ARIA
APPLIED RESEARCH IN ACTION

Object Tracking for High-Speed Pick-and-Place Robot

Enabling Faster Robotic Operations with Real-Time, Detection-Based Item Tracking and Prediction Strategies

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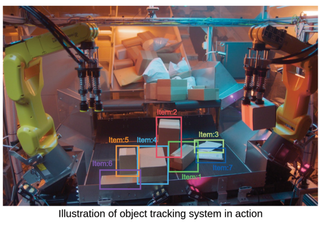


Illustration of object tracking system in action

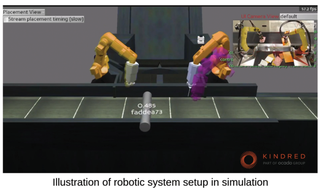
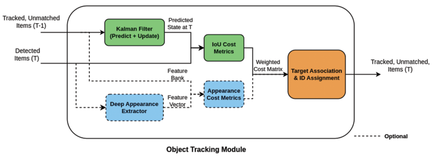


Illustration of robotic system setup in simulation

System Diagram



Object Tracking Module

PROJECT SUMMARY

Kindred's robotics manipulation products rely heavily on accurate and robust computer vision models to perform mission-critical tasks such as grasping and placing deformable items at a high speed. Such characteristics of the robotic manipulation poses a challenge: predicting where an item in the scene will be in the near future becomes critical for faster operation and the planning of preemptive activities.

To that end, we developed a real-time object tracking framework that leverages existing RGB-D cameras to quantify the dynamic properties of items, such as size, shape, and location across frames. Following the tracking-by-detection paradigm, our system takes predicted bounding boxes from an instance segmentation model and performs frame-to-frame target association to capture item identities and correspondence at different timestamps. In addition, we adopted a Kalman Filter module to continuously predict and update item states including position and motion information, allowing our system to propagate item information temporally for downstream tasks. Our motion-based tracking algorithm runs with minimal computational overhead, taking less than 5 milliseconds per frame on average on a workstation laptop. When combined with a half-precision segmentation model deployed in TensorRT, our system demonstrates true real-time capability running at 20+ FPS.

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