Optimising multi stereo camera placement in complex environments with Blender

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1. ABSTRACT

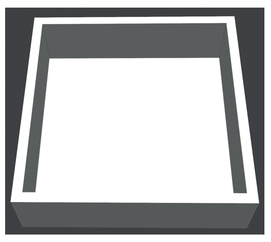
Creating digital twins of industrial environments using photogrammetry
- How to determine the optimal placement of multiple stereo cameras in a complex environment?

Why Blender?
- Can import/ create CAD geometry
- Ray tracing can determine camera's line of sight in complex environements
- Open source
- Can interface with using Python
- Produces a visual result: Easy human interaction

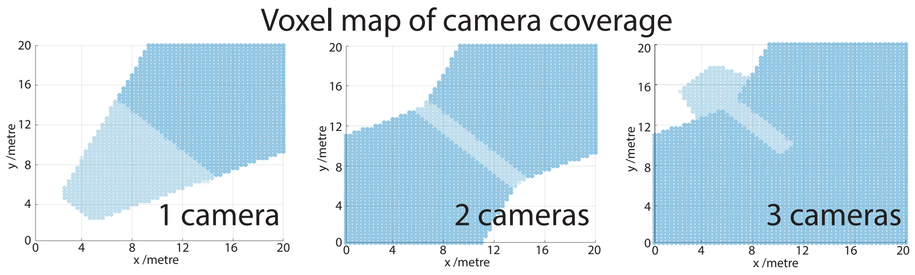
3. RESULTS - MAXIMUM COVERAGE

