [3, 4]. In this thesis, a novel algorithm will be proposed to improve accuracy and computational efficiency in the tracking-based segmentation process.

Tasks:

- Study and analysis of previous works in [3, 4].
- Implementation and comparison of those methods with ground truth data.
- New algorithm proposal and GPU programing for real-time implementation.

Bibliography:

[1] S. Koo, D. Lee, and D.-S. Kwon, Incremental object learning and robust tracking of multiple objects from rgb-d point set data, Journal of Visual Communication and Image Representation, vol. 25(1), pp. 108-121, 2014.
[2] C. Choi and H. I. Christensen, Rgb-d object tracking: A particle filter approach on gpu, in IEEE/RSJ IROS 2013, pp. 1084-1091.
[3] S. Koo, D. Lee, and D.-S. Kwon, Unsupervised object individuation from RGB-D image sequences, in IEEE/RSJ IROS 2014, pp. 4450-4457.
[4] E. Herbst, X. Ren, and D. Fox, "RGB-D flow: Dense 3-D motion estimation using color and depth" in IEEE ICRA 2013, pp. 2276-2282.

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