



Detection and Manipulation of Irregularly Shaped Objects

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Semester Project

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Over-All Idea



<http://gardening.stackexchange.com>

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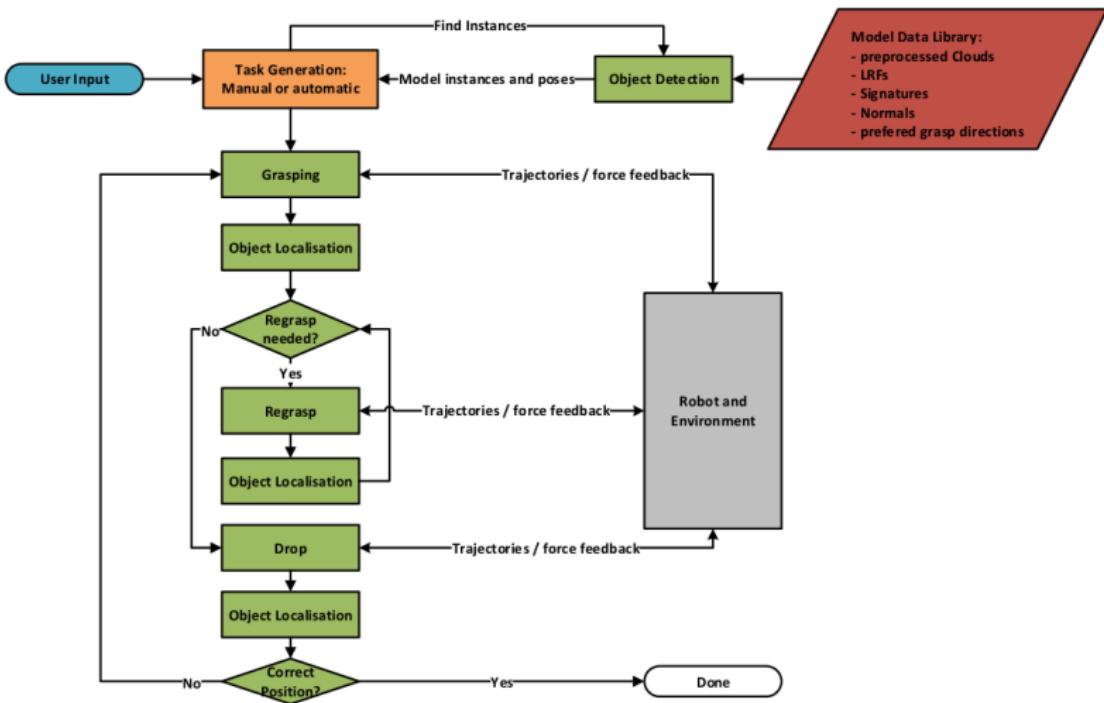
Over-All Idea



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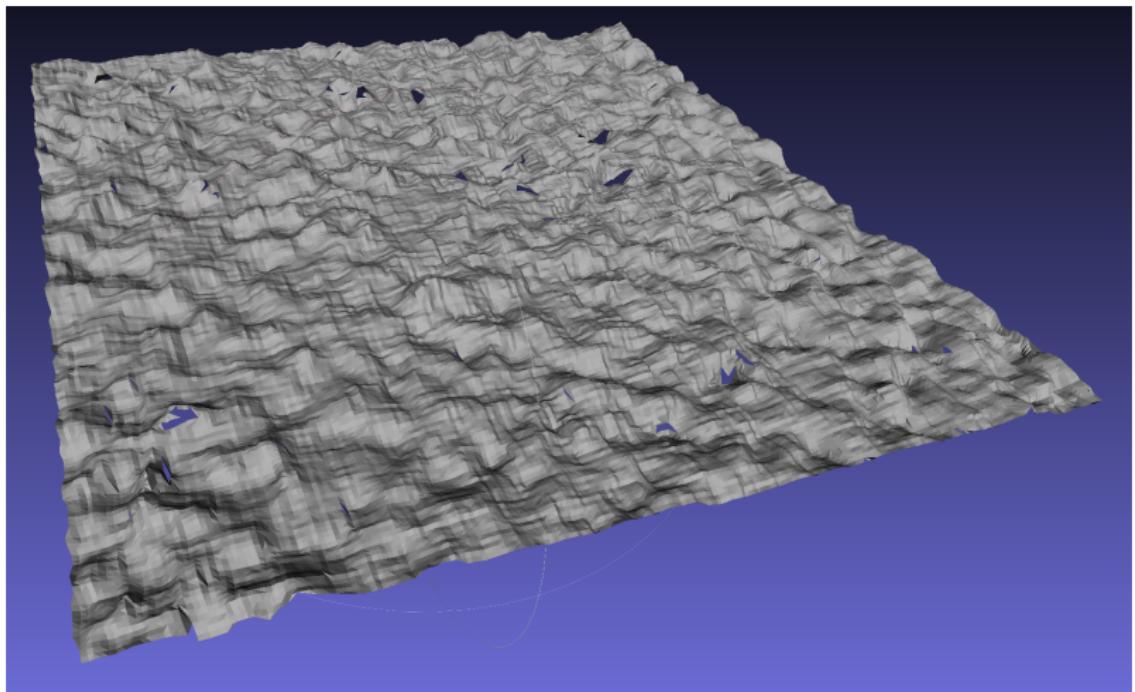
Concept