Stage 1: Empty square room

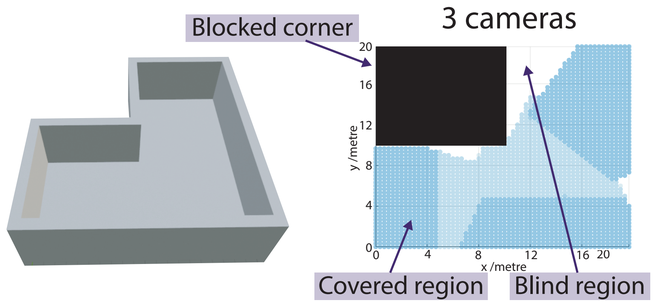
Blender simulation



Voxel map of camera coverage

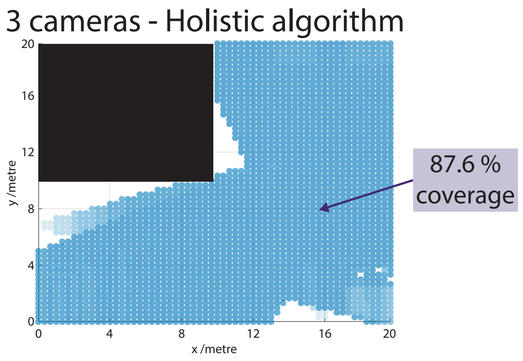


Stage 2: Empty 'L' shaped room

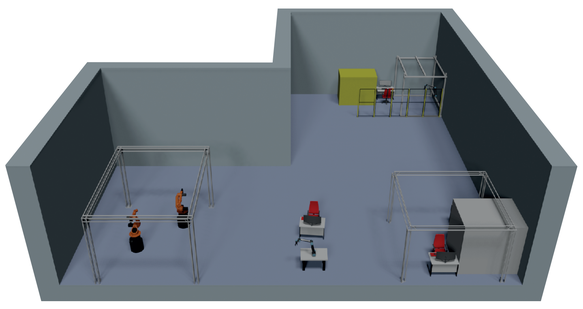


1 camera

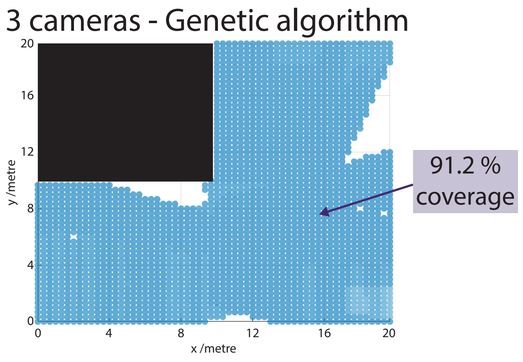
3 cameras - Holistic algorithm



Stage 3: Complex 'L' shaped room

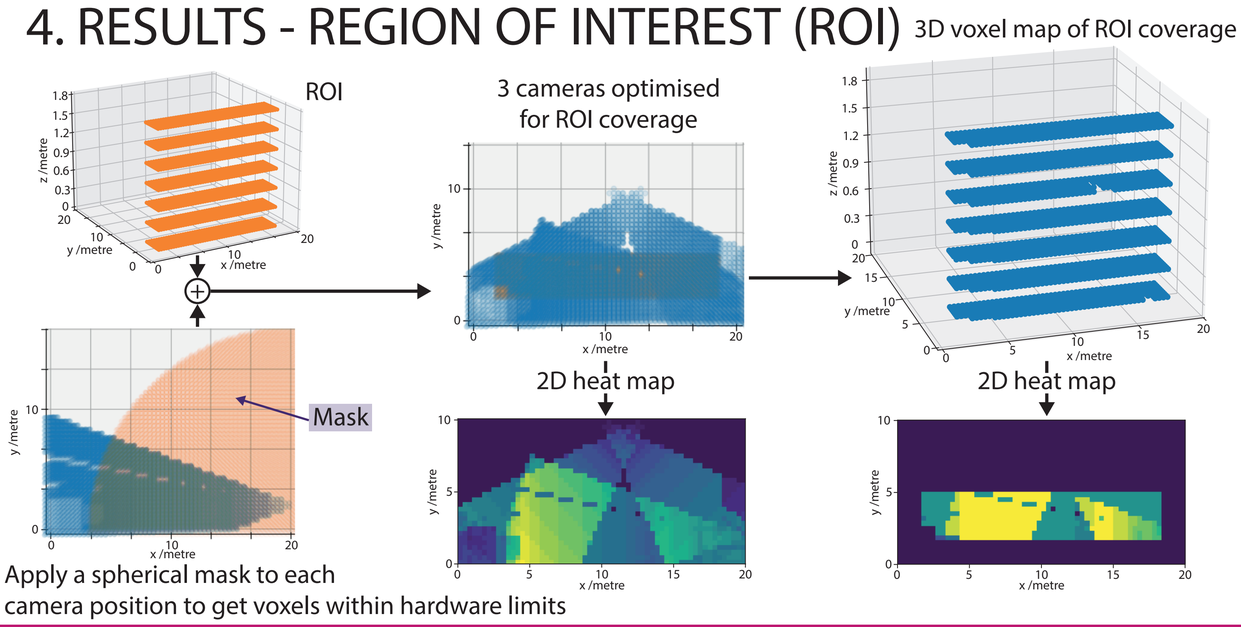


3 cameras - Genetic algorithm



4. RESULTS - REGION OF INTEREST (ROI)

3D voxel map of ROI coverage



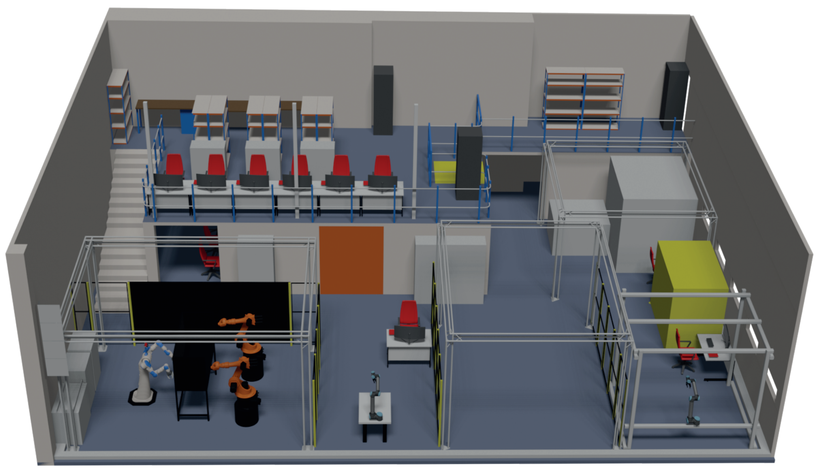
Apply a spherical mask to each camera position to get voxels within hardware limits

