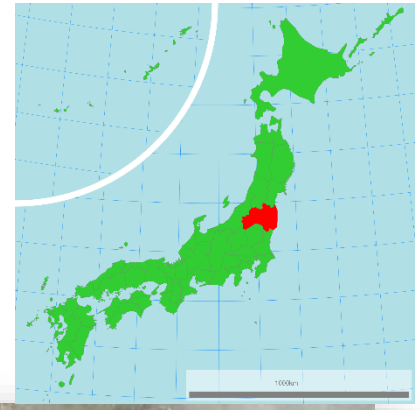
How can Robots Help Building Intelligent 3D Map?

Chia-Chen (Jennifer) Hsu

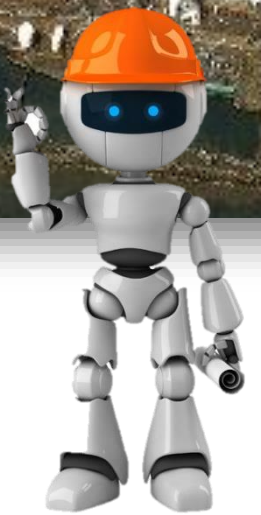
Advisor: Professor Qixing Huang

2011 Japan Earthquake

Fukushima



How to explore this area?

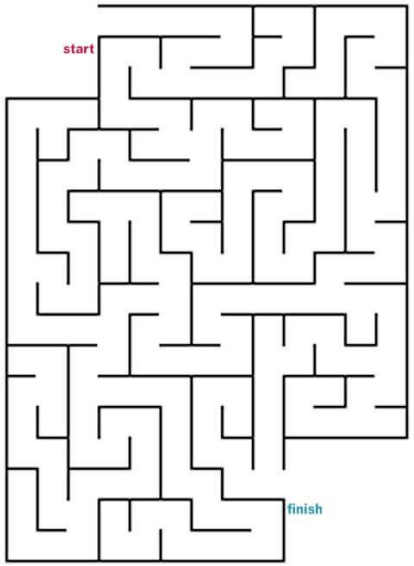


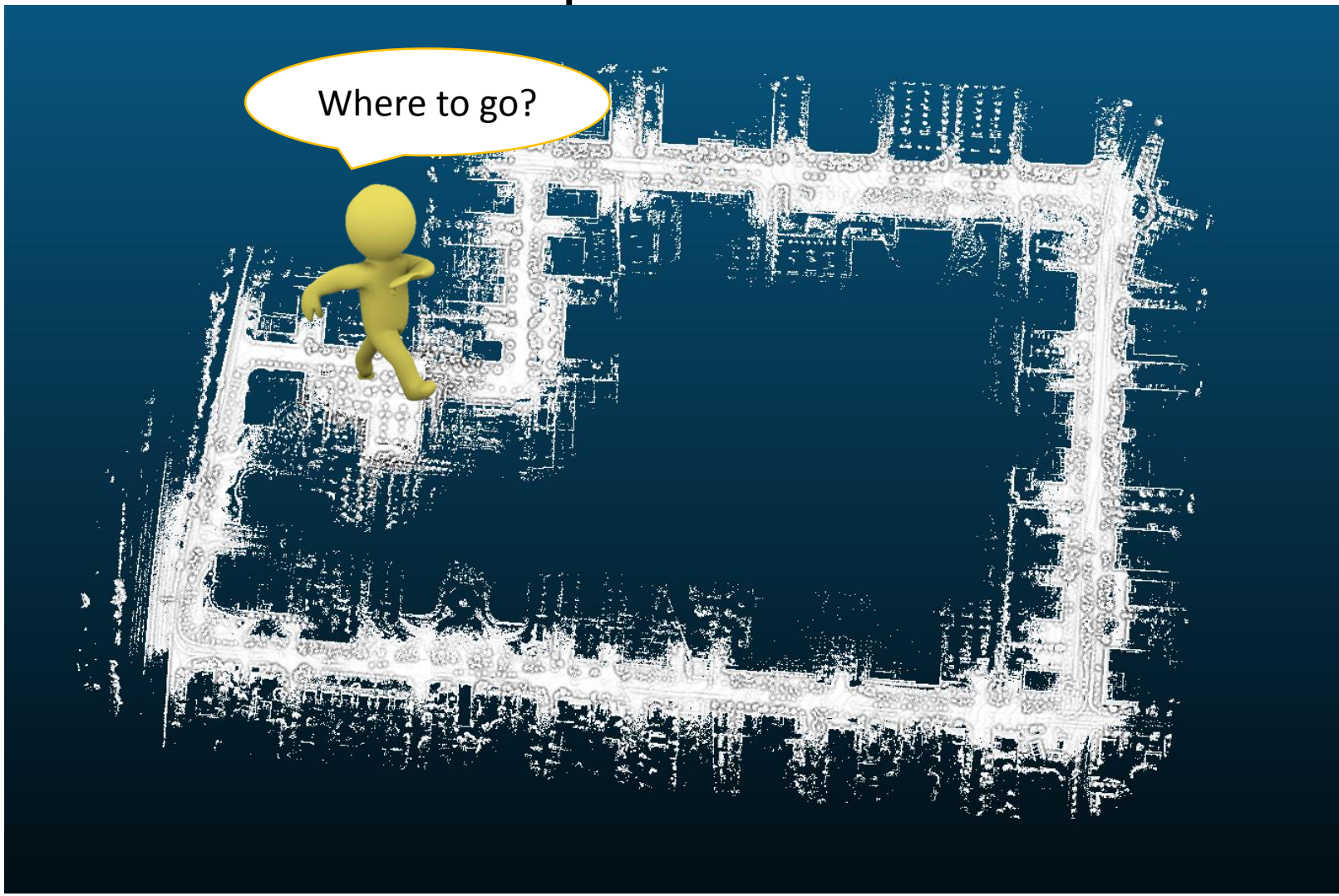
How to control robots to explore this area?

