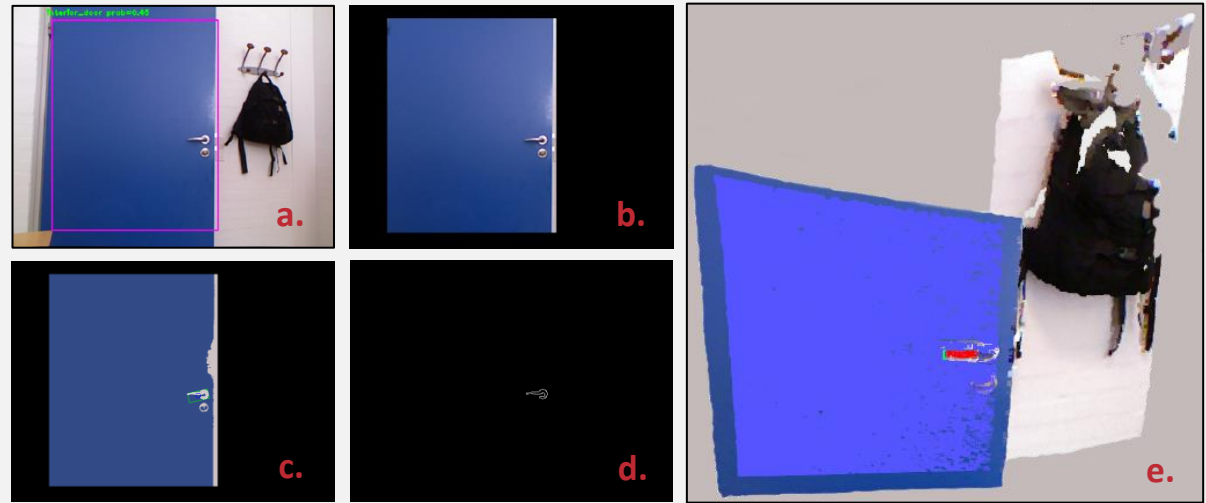# Door Recognition and Handle Detection Using Convolutional Neural Nets

Methodology:

- CNN to extract region of interest.
- Visually segment the handle and generate point cloud.
- Extract planar model of door and keep the outliers as the handles point cloud.
- Fuse both methods for final result.
- Derive key features of handle for robot manipulation.

Figure 1. **a)** CCN object detection. **b)** ROI extraction. **c)** K-means clusterization and contour detection. **d)** Selection of door handles cluster. **e)** Final results (clear blue and red) layered on top of the environment's point cloud.
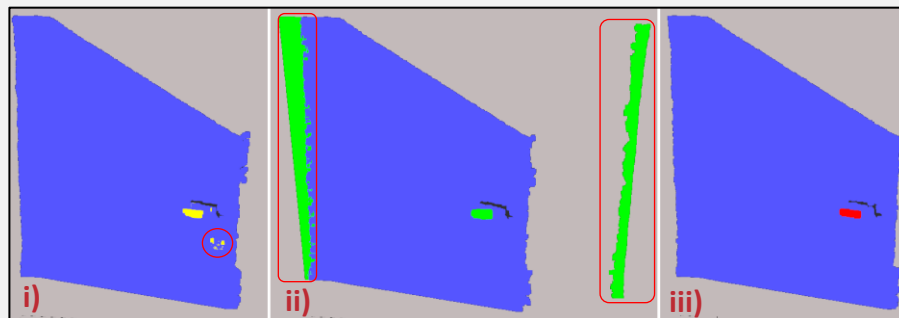

Figure 2. Fusing both methods.
i) Handle point cloud (yellow) obtained from the visual segmentation method (lock is included in the result).
ii) Handle point cloud (green) derived from the direct point cloud processing method (walls are included in the result).
iii) Final handle point cloud (red) after merging both methods (all errors from each method have been removed).

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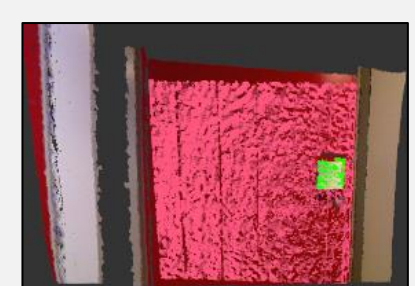# Door Recognition and Handle Detection Using Convolutional Neural Nets

Additional results:
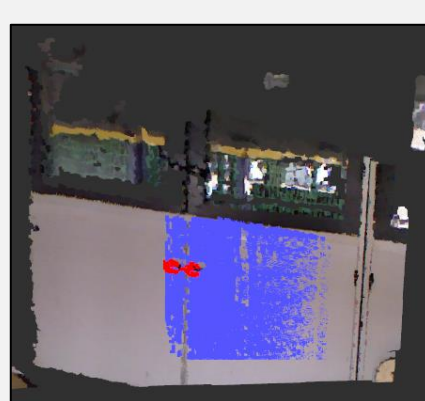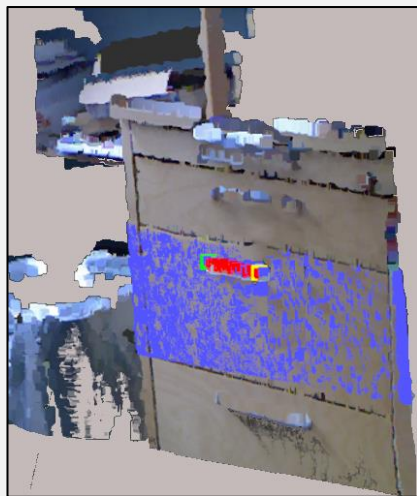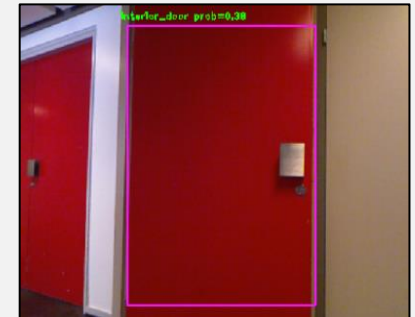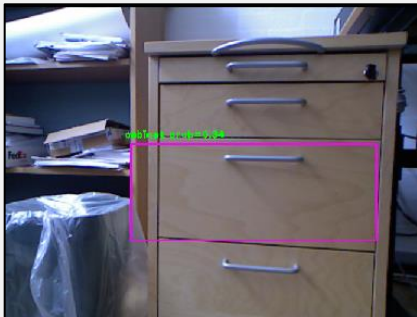
Figure 3. With parameter tuning, the algorithm is capable of working on different types of handles.

Figure 4. Detection of drawer handle in an extremely cluttered environment with heavy lighting from the exterior.

Figure 5. Detection of handle point cloud (green) and door surface (pink).