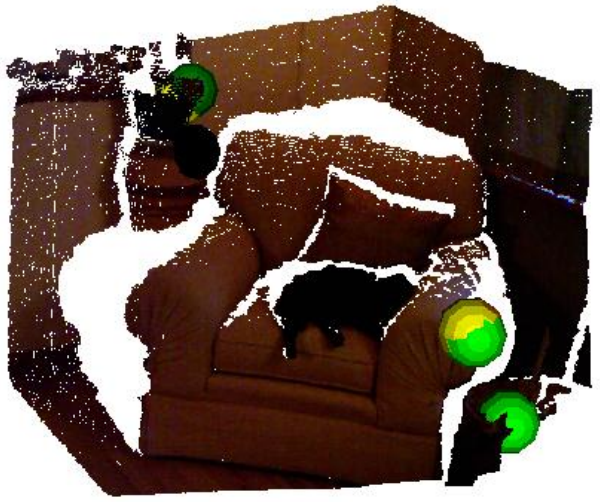


3D Reconstruction

Erika Harrison – April 11, 2013

CPSC601.58 – Winter 2013

Outline

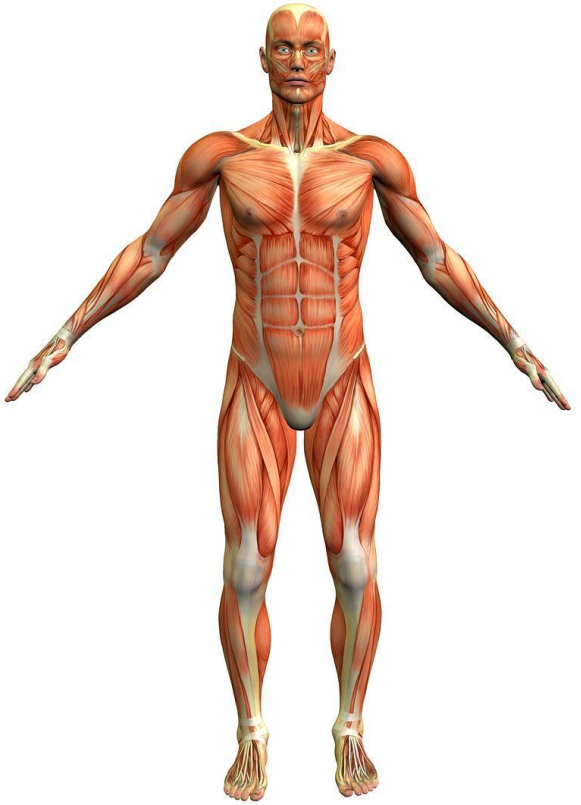
- Background / Motivation
- Objectives:
  - Point Cloud Extraction
  - Surface Tracking
  - Mesh Stitching
- Challenges To Be Resolved
- Future Work and Conclusion

