The problem

Given input a scanned point cloud of an interior environment, the aim is to automatically reconstruct its primary facility surfaces—such as floors, walls, and ceilings.

Challenges

- Robustness to outliers
- Chicken & egg dilemma
- Massive point clouds

J-linkage

Represents data as preferences granted to a set of random provisional models. Clusters of points belonging to the same model are constructed in the preference space in a bottom-up fashion by linkage clustering using the Jaccard distance between preference sets.

Min-Hash

To speed up the computation and to tackle large datasets, we use a min-hash scheme to approximate the Jaccard distance without impacting accuracy.

Wall reconstruction

Line extraction: 2D wall samples are identified, then min-hashed J-linkage robustly recovers the main lines. As a preliminary pruning, those lines that are supported by few wall samples, and the ones that do not conform to the Manhattan Word assumption are rejected as outliers.

Topological refinement: Subsets of faces that are adjacent and, at the same time, “see” a consistent extent of common walls, are grouped through a min-hashed single-linkage clustering based on visibility. Segments that separate cells belonging to distinct clustered regions are retained as dominant walls.

Sample results

References: