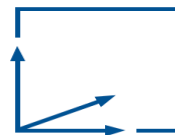


Procedurally Generated and Digitally Recreated Environments Designed for Interactive Content in Augmented and Virtual Reality

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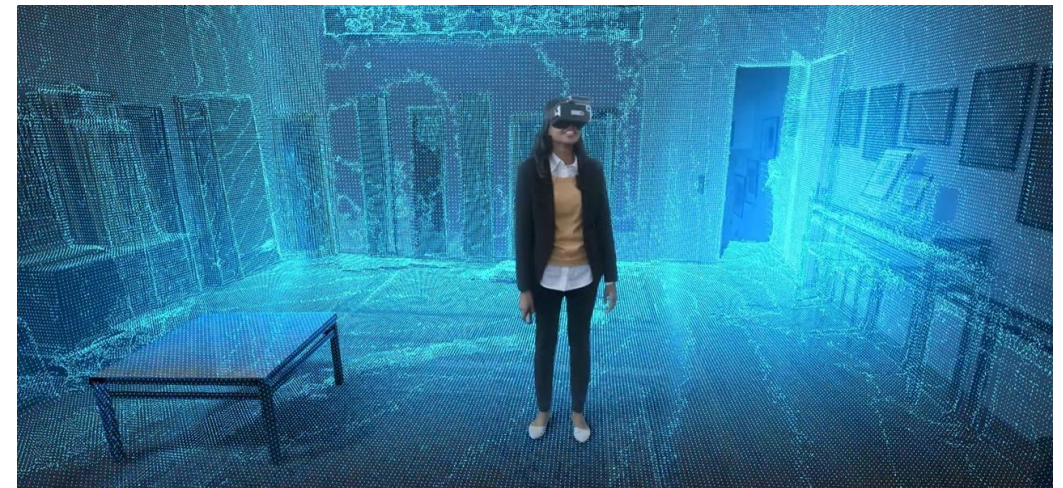
Kickoff: Master Informatics: Games Engineering

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Introduction / Motivation

- Creating understandable interactive content takes time
- Especially in augmented and virtual reality
- Different methods need to be compared and tested in diverse environments

- Can we automate the room creation and placement of interactive content?
- Can we develop a universal solution?



Problem Description: Issues

- **Room Creation:**

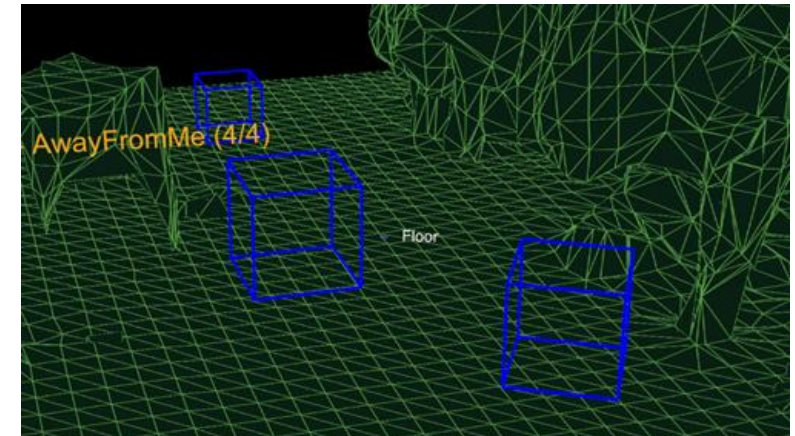
- Future of VR is without cables
- Need a reliable method to recreate the actual boundaries digitally
- Require diverse environments

- **Interactive Content Placement**

- Need to categorize the environment
- Depending on interactive content, spawn at suitable location

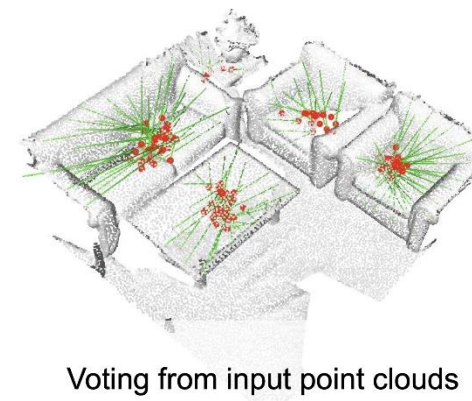
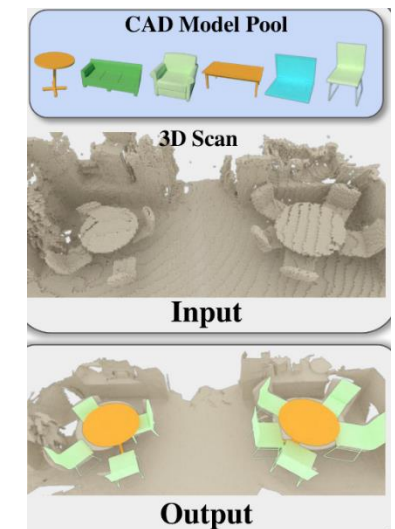
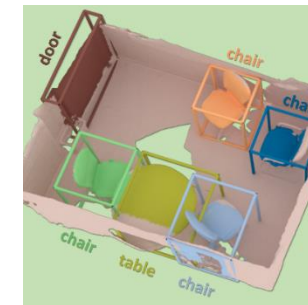
- **Universal Solution**

- Needs to run on different platforms (HoloLens UWP, VR Windows App)
- Should run in all development environments for these platforms (Unity, Unreal, etc.)