Motivation

London, UK

Motivation

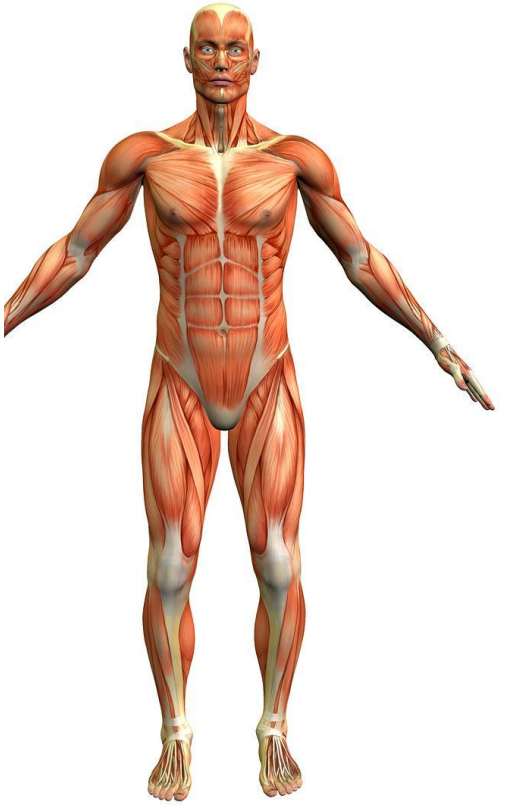
London, UK



Srialls Blogspot

Motivation

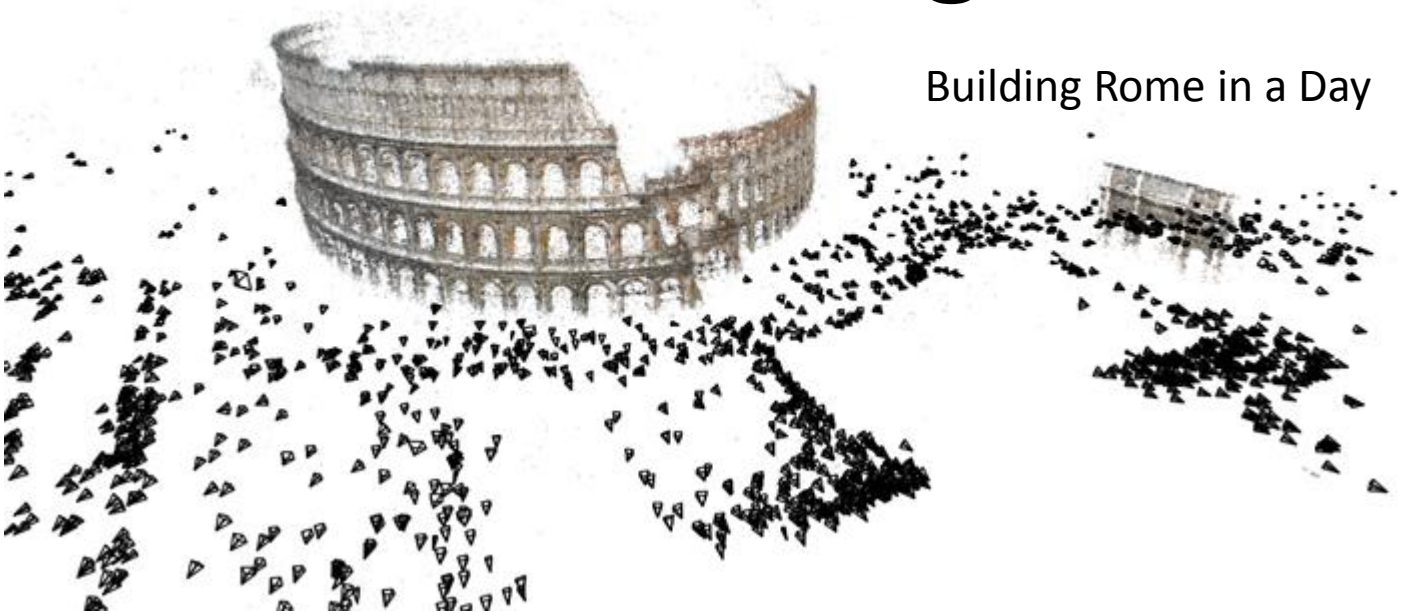
London, UK



Srialls Blogspot

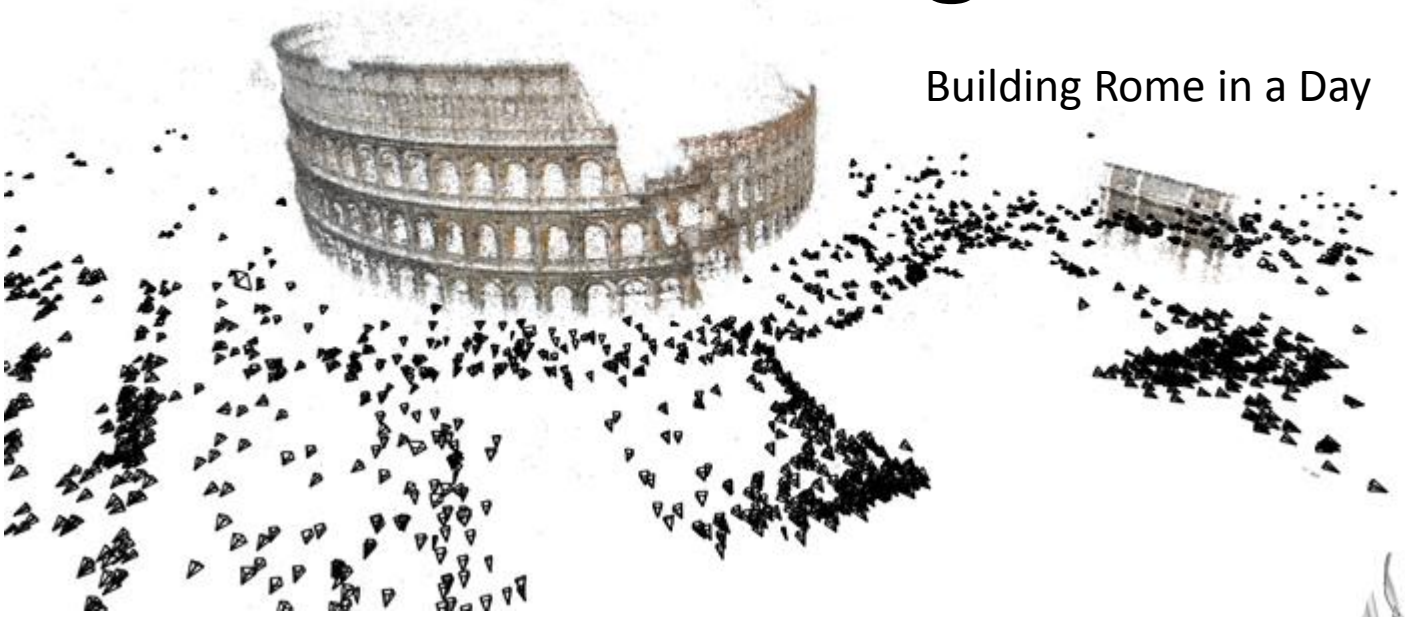
Background

Building Rome in a Day

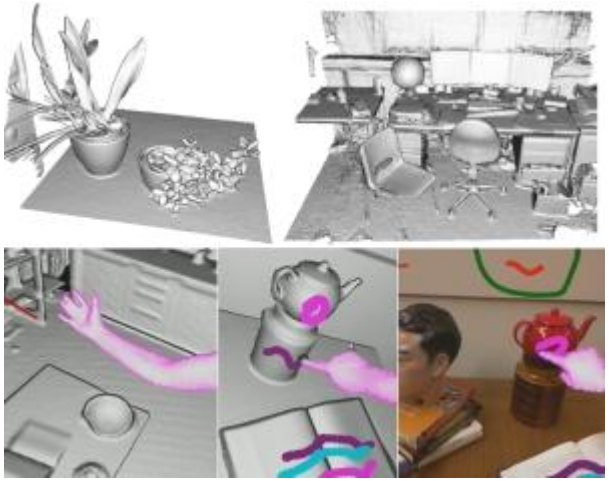


Background

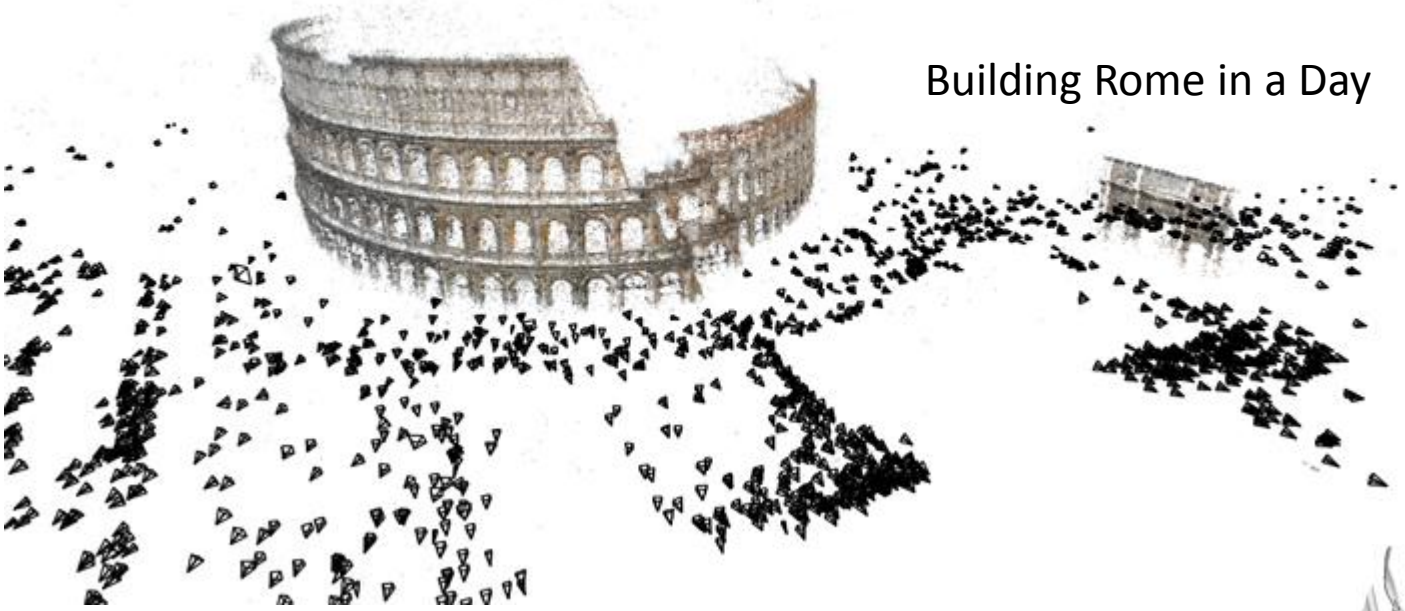
Building Rome in a Day



Kinect Fusion

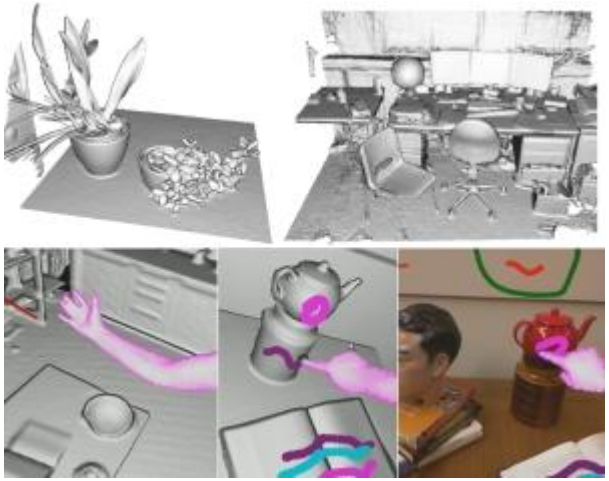


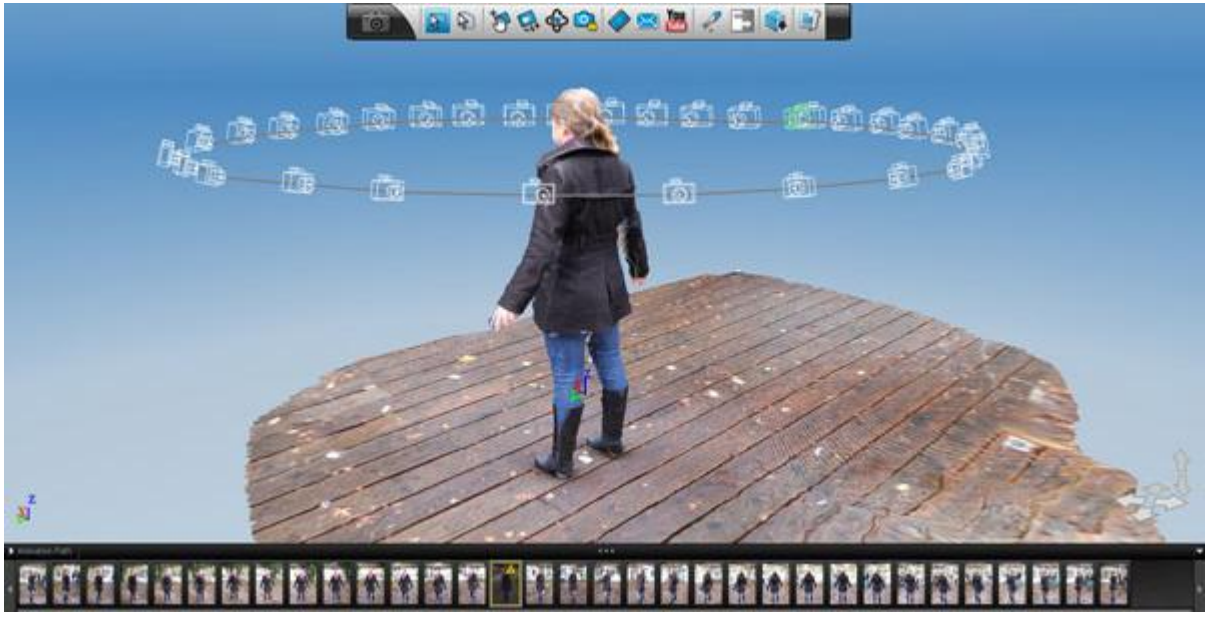
Background



Building Rome in a Day

Kinect Fusion





123D Catch

Objectives: Overview

- Grab Point Clouds
- Align Clouds
- Meshify!

