

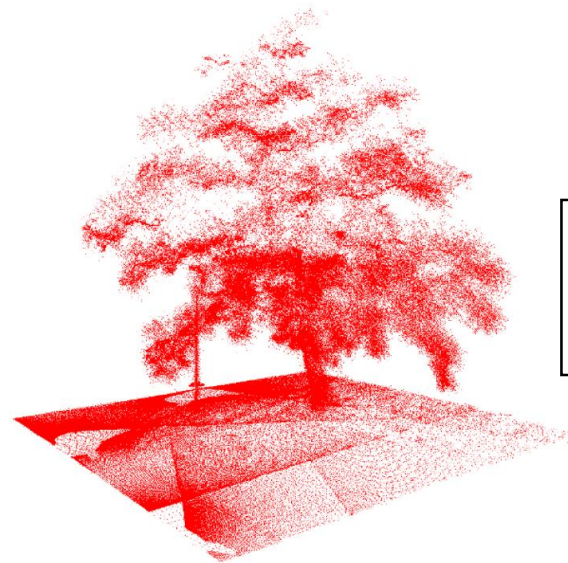
# Super Ray based Updates for Occupancy Maps

Youngsun Kwon, Donghyuk Kim, and Sung-eui Yoon  
KAIST, South Korea

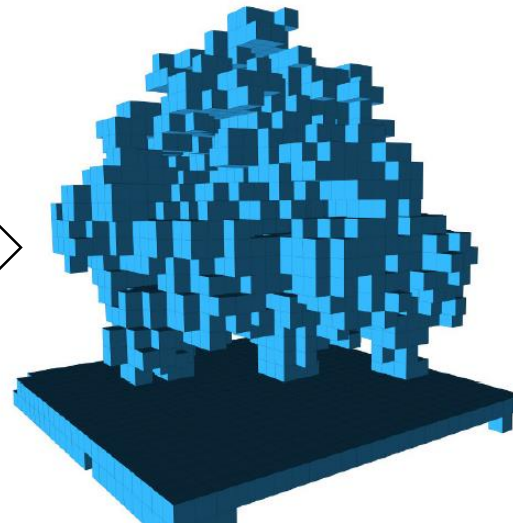
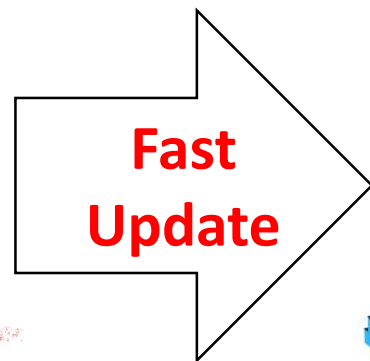


# Motivation

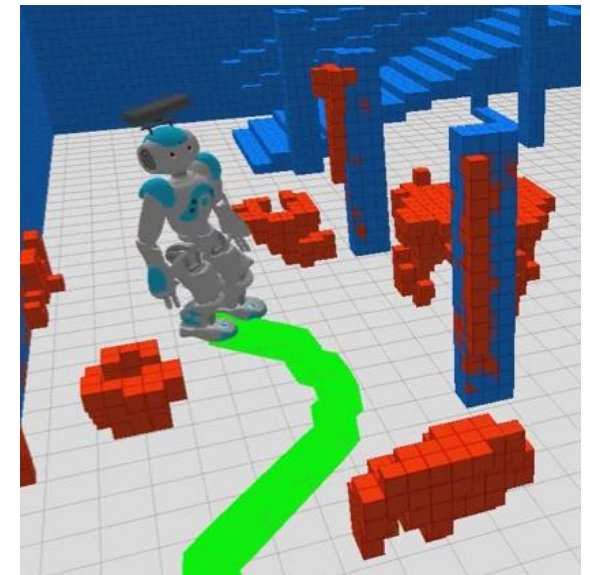
- It is essential to update map representation fast
  - A robot should react to dynamic environment in real time



