Faculty of Electrical Engineering & Computer Science
Master Degree Course Electronics Engineering, MSc EE

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Segmentation of 3D-Logistic Object Point Cloud Data using Mean Shift Algorithm.

ABSTRACT - Masterthesis

This work is concerned with the study of applicability of Mean Shift algorithm towards segmentation of 3d point cloud scenes containing logistic objects, motivated by task of robotic manipulation of objects in logistic environments - A quest towards future automation.

We empirically evaluate results and effects of underlying parameters involved with respect to Mean Shift segmentation and Euclidean distance clustering. Then present techniques to improve the performance of the Mean Shift segmentation using point normal feature derived from the point cloud surface and demonstrate its robustness. We then study the shortcomings involved with Euclidean distance clustering approach and propose an efficient clustering technique based on merging over lapping clusters via the Mean Shift dual domain bandwidth cluster merging technique and demonstrate its robustness by segmenting challenging point cloud data with near real time performance.

Finally, we fit Super Quadratic 3d models to the segmented data to significantly reduce the feature space using RANSAC based non linear least squares fitting with Trust-Region-Reflective algorithm and demonstrate the fitting results.

Throughout this work besides achieving robust segmentation, the vested efforts on minimizing the computation time by down-sampling the raw point cloud data without compromising performance and use of methods such as K-d tree range search with inherent near linear complexity have proven successful in significantly reducing overall run time.