Current Status: Object Detection

- Literature research for algorithm:
fast, occlusion and clutter, structure & texture features
- Tests with RealSense R200
 - Min. distance $\sim 0.5\text{m}$ too large for small stones
 - Dummy-stone made from PA-Foam
 - ordered RealSense SR300 with min. dist. $\sim 0.2\text{m}$
 - uncorrelated, high amplitude measurement noise
 - temporal filtering using median and average. Could use reconstruction.

Measurement Noise



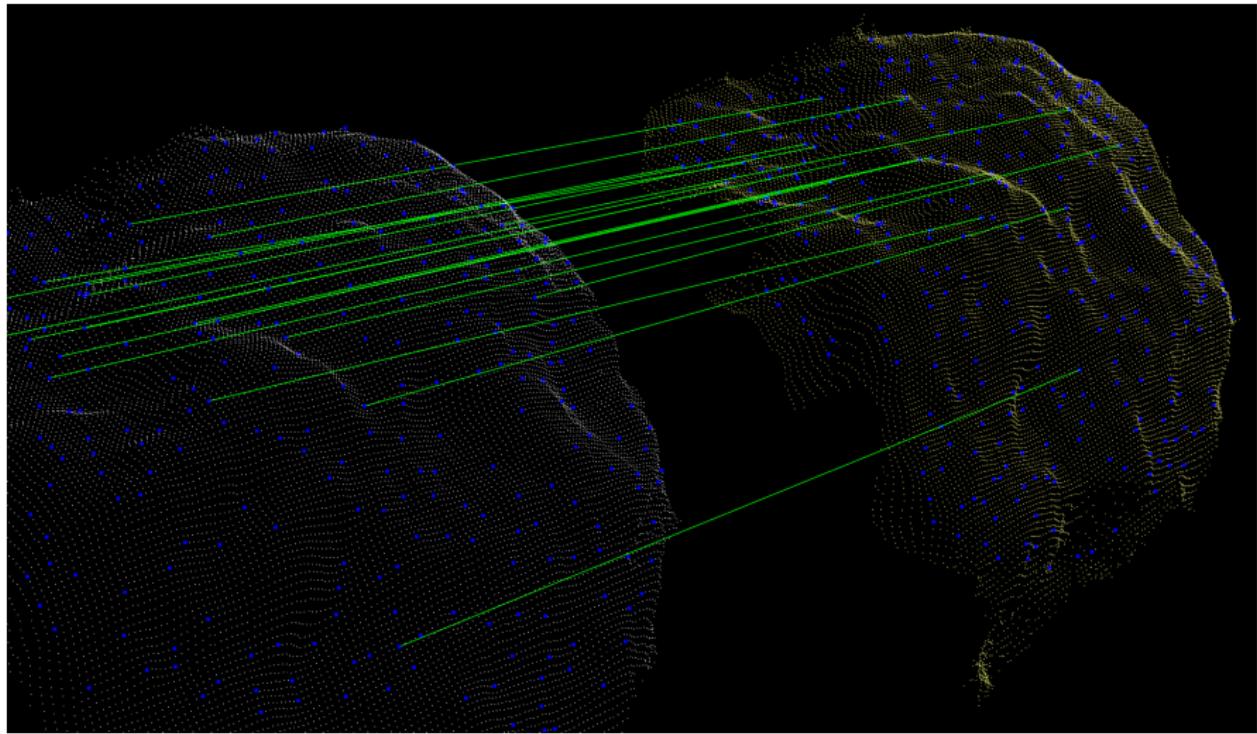
Current Status: Object Detection

- Development of an algorithm based on Point Cloud Library
 - Using local features selected by:
"Intrinsic Shape Signatures (ISS)"
 - Compared descriptors for robustness:
Rotational Projection Statistics (RoPS) vs. Fast Point Feature Histograms (FPFH)
 - current status: object detection with benchmark clouds:
~ 3s for one model.
- Scanning models using ATOS Core: Optical 3D Scanner (IVP)