Objectives: Point Cloud Extraction

KINECT™
for XBOX 360.

Objectives: Point Cloud Extraction

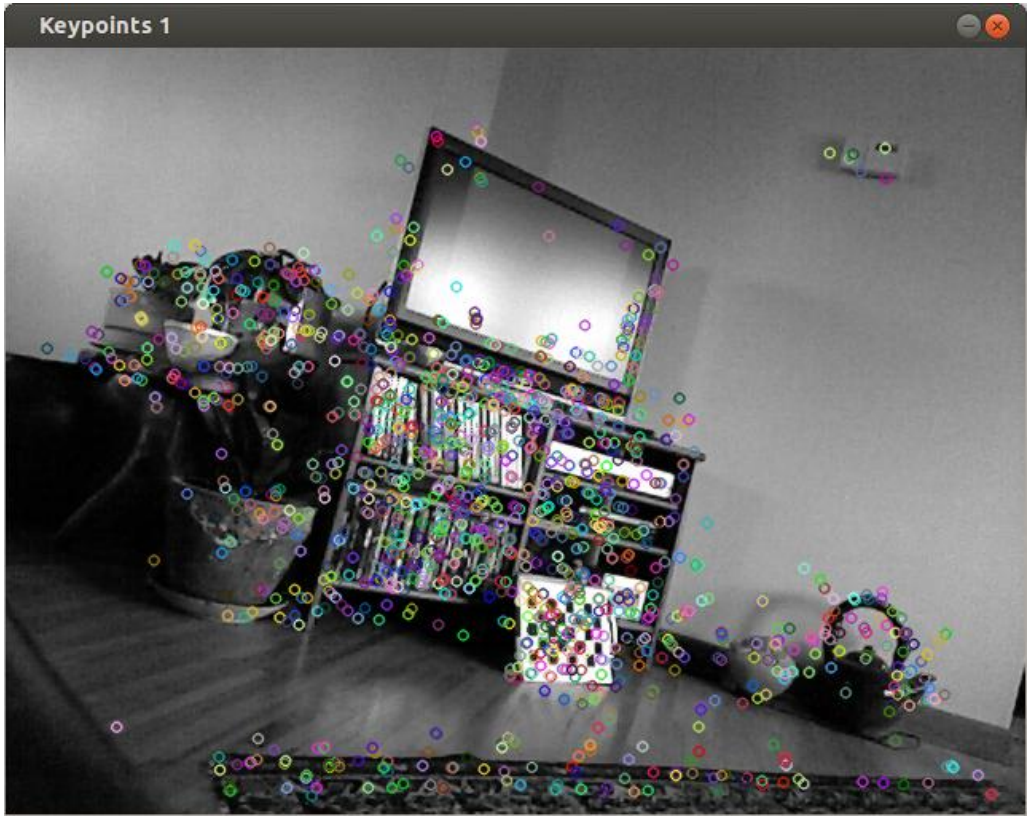
Objectives: Point Cloud Extraction

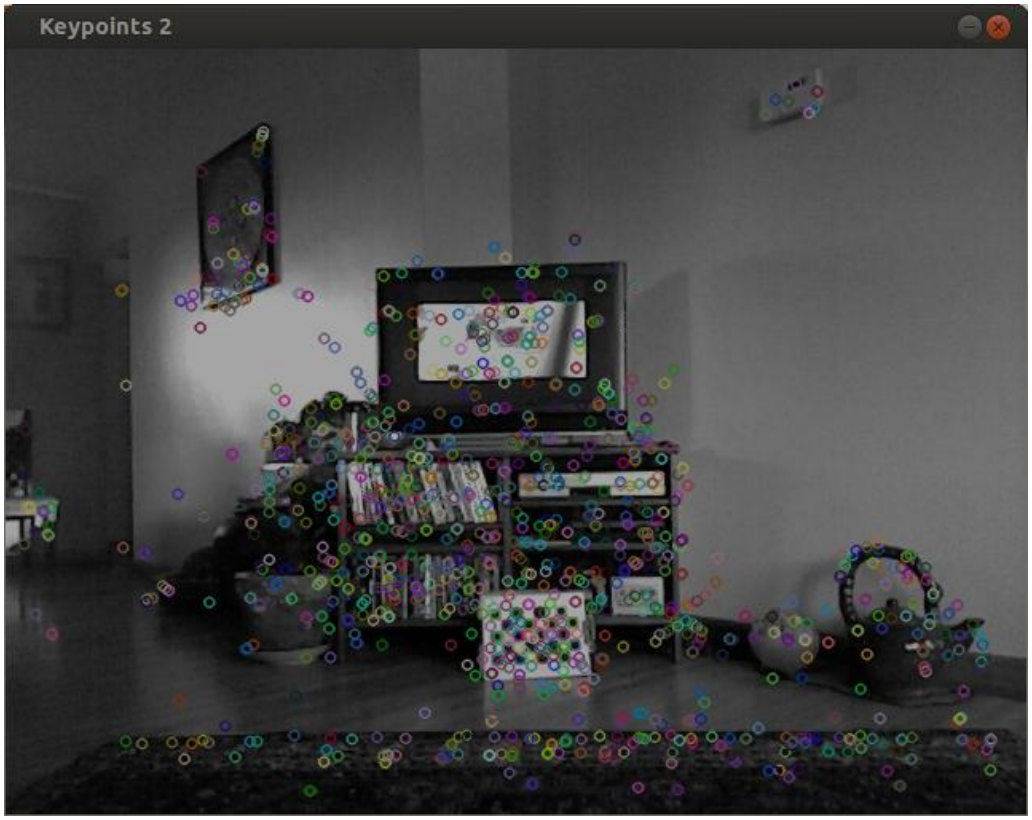
- ‘Simply’ merge them together (registration)
- Existing approaches:
  - Iterative Closest Point (ICP)
  - Normal Distributions Transform

Objectives: Point Cloud Extraction

- ‘Simply’ merge them together (registration)
- Existing approaches:
  - Iterative Closest Point (ICP): pre-alignment
  - Normal Distributions Transform: alignment issues

