Real-Time 3D Model Difference Reasoning with HoloLens

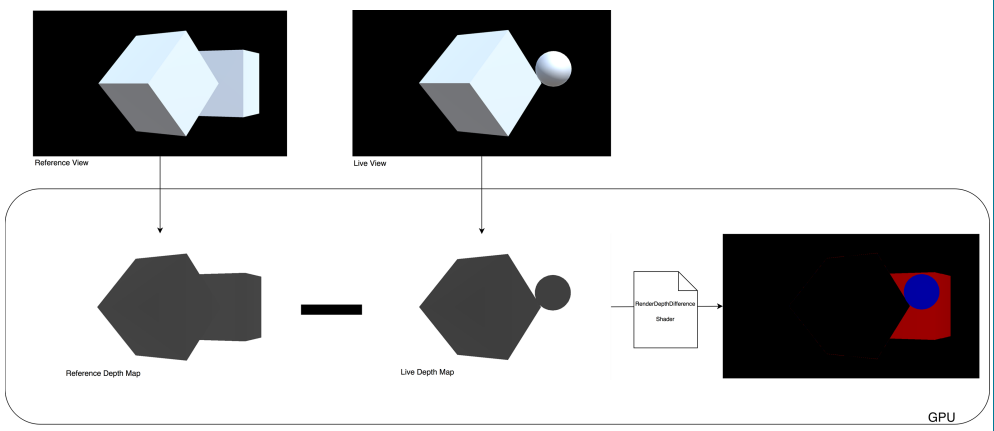
Pierre Beckmann, Mathis Lamarre
Computer Vision and Geometry group, ETH Zürich

Goal

- Compute the **3D differences** between a **pre-loaded model** and a **current scan** using the **HoloLens**.
- Highlight **differences** for an intuitive experience, according to **addition** or **deletion, position** and **depth**.

Method overview

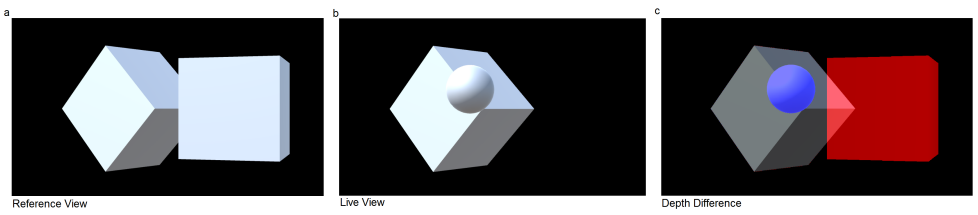
We compute the per pixel **depth difference** of two views.
Rendering the reference view off-screen enables a **shader** attached to the live camera to access both **depth maps** directly on the **GPU**.
Highlighting each pixel according to the sign of the difference shows added objects in blue and removed objects in red.



On the **HoloLens**, an emulated camera accesses a **pre-loaded** model to create the reference view which will be compared to the **spatial mapping** in the live view.

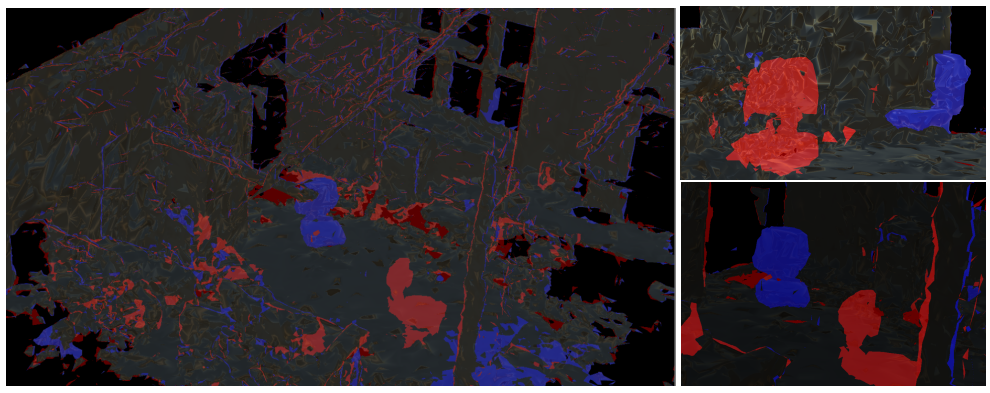
Results

Overlaying the **texture** with the depth-difference highlighting allows the user to track the advancement of the spatial mapping in real-time.



However this leads added objects to have a 3D impression that removed objects lack.

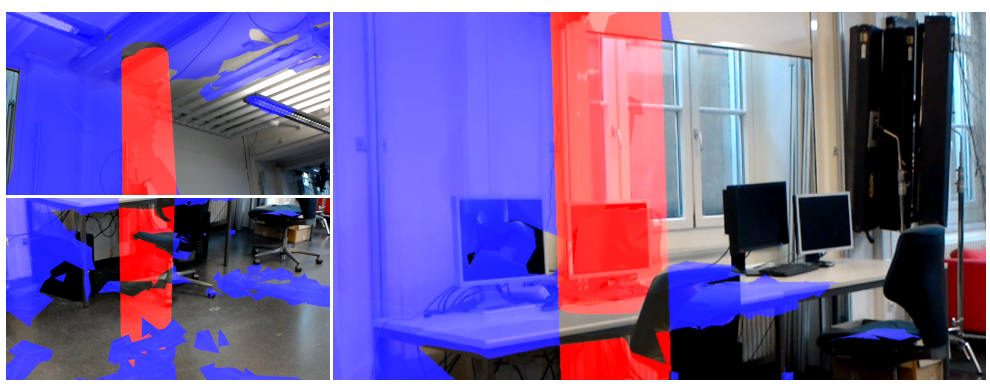
We **scanned** our lab before and after moving a **chair**.



See the two positions of the chair. **Noise** and slight **differences** in the scans create false positive highlighting.

Shading gives the **impression of depth** for this person laying back with a window in the background.

Alignement of the models in the HoloLens is not implemented.
We applied difference reasoning with a **pillar** as the loaded model.



The **depth difference threshold** infuences the highlighting of intersecting regions.

Conclusion

- Our algorithm works really well **offline** with simple shapes and **smooth surfaces**.
- Some problems arise when using **real scans** because of their **imprecision**. Satisfying results can be achieved when fine tuning parameters, but at cost of less **sensibility**.
- **Real-time** use should work as soon as a way to **align** the **pre-loaded model** and the **live scan** is found.

Supervisors: Martin Oswald, Pablo Speciale