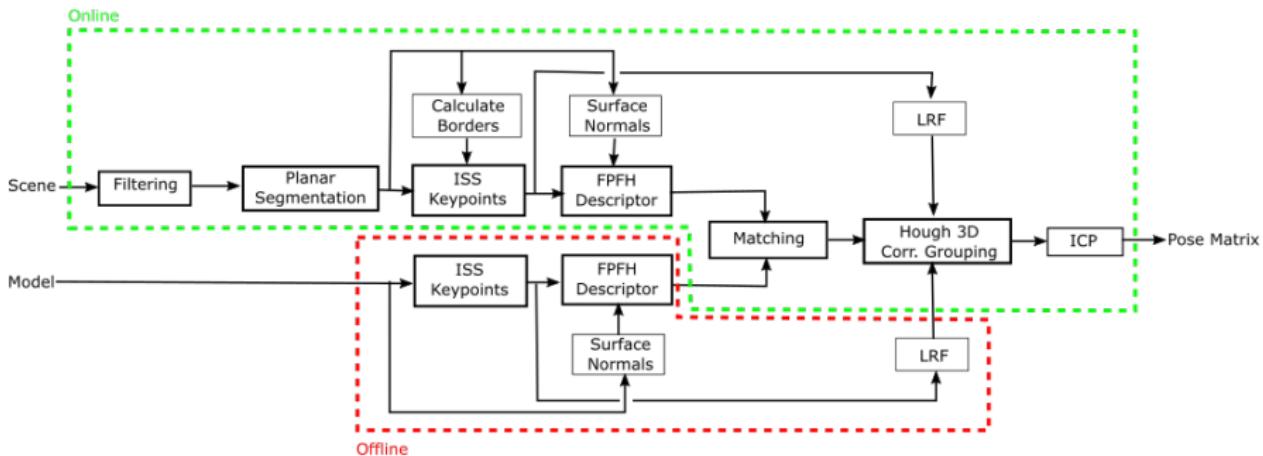
Object Detection



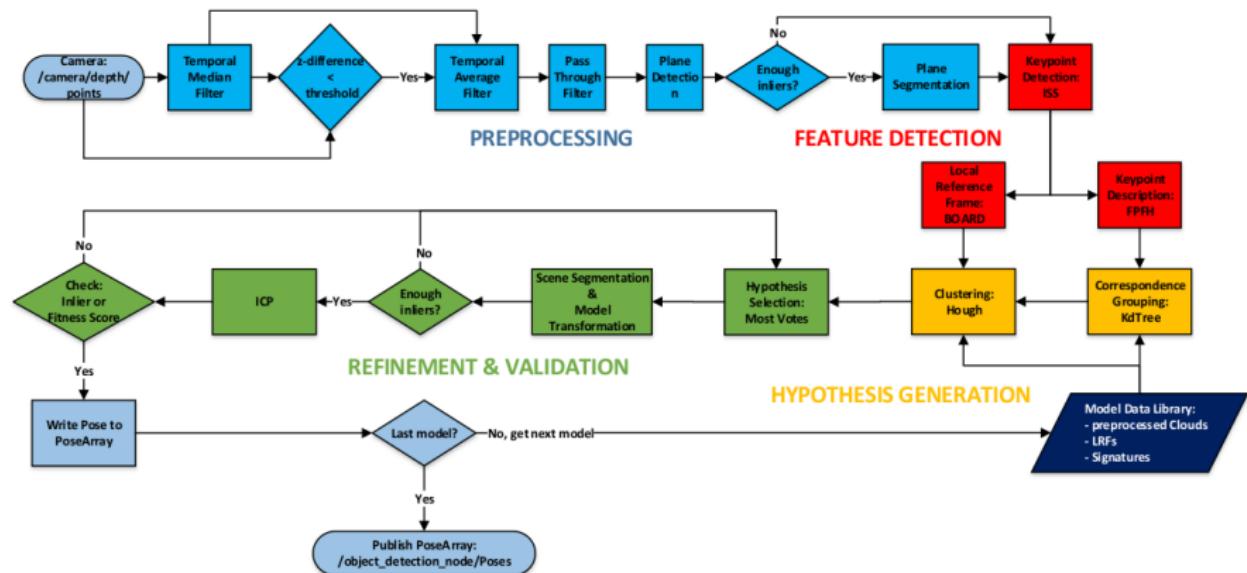
Object Detection



Object Detection Workflow Architecture



Object Detection Workflow Architecture



To Do

- Object detection
 - Tests with stones using the RealSense F200
 - Embedding the detection algorithm in the manipulation task
- Manipulation
 - Simple manipulation algorithm for NCCR dfab demonstrator
 - CoG aligned grasping
 - Feedforward placement with contact detection
 - Incorporate grasping and placement strategies
 - Grasping using known model characteristics
(e.g. normals)
 - Placement with (force/torque and visual) feedback
 - Scanning simple formations and rebuilding autonomously