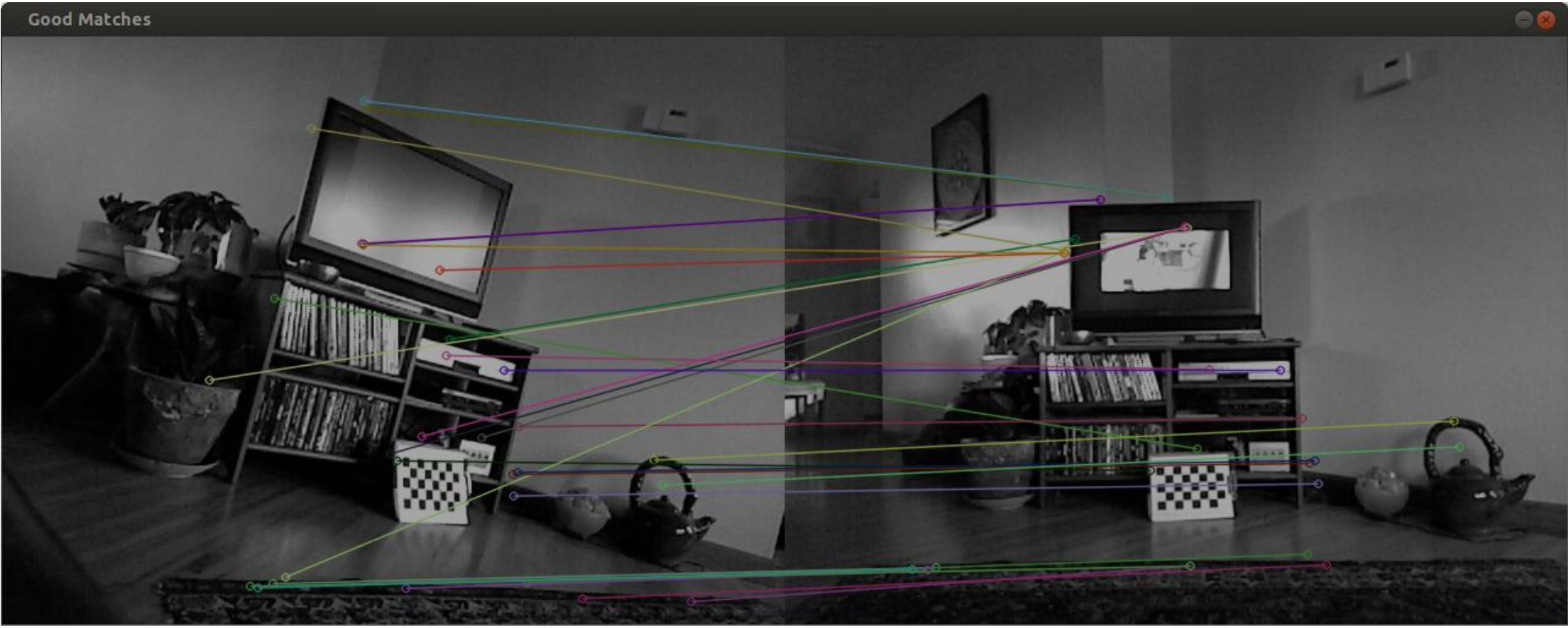
Objectives: Surface Tracking





SURF Keypoints

Objectives: Surface Tracking

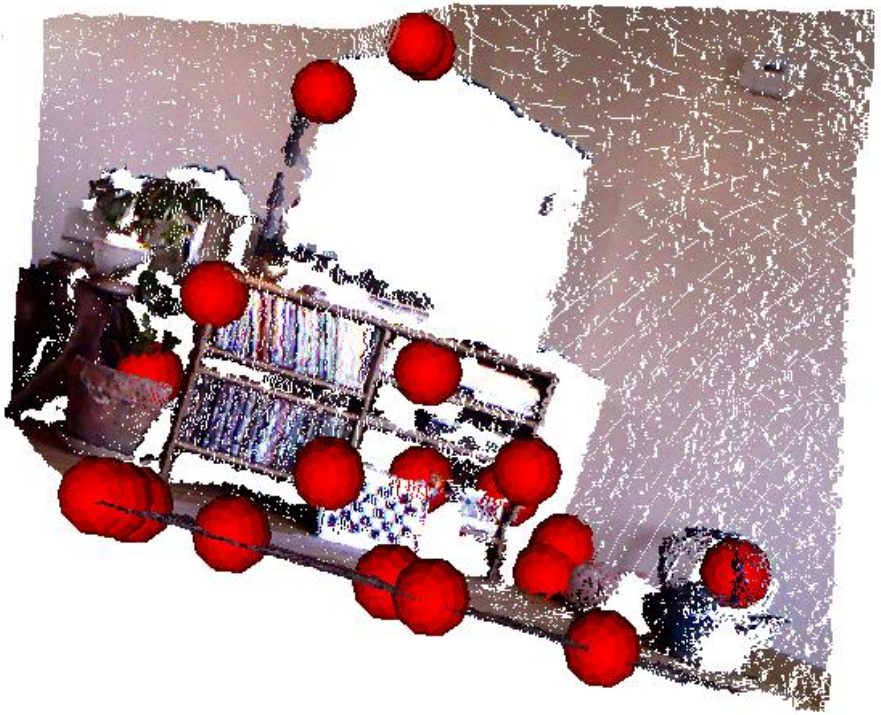


SURF Matching

Objectives: Surface Tracking

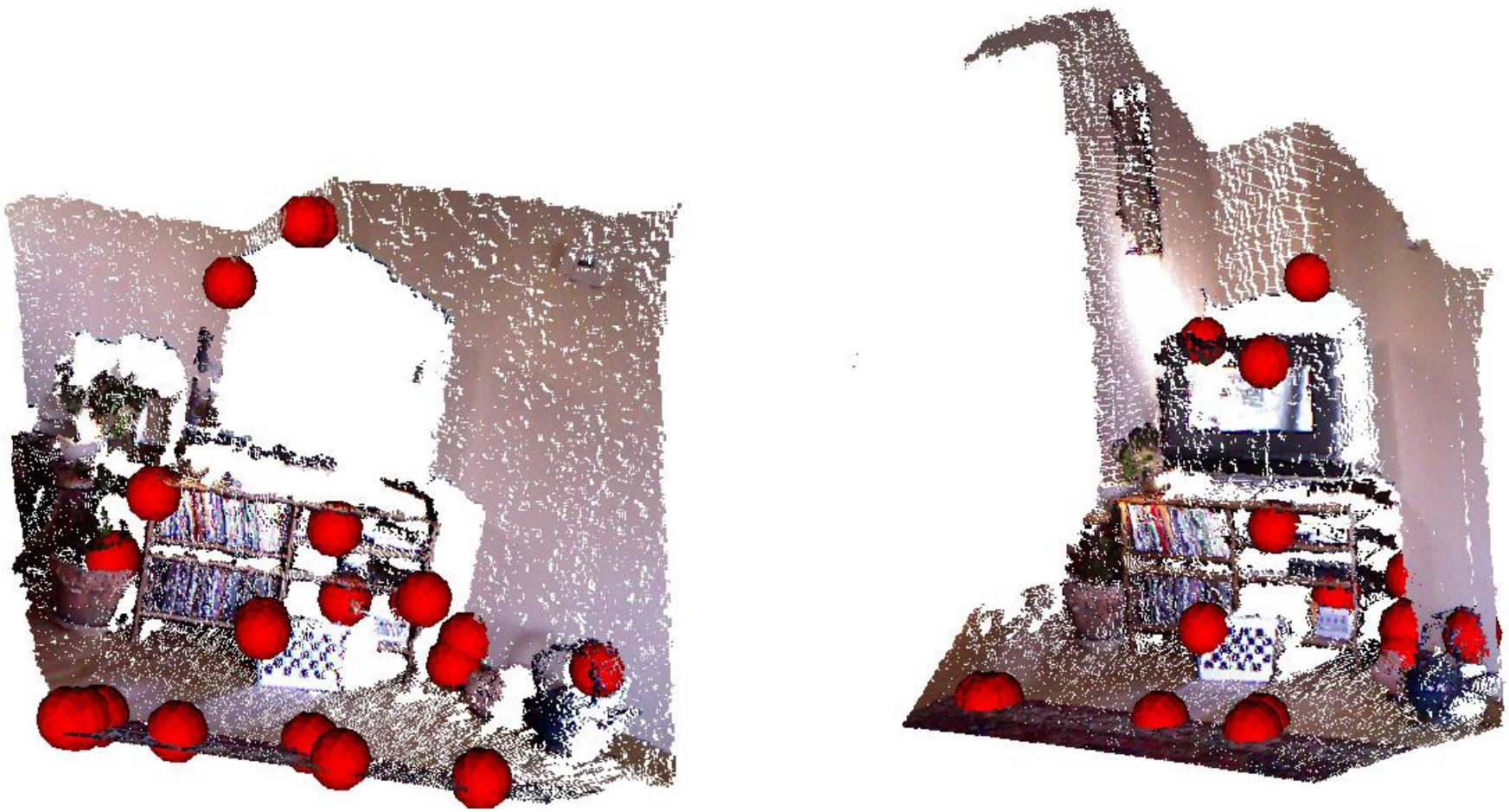
PCL Kinect Organized Point Cloud
→ 3D Coordinate Extraction

