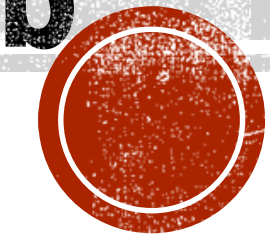
3D PATH-FINDING IN A VOXELIZED MODEL OF INDOOR ENVIRONMENTS

Martijn Koopman

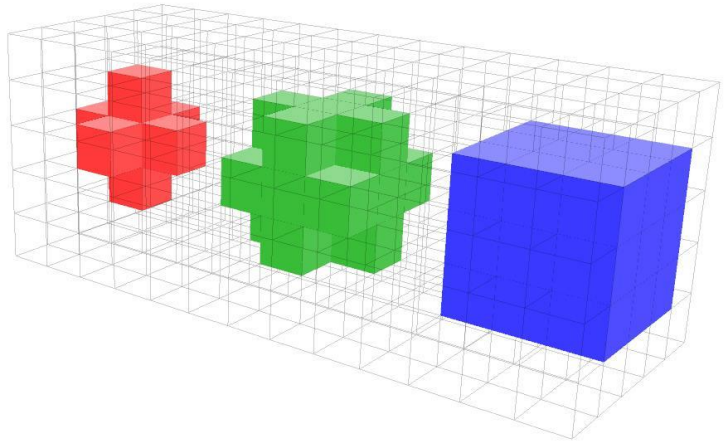


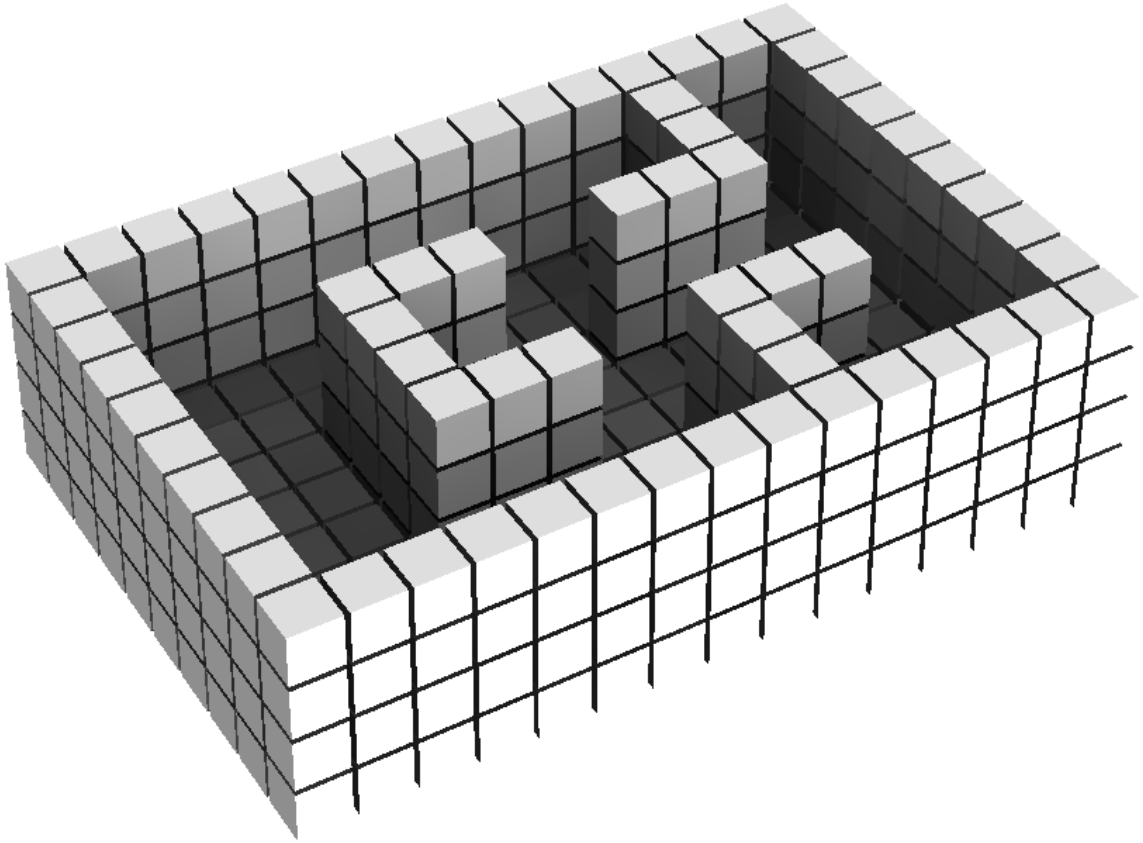
CONTENT

- Voxelized model
- Requirements
- Parameters
- Path-finding example
- Extending the method