FUTURE WORK

Increase complexity of position calculation including, camera intersection angle
Experimental verification of solutions
Application study such as people tracking through different FOV

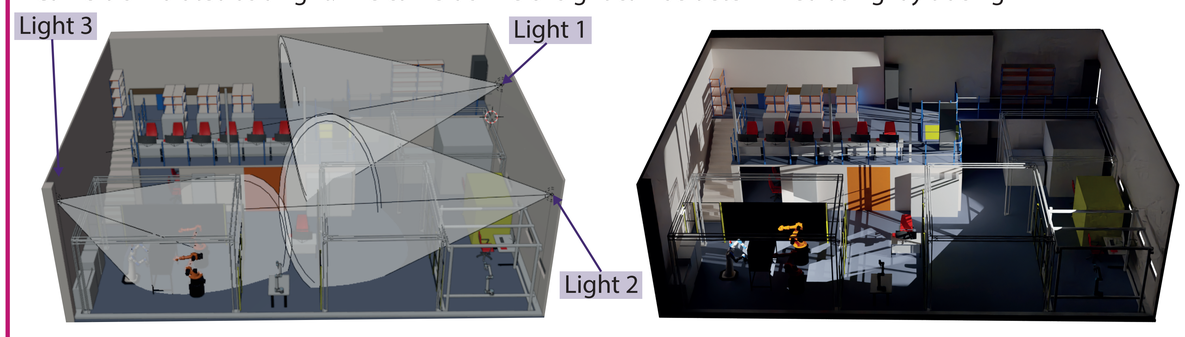
2. METHODOLOGY

Model creation in Blender



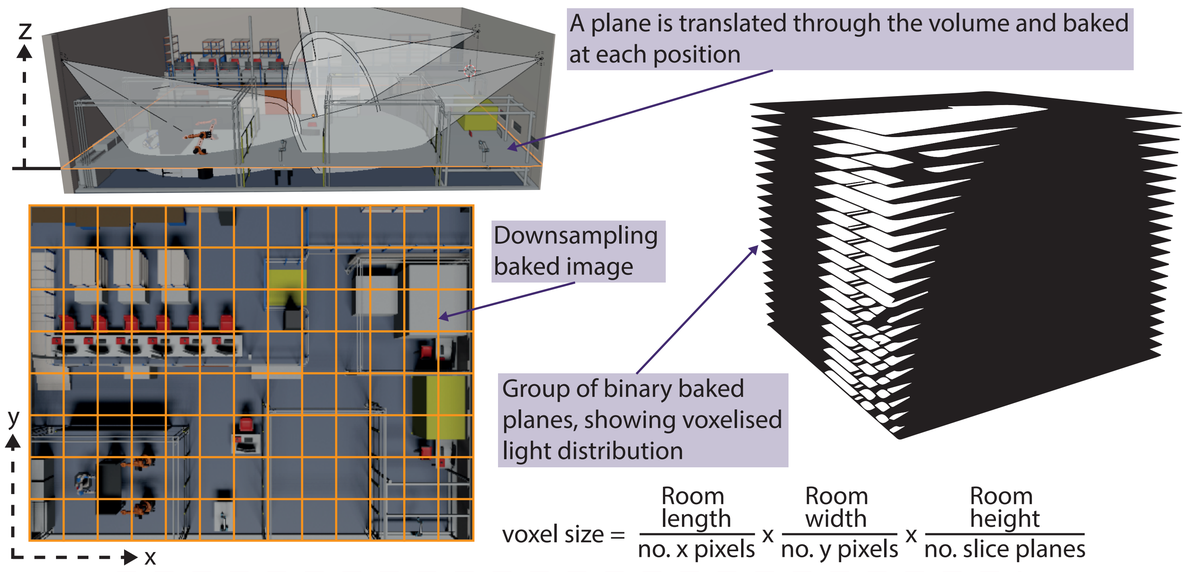
Camera simulation

Camera simulated as a light. The camera's line of sight can be determined using ray tracing