Point clouds



Map representation  
( grids or octrees )

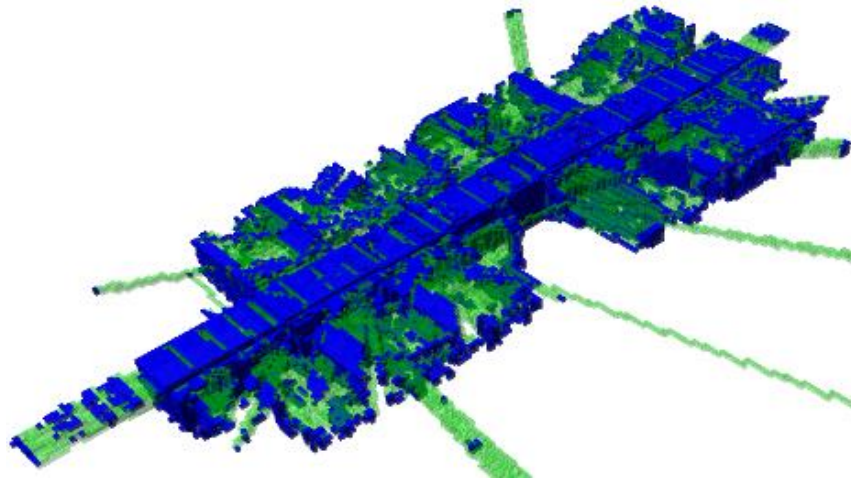


Applications:  
e.g. Motion Planning

# Research Goal

- Accelerate update speed of map representation without degrading representation accuracy

Prior work (3DDDA)