VOXELIZED MODEL

- 3D grid
- Voxels
- Resolution
- Simple connectivity





VOXELIZED MODEL

Advantages:

- Direct usable for path-finding
- Truly 3D

Disadvantage:

- Performance dependent on the amount of voxels

REQUIREMENTS

- Different modes of locomotion
  - Walk
  - Drive
  - Fly
- Different actor dimensions
  - Width, height, length
- Type of path
  - Shortest, Hamiltonian, etc.

PARAMETERS

- Type of path
- Actor height
- Actor horizontal radius (= width & length)
- Actor mode of locomotion
- (Actor length & orientation)

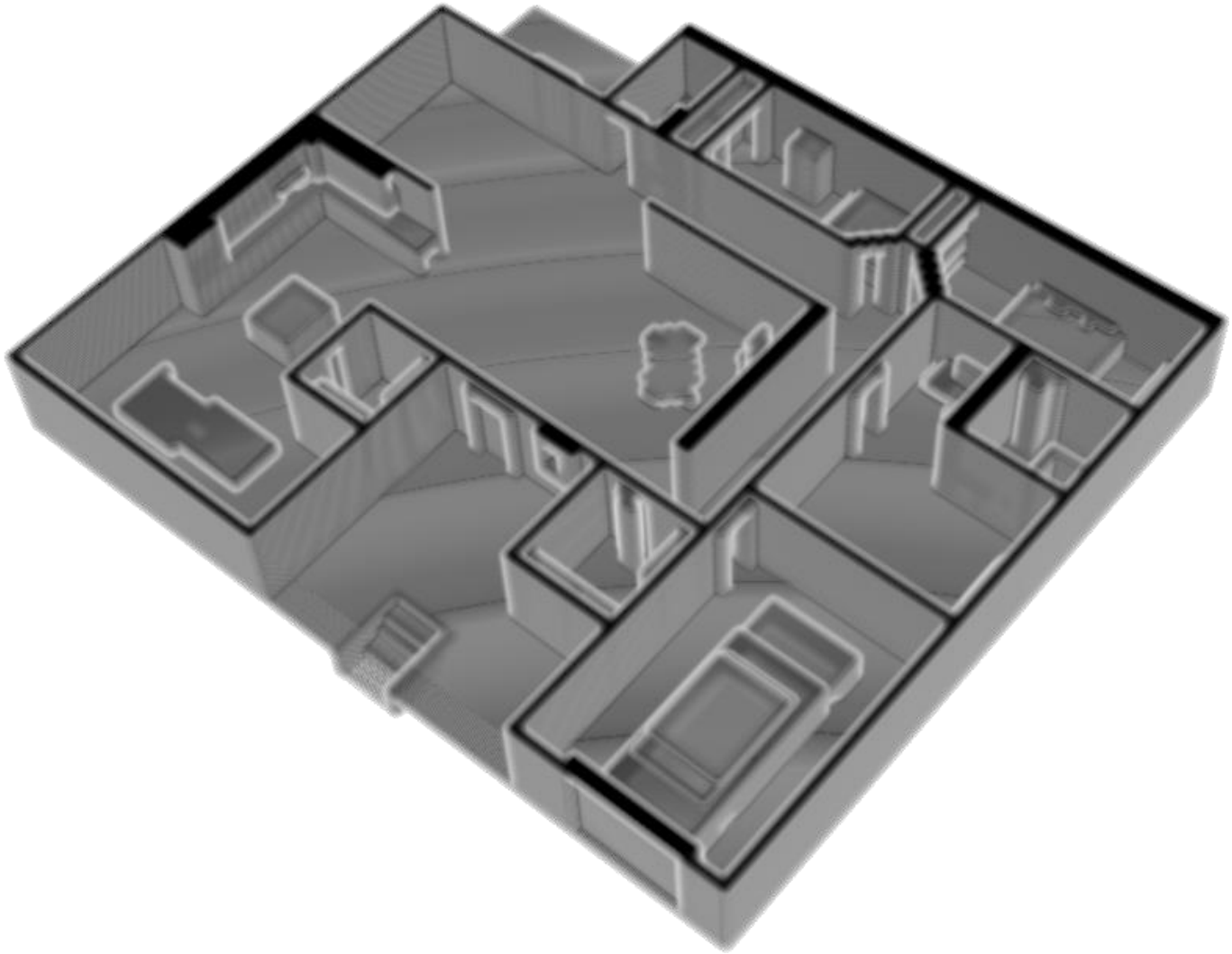
Extra for driving actors:

- Maximum surface slope

Extra for flying actors:

- Preferred flying height

PATH-FINDING EXAMPLE



GEOMETRY

Voxel spacing = 20 cm

Parameters:

Type of path = Shortest

Actor width = 50 cm

Mode of locomotion = Flying

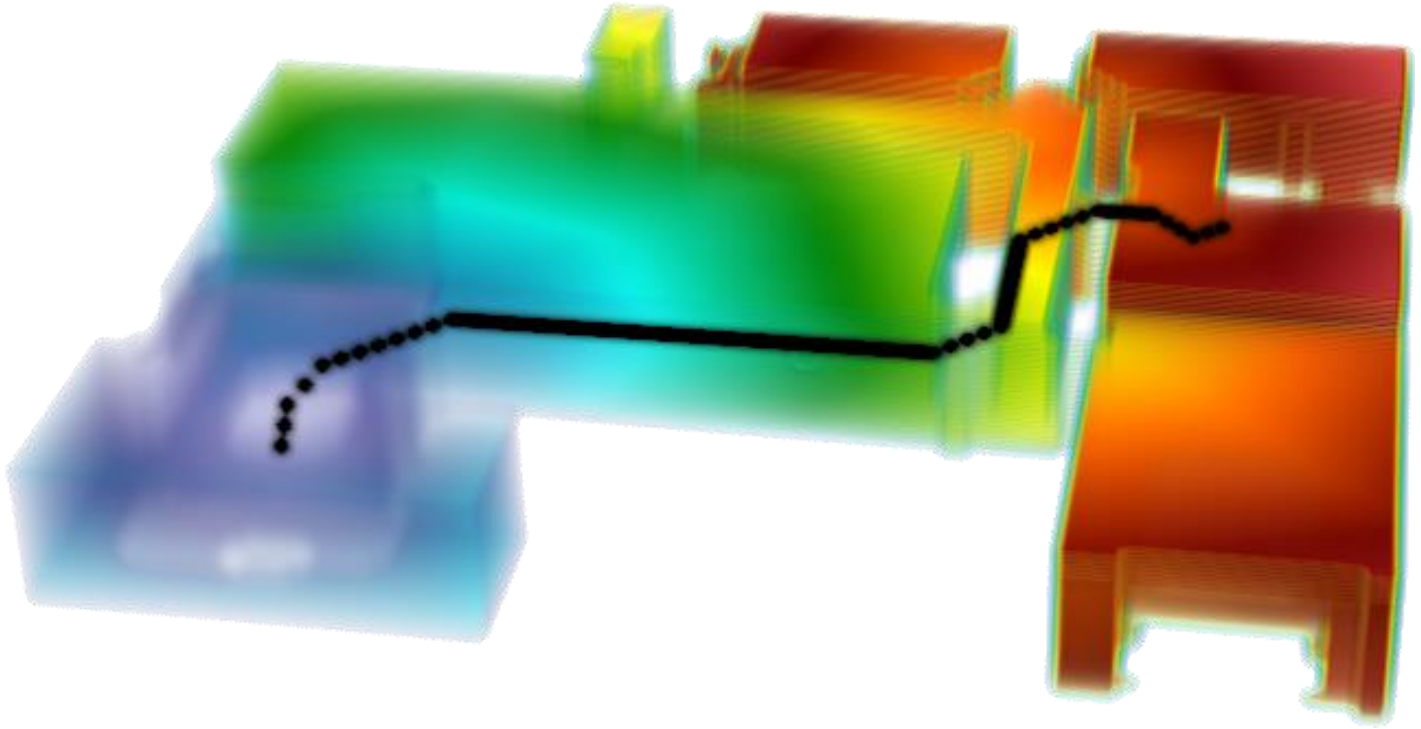
Preferred flying height = 2 m

GEOMETRY

Dilation