Objectives: Surface Tracking



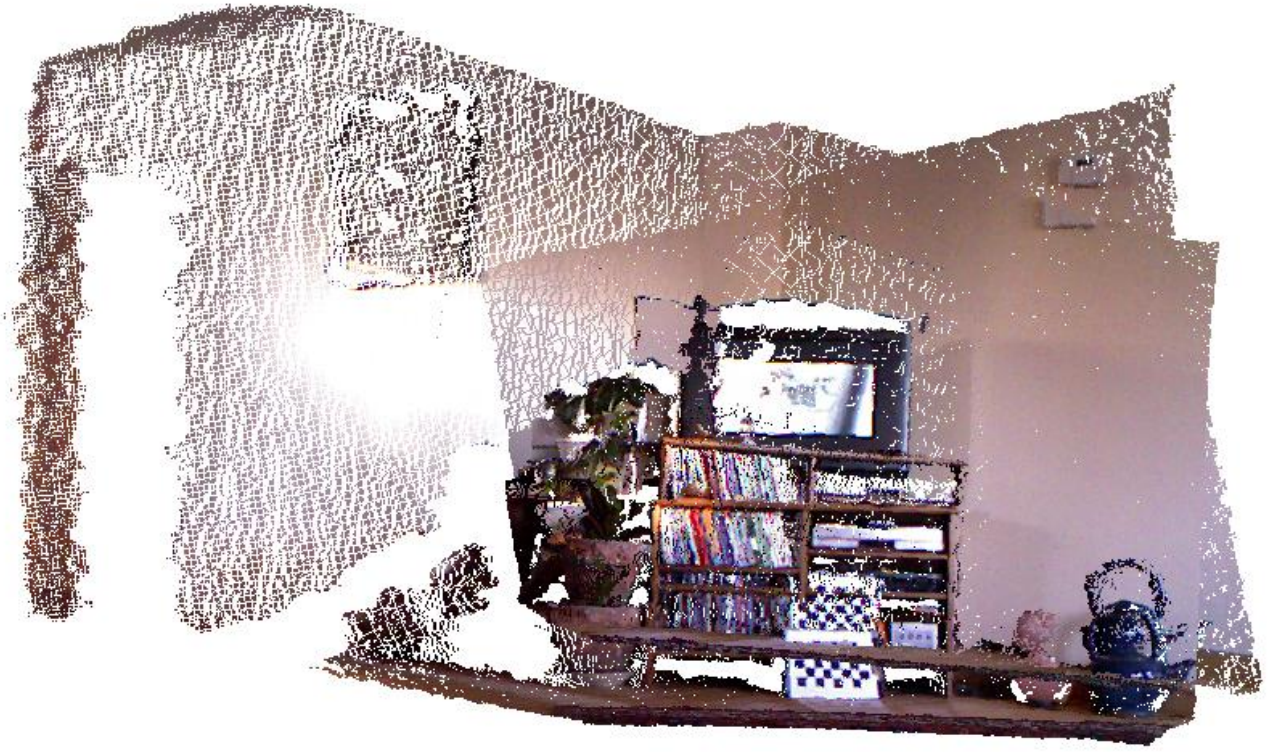
SURF Matching

Objectives: Surface Tracking



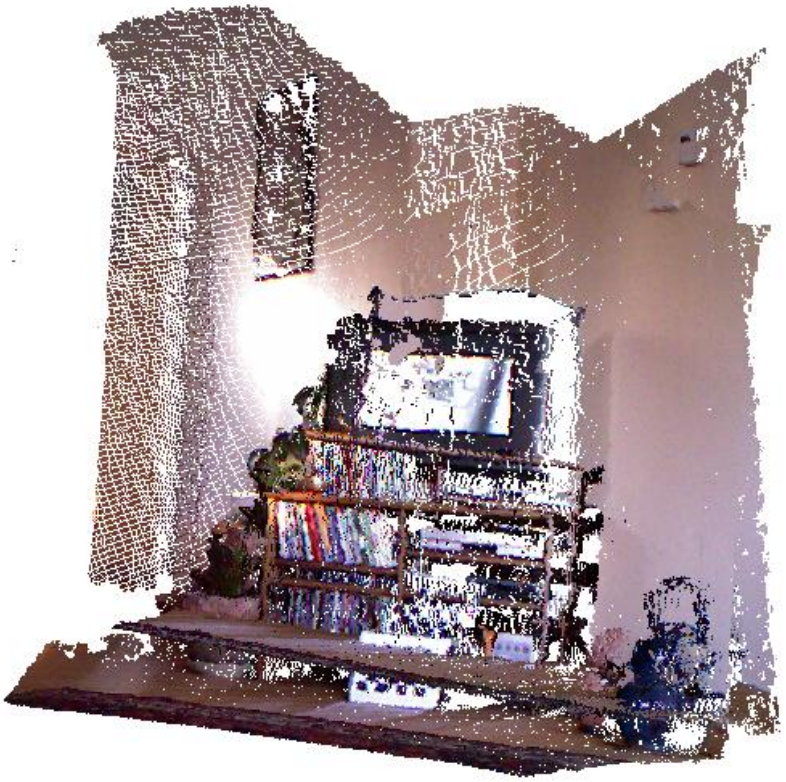
SURF Matching

Objectives: Mesh Stitching



SURF Matching

Objectives: Mesh Stitching



SURF Matching

Objectives: Mesh Stitching

SURF Matching + Normal Distribution Transform

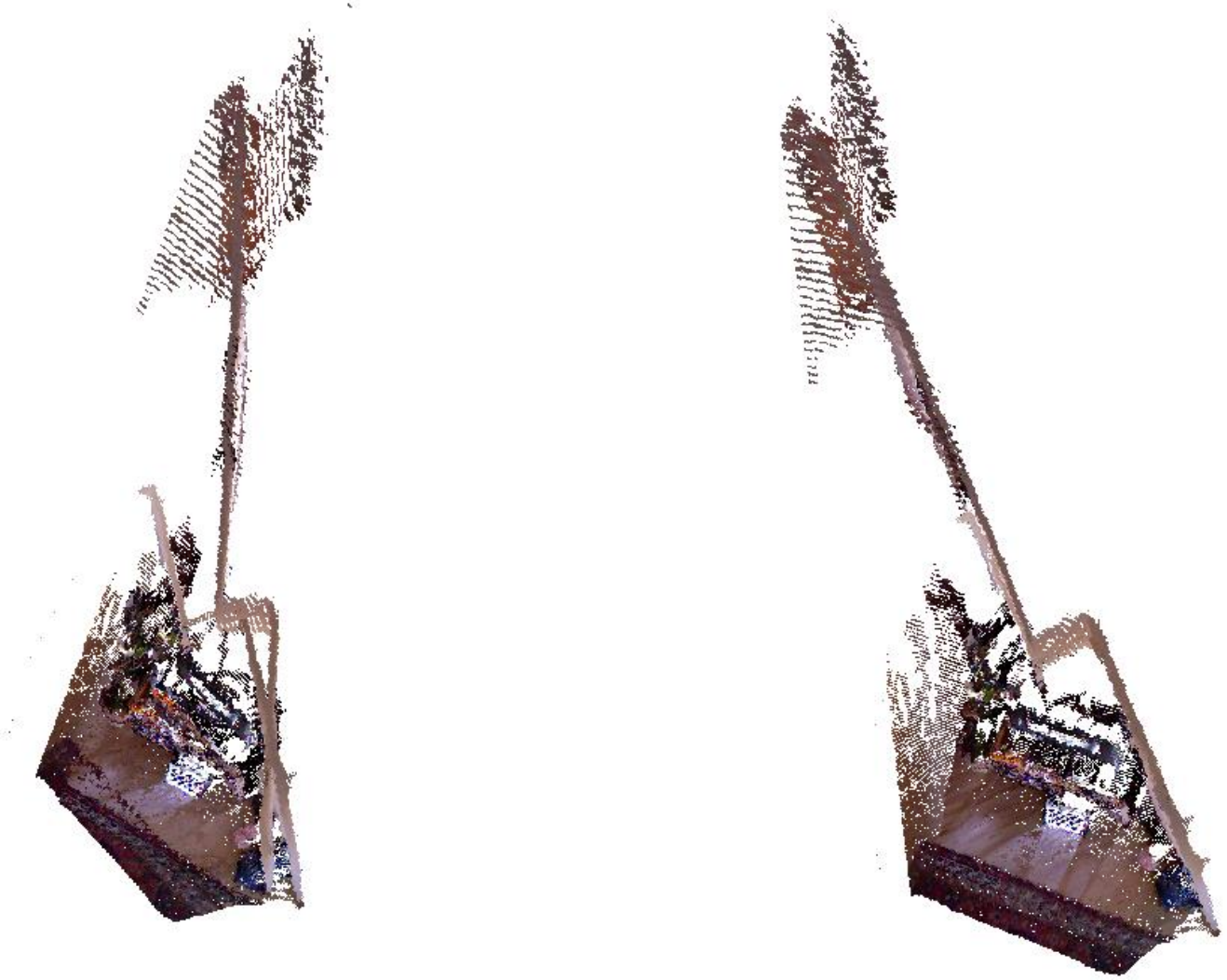
Objectives: Mesh Stitching

SURF Matching + Normal Distribution Transform

Objectives: Mesh Stitching

