Virtual Reality 3D Scanning

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Introduction

- Introduce 3d scanning, registration
- Motivation for interactive 3d scanner (holes / interactive registration)
- Motivation for HMD / virtual reality immersive interface (depth perception for interactivity, hand gestures?)

Background, Related Work

- Kintinuous: registration for large scale data
- AR-Rift: integration of real-time live video into the Oculus
- "Sparse Iterative Closest Point": registration algorithm most suitable for this situation, discuss correspondences and pairwise registration for sequences of clouds
- Other registration algos and why ICP was chosen (initial guess, interactively watch convergence)

Approach/Methodology

- Three main parts: VR view, camera capture, continuous registration
- Discuss live VR view and conversion from camera to VR coordinates
- Use of VR positional tracking information to provide mostly accurate initial guess for ICP
- Discuss use of 'third eye' for color, mapping to texture and calculation of UV coordinates in texture
- Interactive selection of point clouds to register from a live 'staging area'
- Interactive registration (can move/scale current point cloud relative to old)
- Watch ICP iterations in real-time

Challenges

- Performing ICP while providing interactive framerates (threading?)
- Accounting for depth camera <-> HMD position/rotation offset

Evaluation

- Capture test scenes
- Compare ICP with and without initial guess from HMD positional tracking

- Data: ICP convergence, (use UV/color in convergence data?), framerates with / without threading, framerates using buffers vs. individually rendering point clouds, coverage/FOV and min/max angles upward/downward during tracking

Future Work

- Extending range of HMD positional tracking
- Other registration methods