Half the width of an actor

Potential Field + Distance to Elevation



POTENTIAL FIELD + PATH

GEOMETRY + PATH

EXTENDING THE METHOD

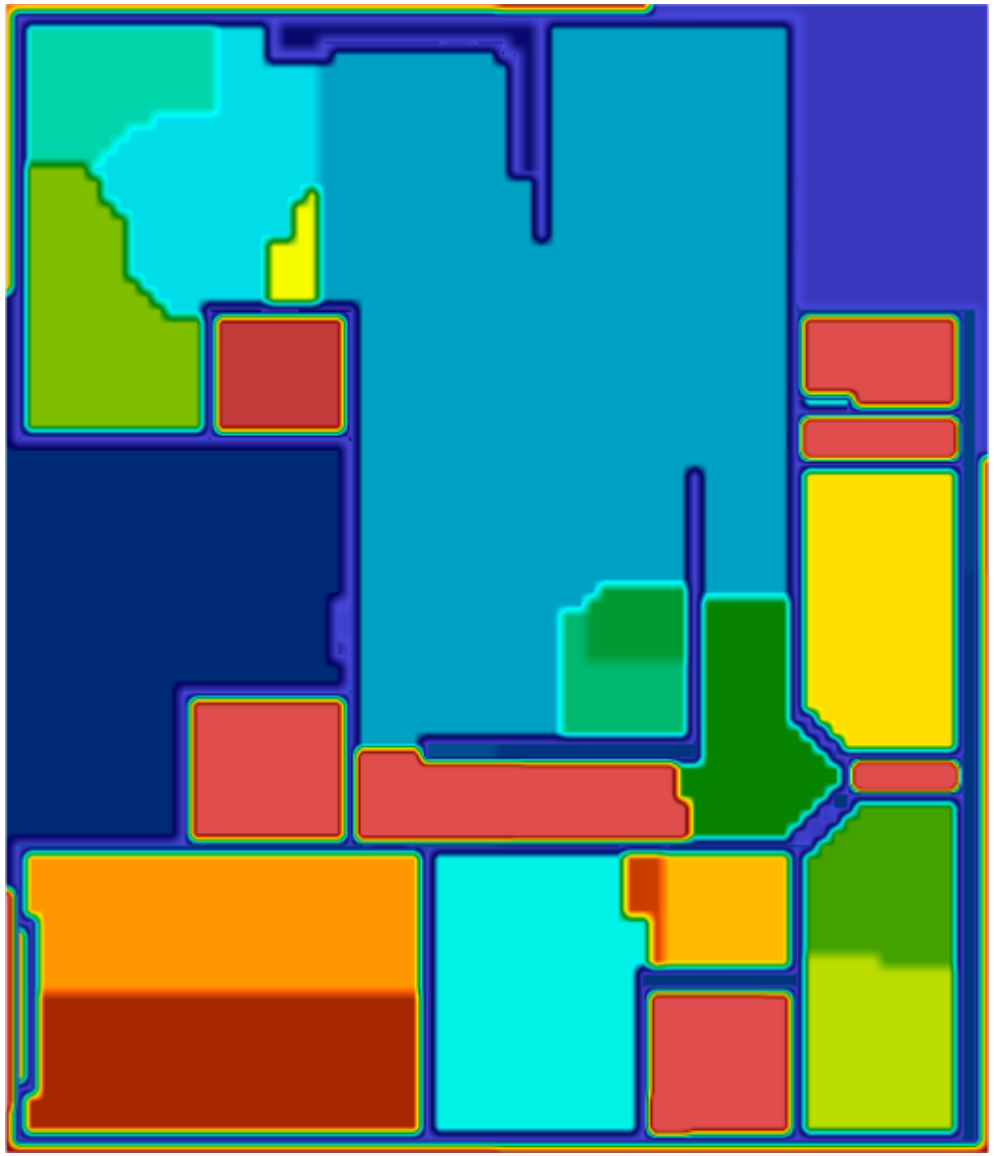
HIERARCHICAL PATH-FINDING

- Complexity scales linearly with the amount of voxels
- Real-time / fast computation impossible
  - Large models
  - High resolution