NDT Only

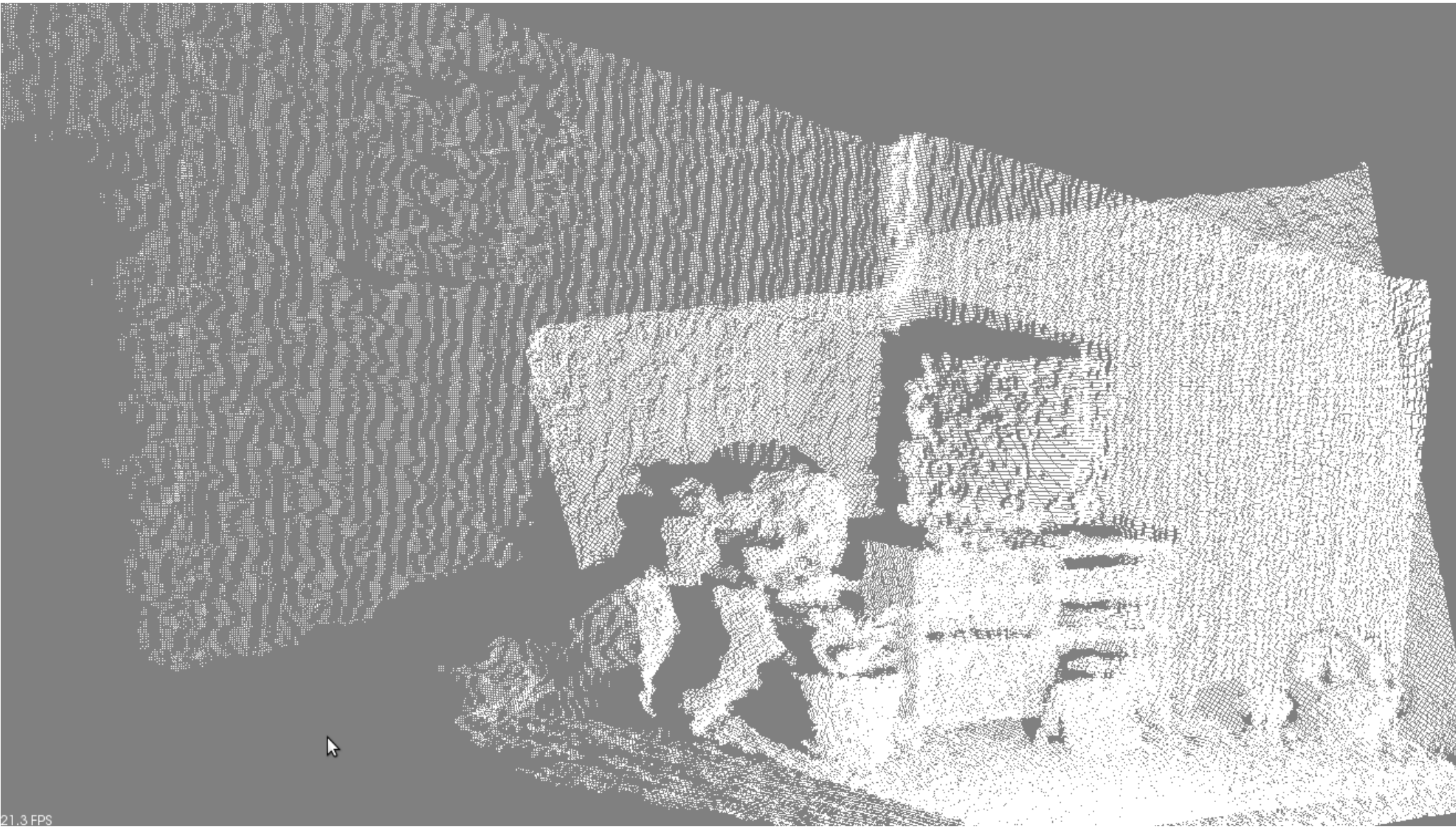
Objectives: Mesh Stitching



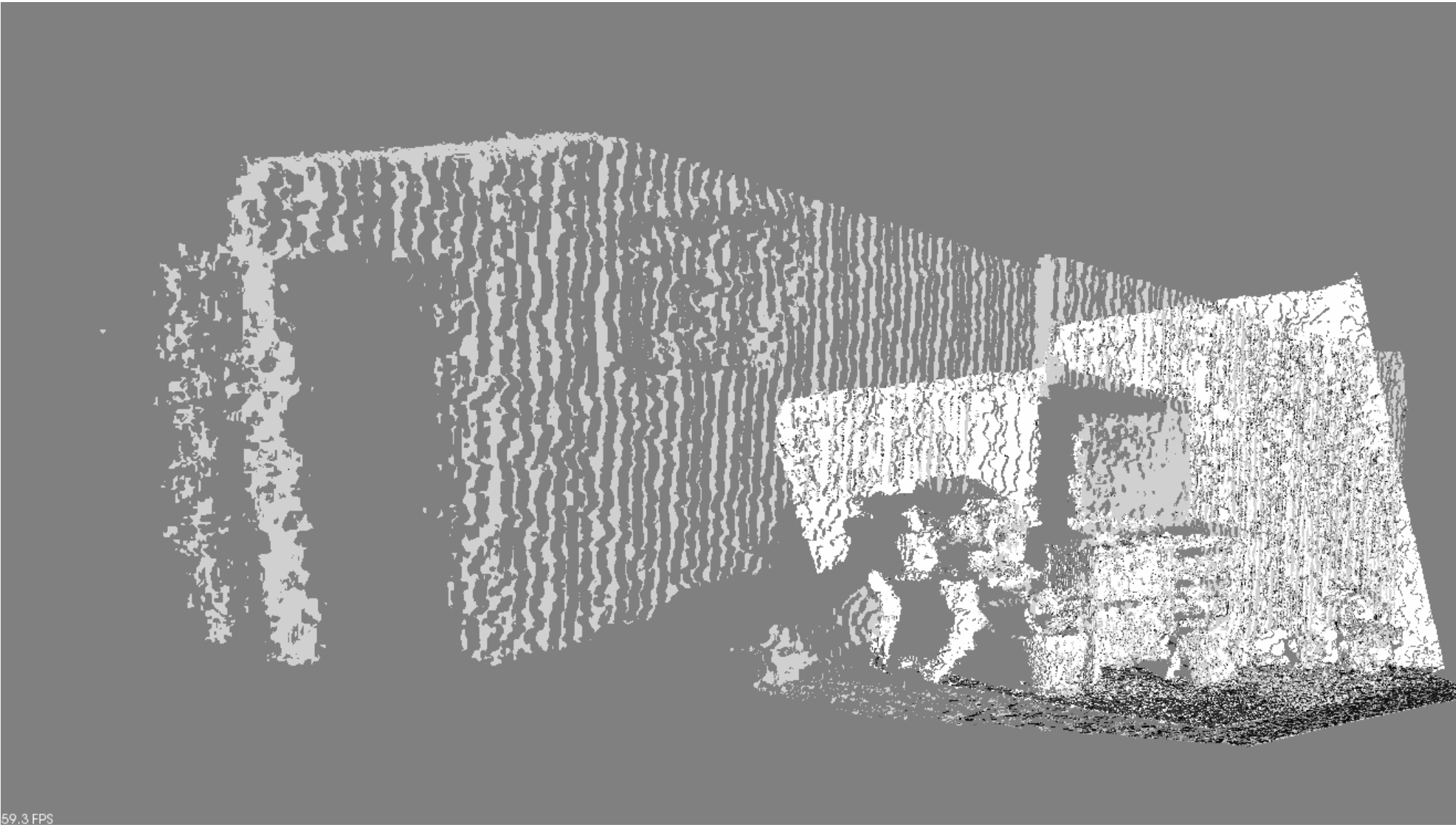
NDT Only

SURF + NDT

Objectives: Mesh Stitching

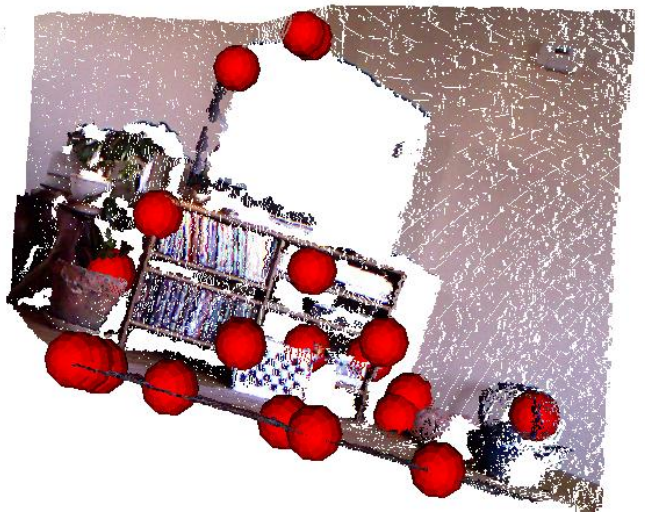


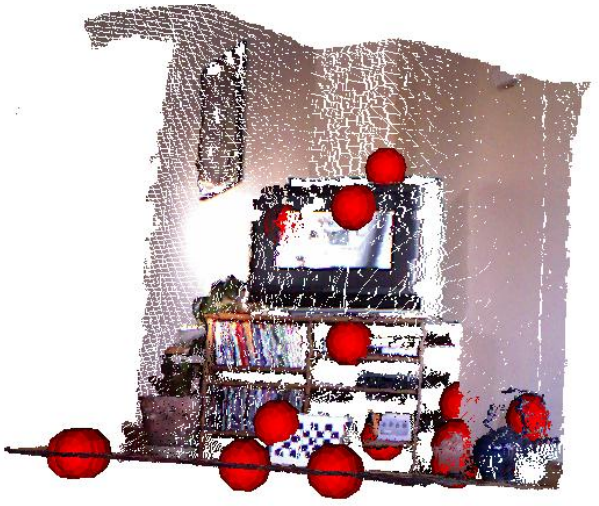
Objectives: Mesh Stitching



Challenges to be Resolved

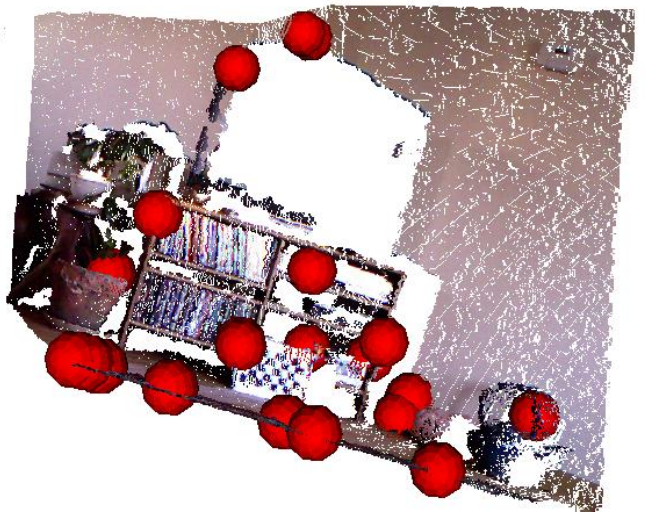
- Currently: Cloud Limitation
- Resolution (ala panorama stitching):

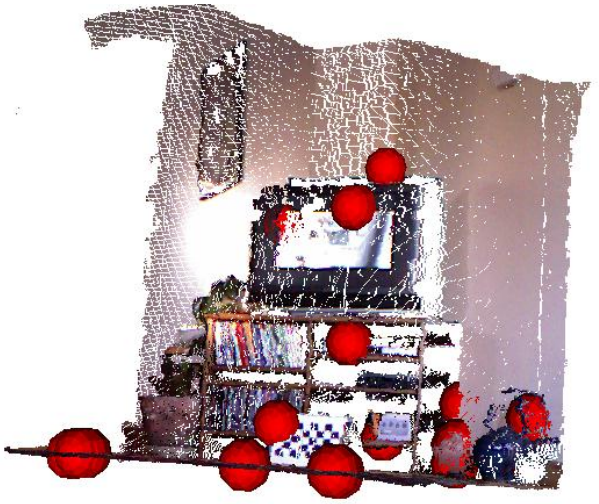