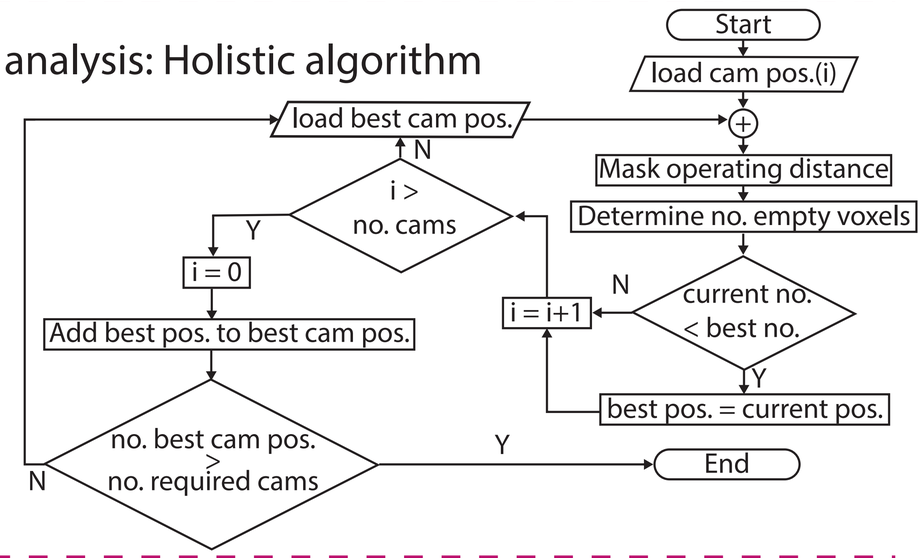
Mask applied on each light to control the camera's field of view

Voxelisation

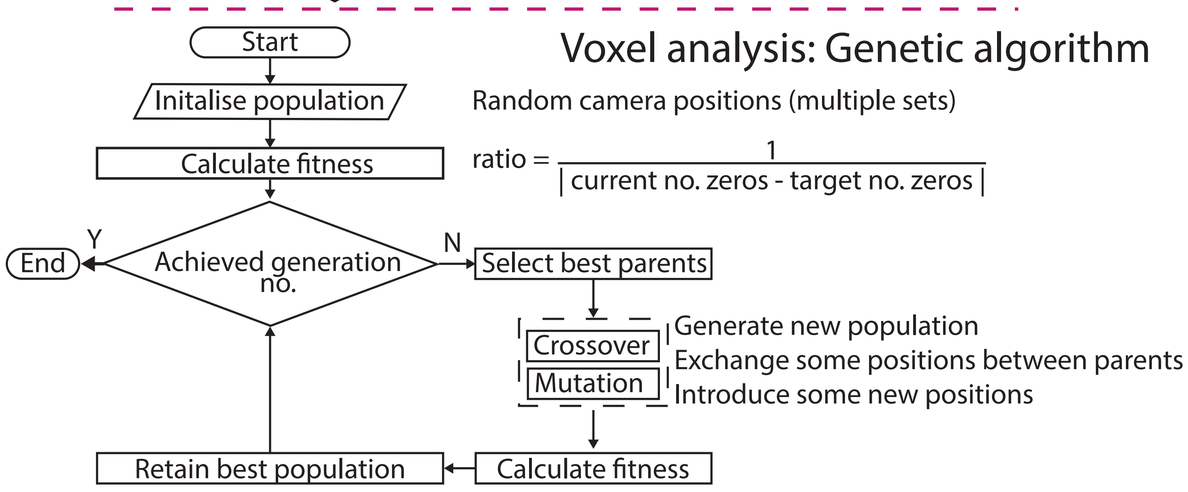


$$\text{voxel size} = \frac{\text{Room length}}{\text{no. x pixels}} \times \frac{\text{Room width}}{\text{no. y pixels}} \times \frac{\text{Room height}}{\text{no. slice planes}}$$

Voxel analysis: Holistic algorithm



Voxel analysis: Genetic algorithm



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