Solution

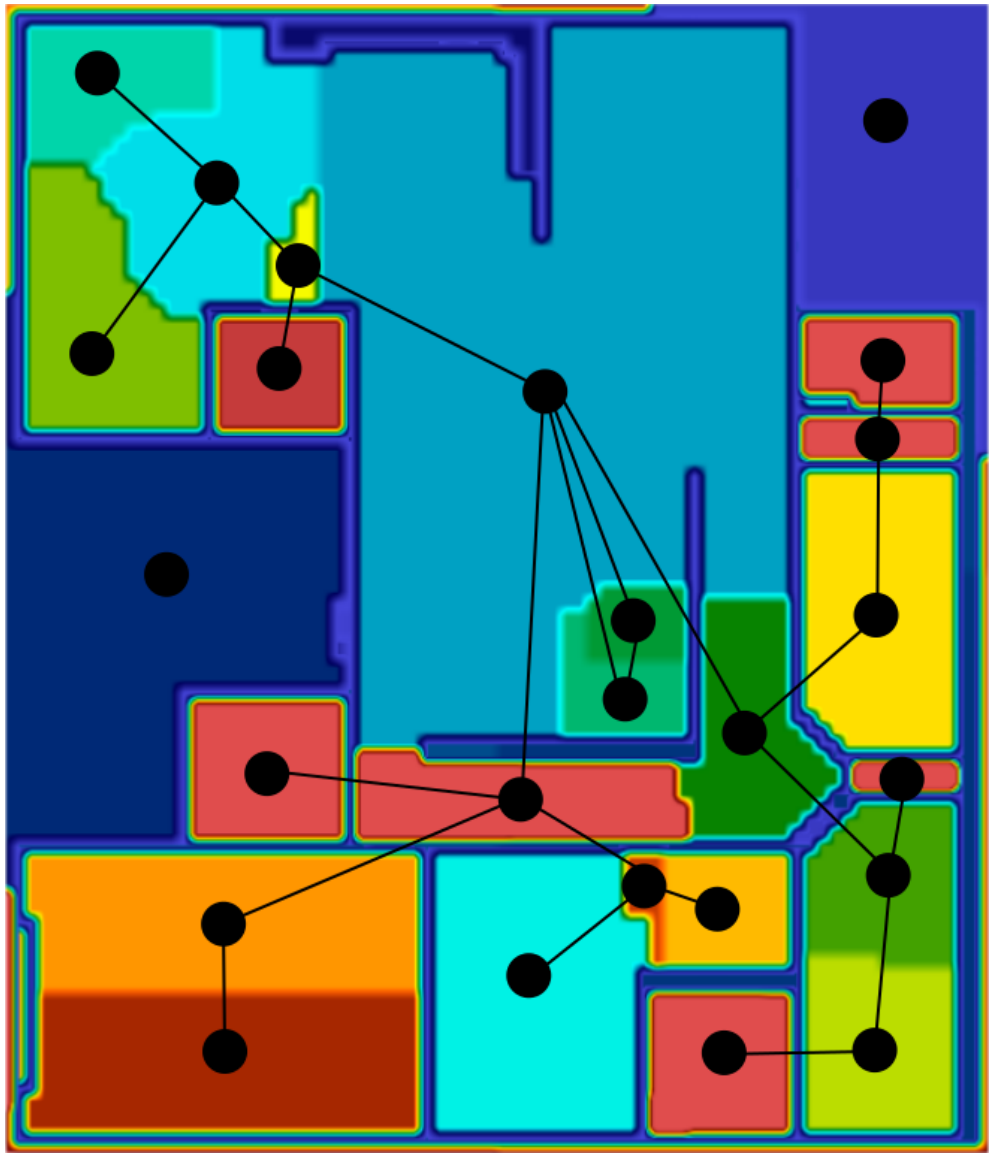
- Hierarchical path-finding
  - Level 1 – Room to room (for example)
  - Level 2 – Voxel to voxel

Distance to Geometry



CELLS

Watershed on the distance field



Cell and Portal Graph

Assign attributes to nodes and edges

- Portal size
- Cell type
  - Above stairs, floor, obstacle, etc.

To Do:

- Merge cells
- Reduce influence of furniture
- Many more…

THANK YOU FOR YOUR ATTENTION