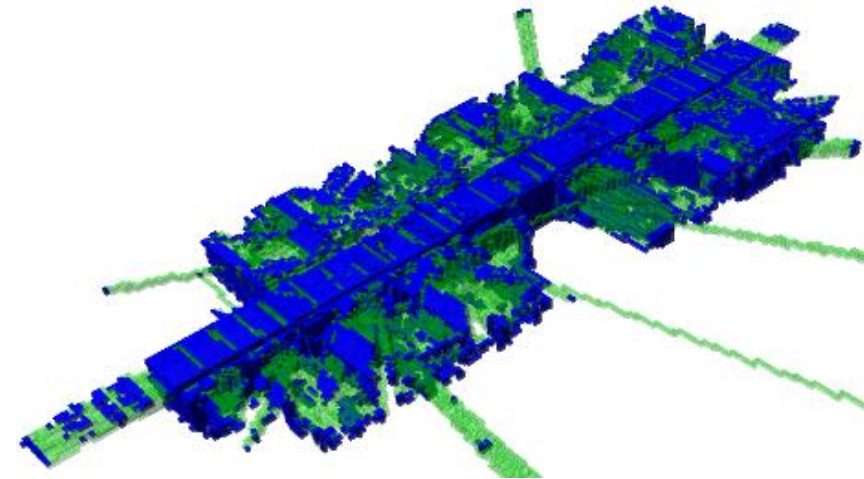


0.2m resolution

7.3 FPS

J. Amanatides et al., *Eurographics*, 1987

Ours

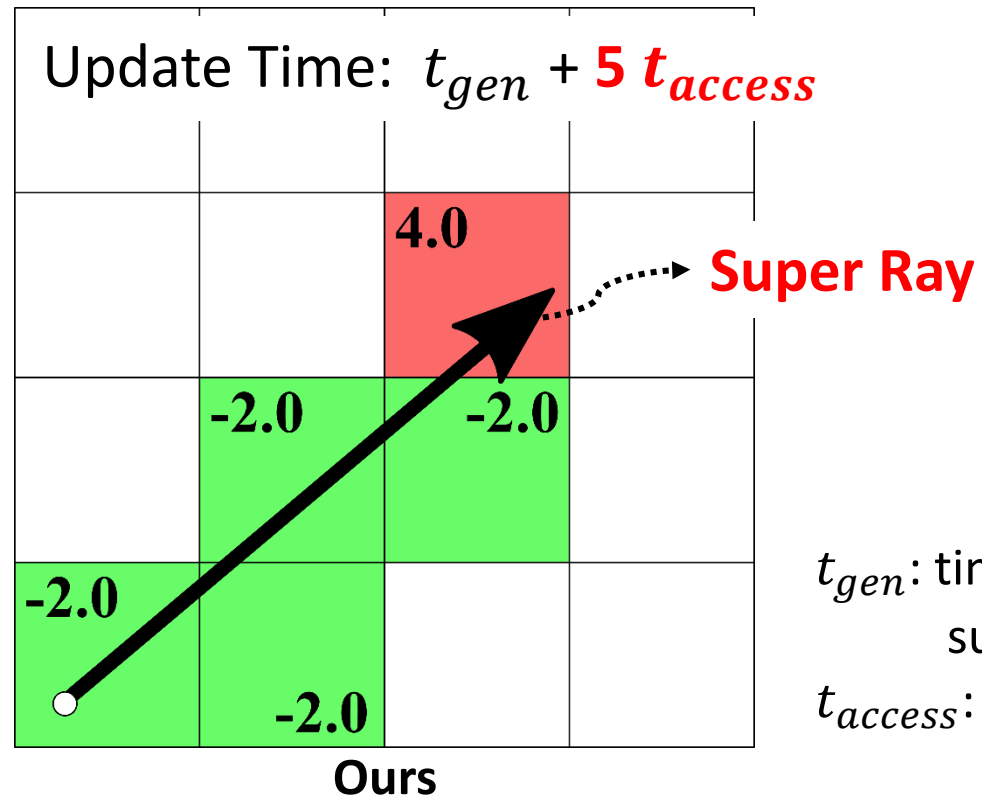
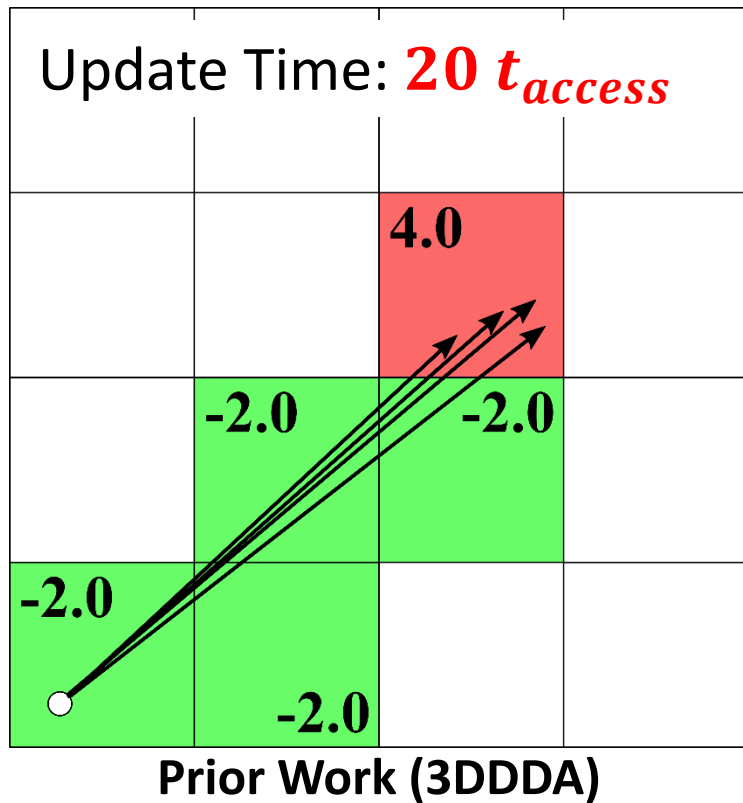