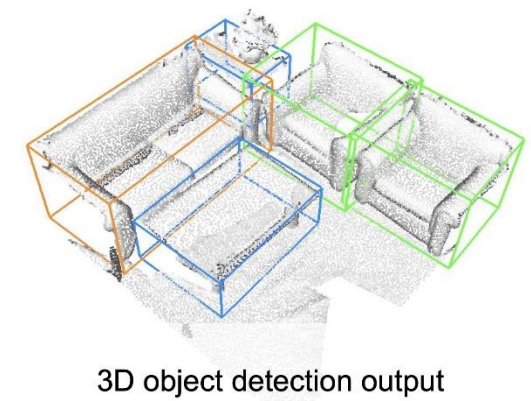


Existing Solutions / Related Work

- **Room Generation:**
 - Room Recreation ([2, 6, 7])
 - Placing models over room scan ([8, 9, 10, 11, 12, 13])
- **Mesh Understanding:**
 - Some for HoloLens and Rooms ([1, 2, 14])
 - Some for general 3D meshes ([3, 4, 5])
 - None for suitable locations for interactive content
- **Universal AR/VR Solution:**
 - None for both
 - None in real-time for both



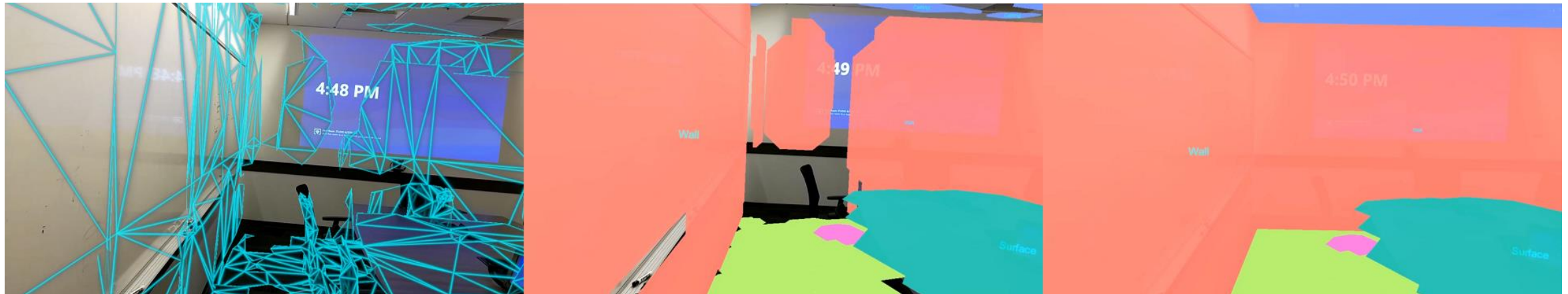
Voting from input point clouds



3D object detection output

Goals of this Thesis

- Help to speed up testing and developing of new interactive content in AR/VR environment
- Deliver room creation with wireless AR/VR headsets in mind
- Categorize interactive content automatically



Proposed Work / Approach

- Create a plugin in C++ that is compatible with Unreal, Unity, etc.
- Use existing hardware and methods to scan the room (HoloLens, ZED mini)
- Evaluate spatial understanding algorithms to be used in AR and VR
- Implement procedurally generated and digitally recreated environments
- Research and implement categorization algorithm for interactive content
- Provide real-time solution

Discussion of Potential Issues

- Hardware and operating system limitations on the HoloLens can restrict the universal solution
- Compatibility to Unreal, Unity and other engines could be a challenge
- Spatial understanding algorithms might be difficult to realize in real-time
- Categorization of interaction content might be challenging for solutions that span multiple categories

Time Line

- Research and Implementation of Framework
 - Deadline: Mid December (~ 2-4 Weeks)
- Research and Implementation of Room Creation and Understanding
 - Deadline: Mid February (~ 6-8 Weeks)
- Research and Implementation of Categorization
 - Deadline: Mid March (~ 2-4 Weeks)
- Finalization of Implementation
 - Deadline: Late March (~ 2 Weeks)
- Writing Thesis
 - Deadline: Mid April (~ 6-10 Weeks)
- Additional Time until Mid May (~ 4 Weeks)

List of References

1. <https://github.com/microsoft/MixedRealityToolkit/wiki/HoloToolkit.SpatialUnderstanding>
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Questions?