Expectation: get a 3D map which contains the 3d reconstruction in this area

How to build a detailed 3D map

Go Everywhere,
Do not miss any corner





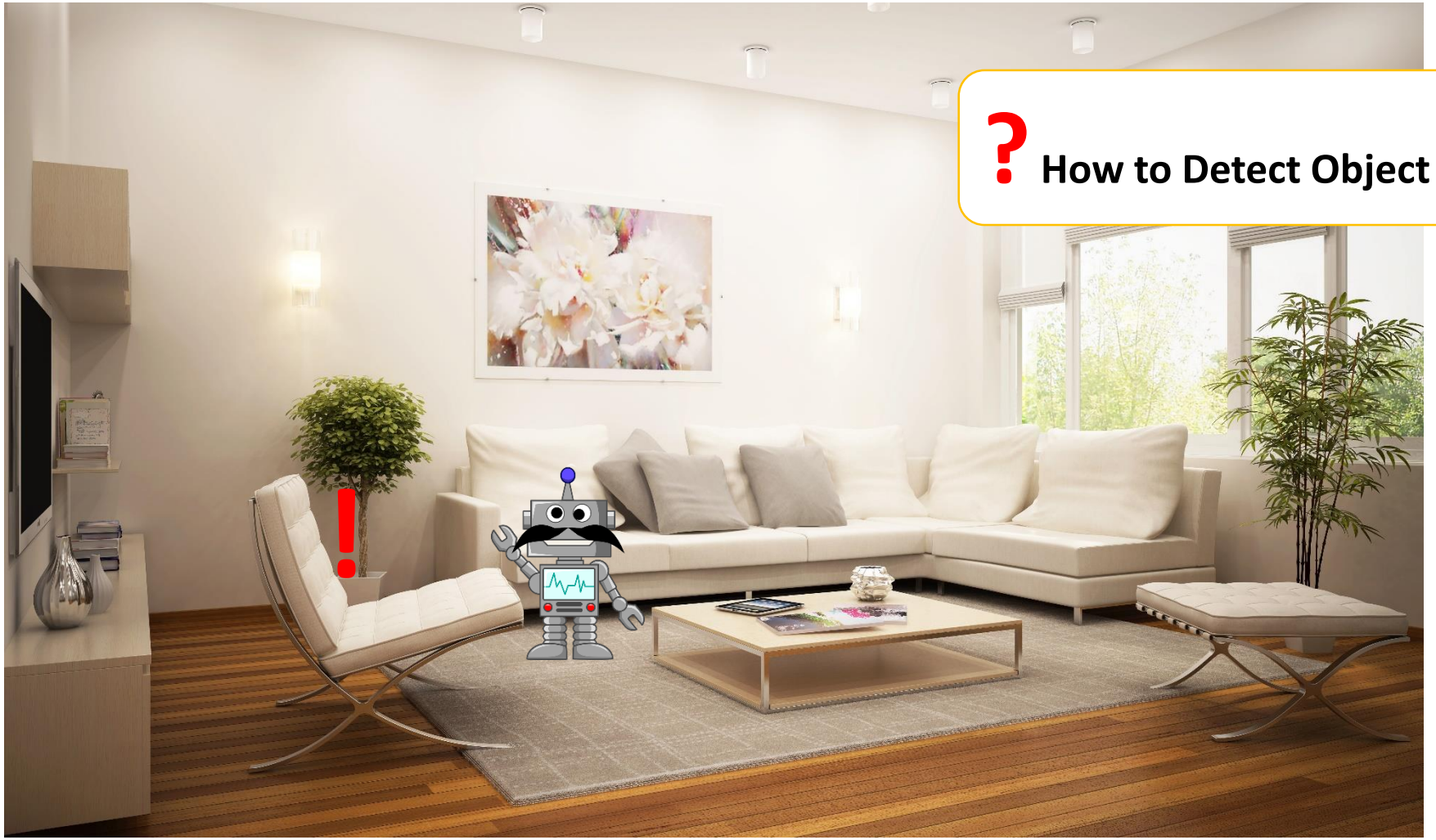
How to build a detailed 3D map

Go Everywhere,
Do not miss any corner

+

Reconstruct Objects
in Detail

Detect Object of Interest



Reconstruct Objects in Detail

3. High Level Attributes
Deformable, weight, …

2. Texture
wood, plastic, Glass, metal?

?

?

1. 3D Geometry Reconstruction

http://www.robots.ox.ac.uk/~vgg/research/texclass/

3D Geometry Reconstruction : Scanning in Detail

?

?

How to scan it in detail without losing any part?

How to do it automatically by robots?

High-Level Attributes

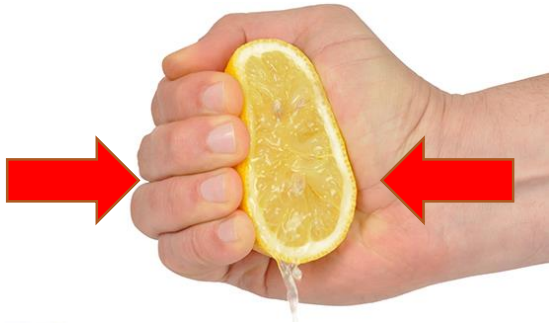
Weights

Newton's second law
F=ma

Push

Deformable

Squeeze!



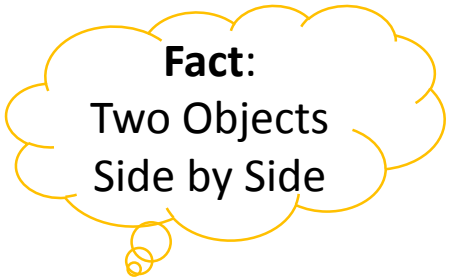
Press!

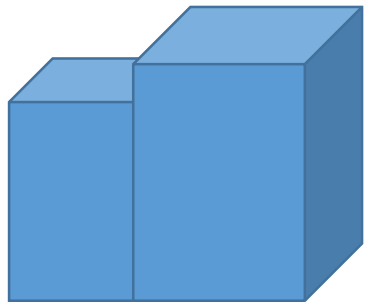
touch

Liquid?

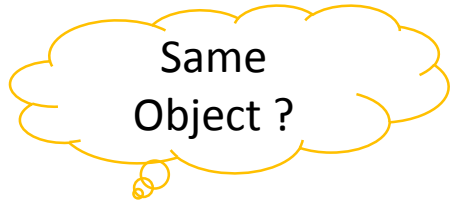
