

Title: Safe Human-aware Robot Navigation in Warehouses

Indian PI: G C Nandi, Professor, IIIT-A and PI in the grand project on Human Robot Interactions in the I-Hub Foundation for Cobotics (IHFC), India.

US PI: Prof. Katherine Driggs-Campbell, University of Illinois at Urbana-Champaign

The current warehouses and fulfilment centres deploy a fleet of robots to carry products on a predefined path to a human picker, who does the job of picking and packaging of the items. Packing these items can be strenuous and repetitive, making the human’s job prone to long-term injuries. There is a need to improve both the intelligence and capabilities of the autonomous delivery and packing, to facilitate smooth collaboration between the human and robot workers while increasing safety and efficiency. In this project, we look at (1) modelling human behaviour; (2) socially-aware navigation among human co-workers; and (3) intelligent manipulation for packing. We address challenges around working with humans in the loop safely, especially considering occlusions and semi-structured environments (e.g., crowded intersections).

The key contributions of the project lie in developing a safe human-aware **Robot Crowd Navigation** in warehouse scenarios using accelerated **Reinforcement Learning** and **Human Motion Prediction**. We are developing optimization and initialization methods for slim/sparse neural network architectures for intelligent **Robot Grasping**. We deploy and evaluate our methods in simulation and on re-creation warehouse environments.

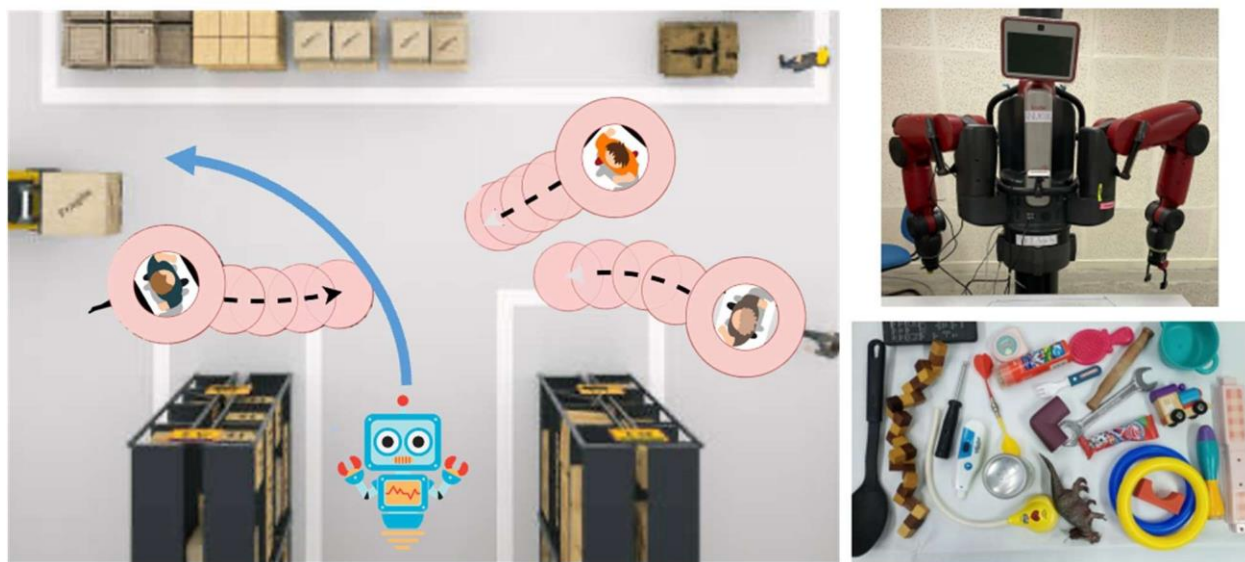


Figure 1: (Left) Visualization of robot navigation in warehouse environment. Challenges arise from freeform interactions with human workers and limited visibility from at intersections between shelves. (Right) Once items are delivered by mobile robot, the items must be efficiently packed. Intelligent grasping is powered by “slim” neural network architectures.