MECHANICAL ENGINEERING STUDENT SEMINAR

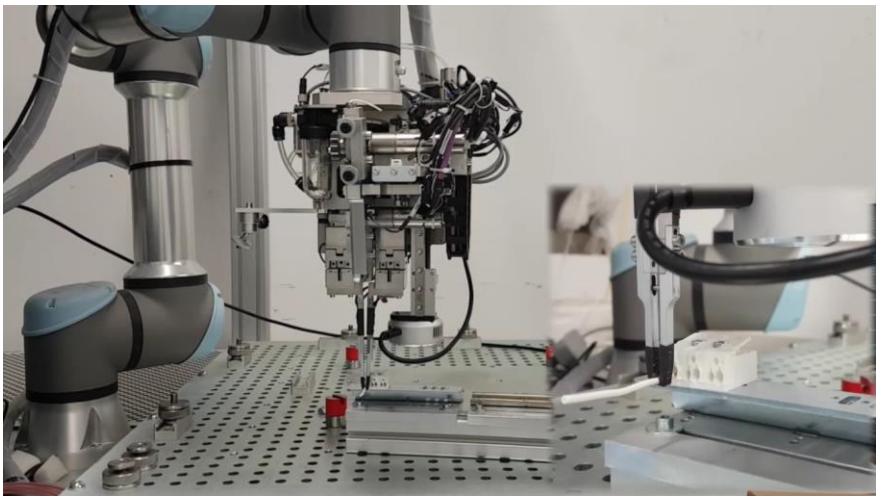
Wednesday, February 1, 2023, at 11:30
Online: https://technion.zoom.us/j/4703086068

Learning-based object detection and 6D pose estimation from RGB-D images for industrial robotic manipulations

Maxim Mednikov

Adviser: Prof. Anath Fischer

For robot automation tasks, such as assembly tasks, deterministic process knowledge is necessary. This knowledge is based on a perception of the spatial environment such as the location of the parts to be assembled. Planning the robotic manipulation path requires object detection and 6D pose estimation of the assembly targets. Both are difficult tasks since they differ in texture and shape complexity. For this reason, a common solution is to use an RGB-D camera with visual learning.
While much progress has been made in localization of objects with synthetic datasets and highly accurate annotated benchmark datasets, the performance on real industrial operation scenes with uncertain annotations have not been explored to the same extend.
Our focus in this work is on leveraging 3D captured data to further increase the accuracy of the Yolo6D architecture which our method is based upon. The research was accomplished by developing and demonstrating the effect of fusing the depth information in different architecture schemes. Additionally, we propose a method that utilizes the depth information. This method is called Point of View (PoV) algorithm was developed that uses the initial estimation of the object's 6D pose and it's CAD model.
Finally, we showcase the results on industrial real data, for which an acquiring process was made, and on a common benchmark dataset. Unlike the benchmark dataset whose depth data is relatively clean, and the annotation is exact, the industrial dataset is noisy. The PoV performance analysis considering the complications which are involved in it such noise and inaccuracies in annotation, shows high improvement in translation refinement. We demonstrated significant improvement in localization accuracy, that leads to a successful robotic manipulations of industrial use cases.



Note: the seminar will be given in Hebrew

Seminars Coordinator: Assoc. Prof. Matthew Suss.