3D Geometry Reconstruction : Segmentation

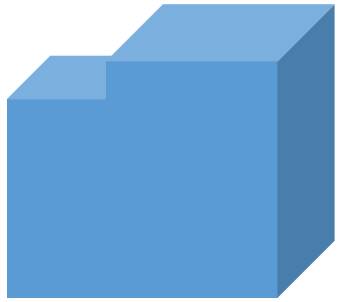
Push



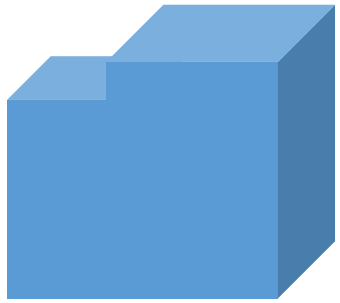


Real Word





Initial Reconstruction Result



Push it

Tasks	Mission
• **3d Reconstruction**	• Input : A series of RGBD scans • Output: Reconstructed 3d geometry • Process: Use/Implement exist reconstruction algorithm • (Challenge) Try to come up the best route to scan an object (circle? Up/down?) • (Challenge) Try different objects
• **Detect Object of Interests**	• Input: Series of Scanned Image • Output: Find Object of Interests by Classification Algorithms • Try several image-based object classification algorithms and test the accuracy.
• **High Level Attributes**, especially deformability	• Let Robot explores objects using different behaviors • Check "**deformability** " : Compare the image of the object before and after robot's behavior • (Challenge) Try to use other data collected from robot to understand deformability.