Challenges to be Resolved

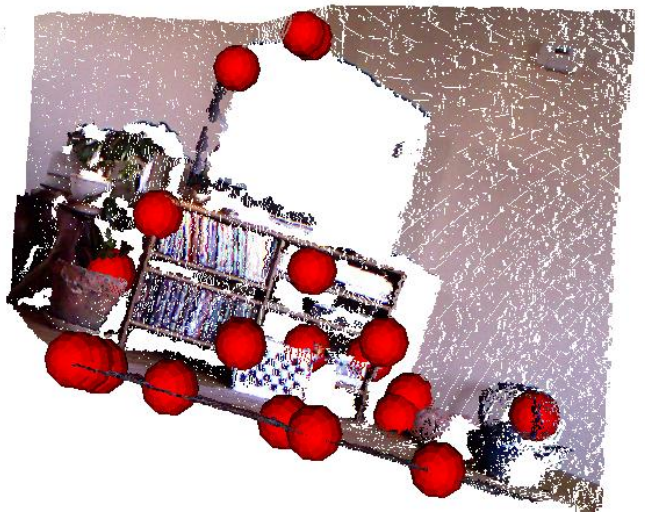
- Currently: Cloud Limitation
- Resolution (ala panorama stitching):
  - Capture Class: 3D Keypoints, Descriptors, Target Transformation

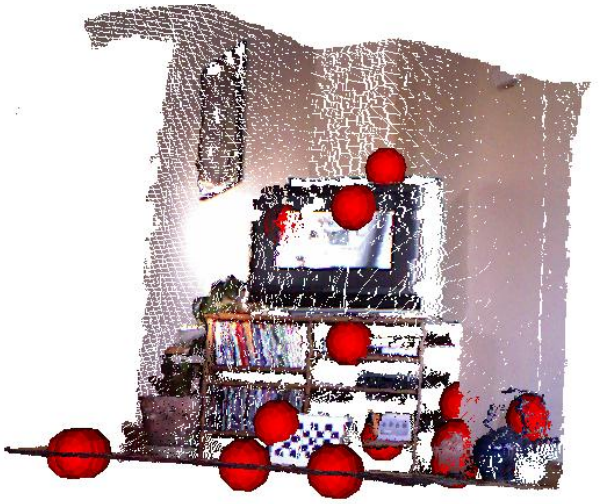




Challenges to be Resolved

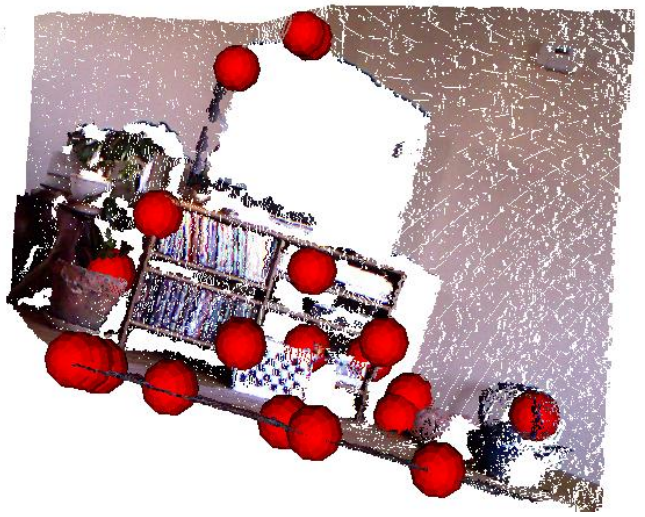
- Currently: Cloud Limitation
- Resolution (ala panorama stitching):
  - Capture Class: 3D Keypoints, Descriptors, Target Transformation
  - Brute Force: Scan for ‘best match’