0.2m resolution

**12.1 FPS**

# Basic Idea of Our Approach

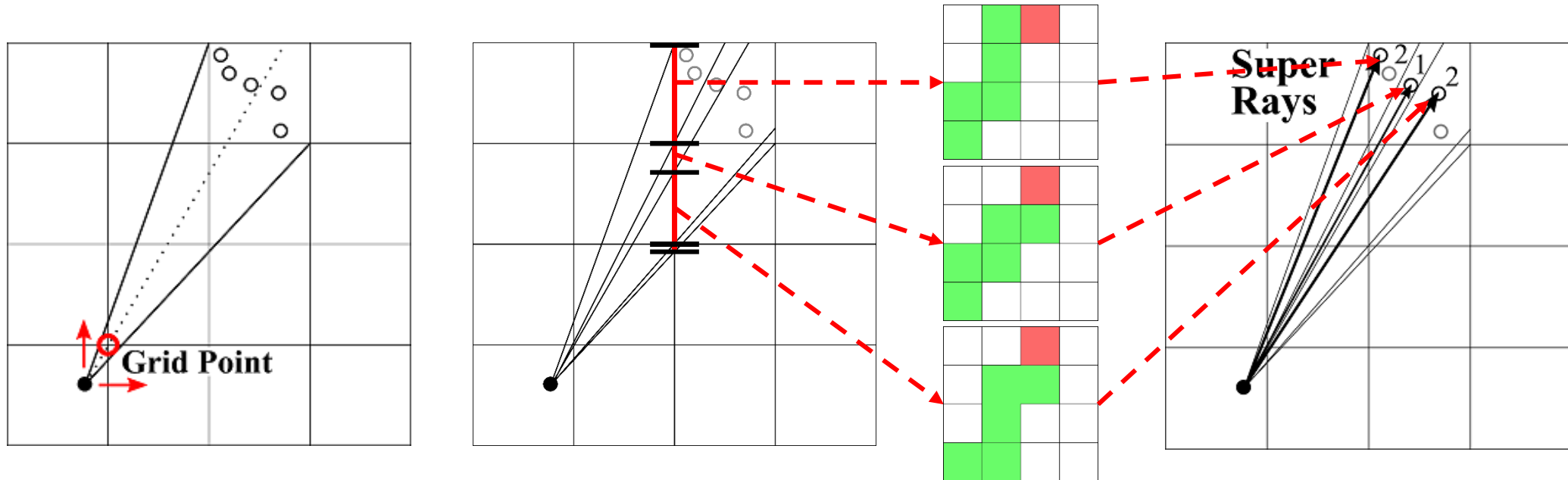
- Propose a novel concept: **Super Ray**
  - A representative ray for set of points that traverse the same cells
  - Reduce the number of accesses for cells to be updated



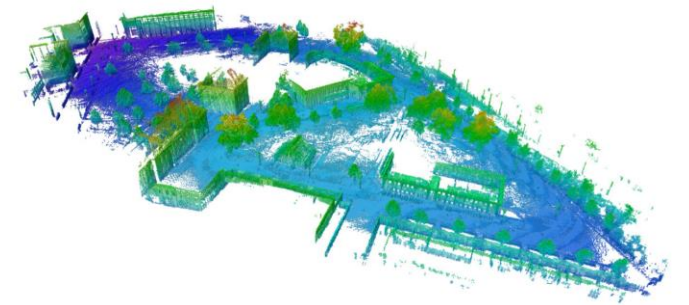
$t_{gen}$ : time to generate  
super rays  
 $t_{access}$ : time to access  
a cell to be updated

# Basic Idea of Our Approach

- **Generate super rays from point clouds efficiently**
  - Key observation: traversal patterns of cells differ along **grid points**
  - Classify point clouds into set of points with the same traversal pattern
  - Available in both 2-D and 3-D



# Main Result – Outdoor Scene



- Source code is available at <http://sglab.kaist.ac.kr/projects/SuperRay>
- Enable **1.5 times** on average performance improvement