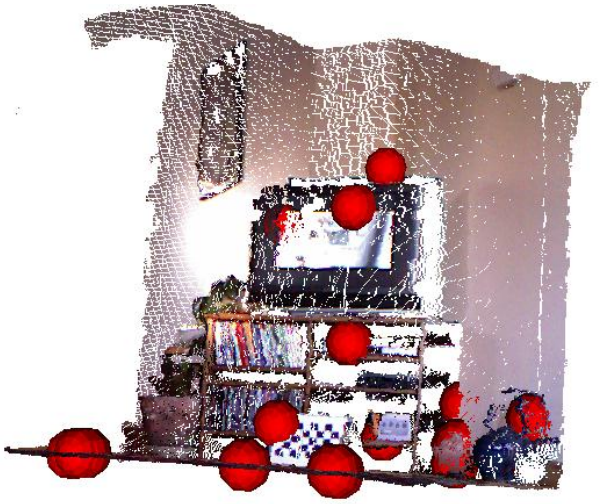




Challenges to be Resolved

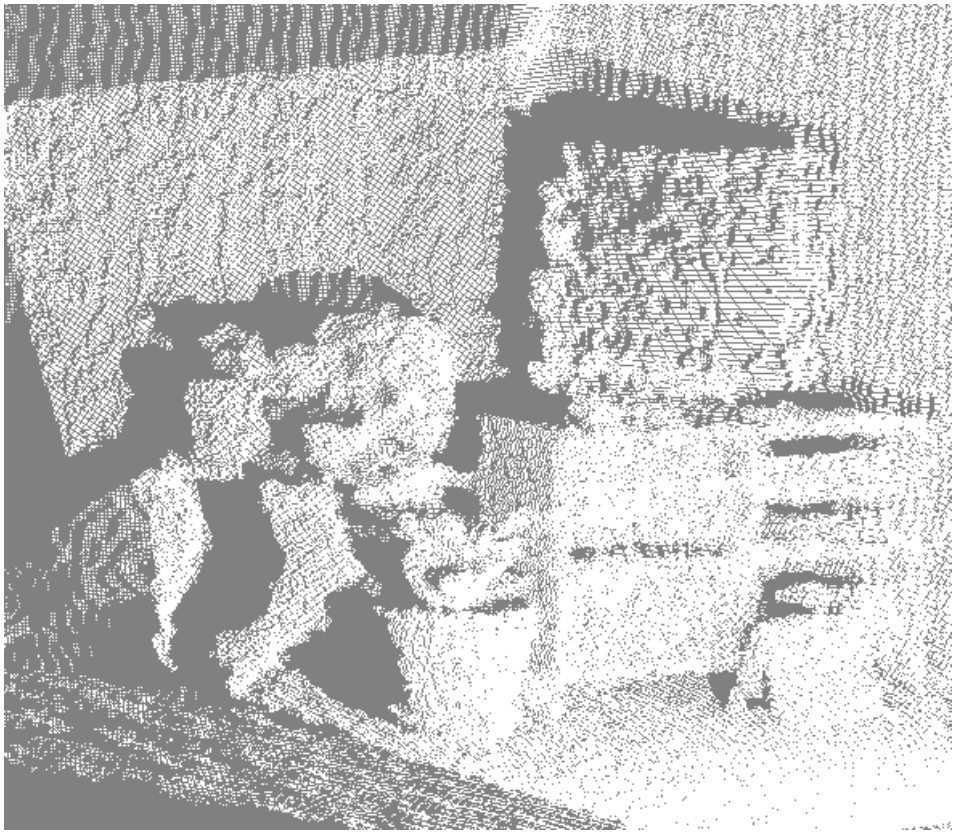
- Currently: Cloud Limitation
- Resolution (ala panorama stitching):
  - Capture Class: 3D Keypoints, Descriptors, Target Transformation
  - Brute Force: Scan for ‘best match’
  - Simplify: Remove redundant captures





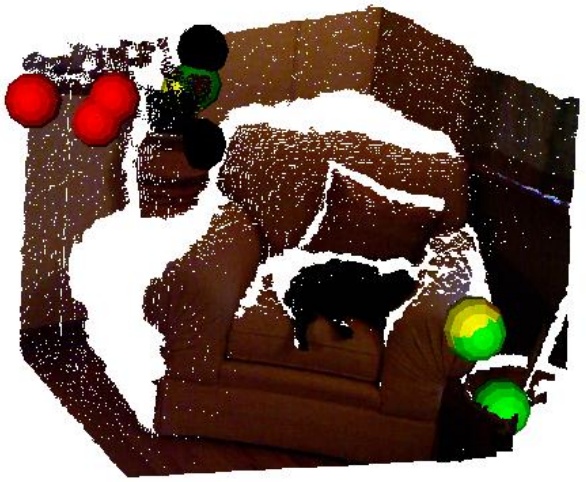
Future Work

- Mesh Smoothing + Colour



Future Work

- Mesh Smoothing + Colour
- Reduce Bad Matches



Future Work

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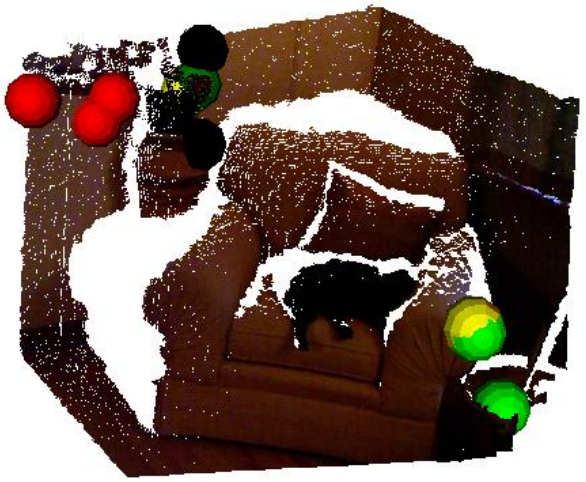
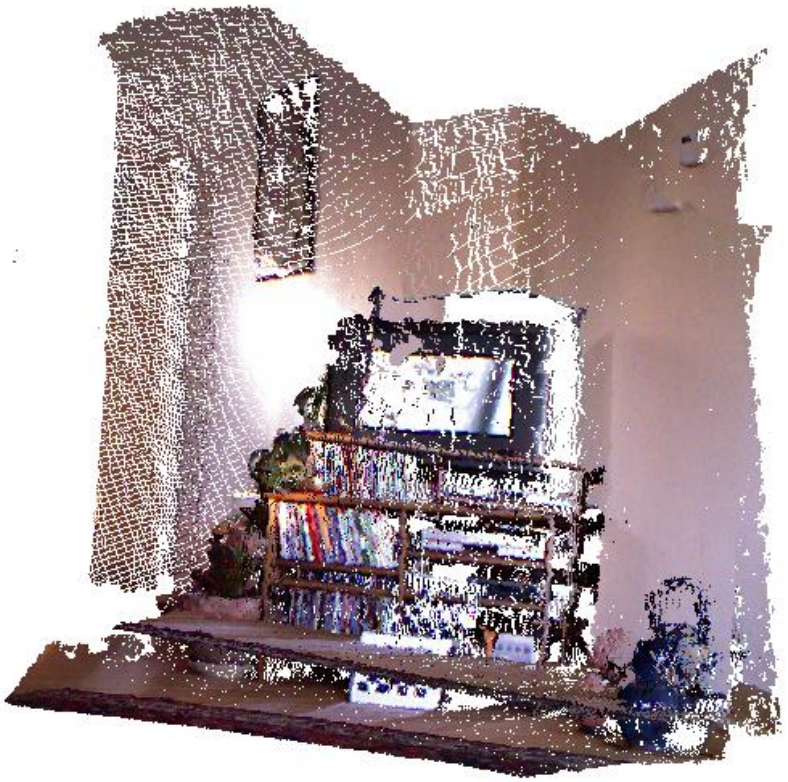


Future Work

- Mesh Smoothing + Colour
- Reduce Bad Matches
- Faster Alignment

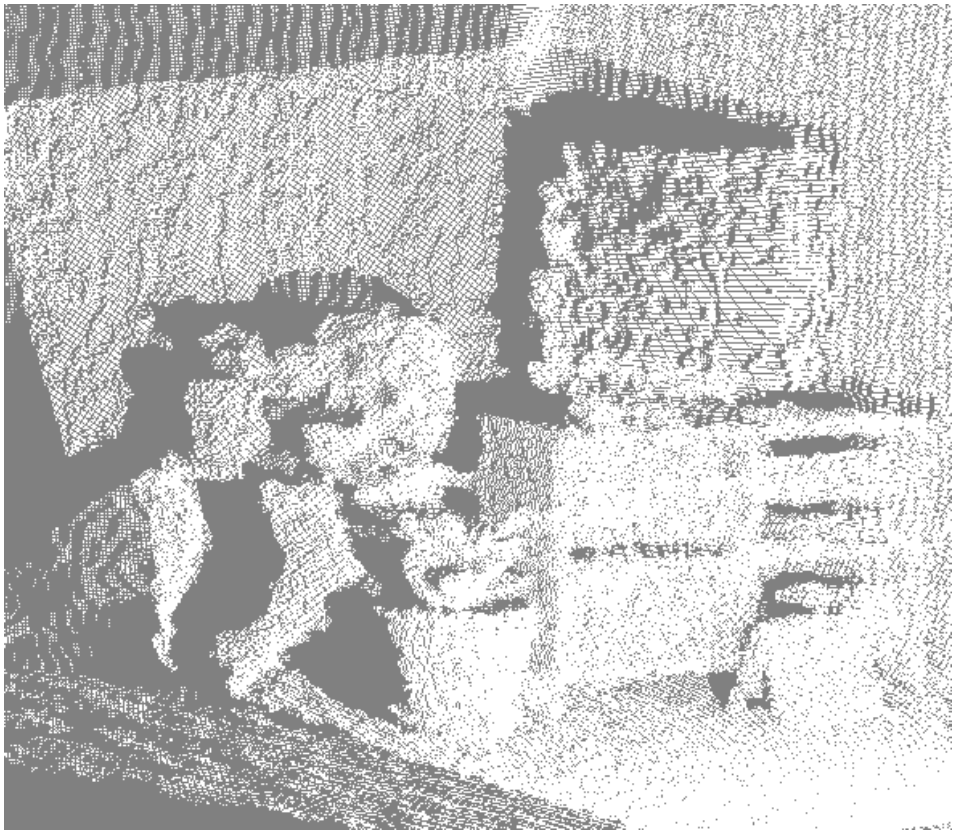
Future Work

- Mesh Smoothing + Colour
- Reduce Bad Matches
- Faster Alignment
- Stereo-Vision, Monocular-Vision Input



Conclusion

- No One Solution
  - Combination of Efforts
- Find a Successful Collation
- Still Much to Do for Ubiquity



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Questions?