Casual Real-World VR using Light Fields

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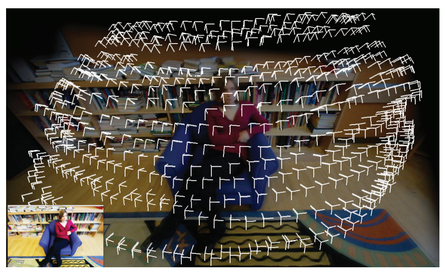
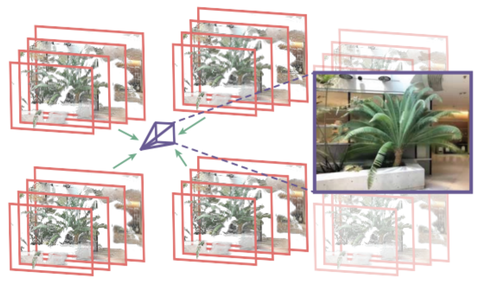
Goal

- Create real-world VR content in a casual and fast manner
- Allow photo-realistic synthesis of novel views with VR capable performance

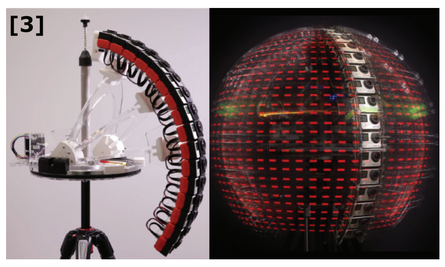
Related Work

- Requires hundreds of images [1]
- Limited performance for VR [2]





- Specialized hardware [3] and time-consuming capture or processing to obtain 3D representations [4]



Solution

- Capture Light Fields represented with Multi-plane-Images (MPIs) [5] with a custom AR app which guides user an optimal trajectory
- Process only sparse subset of input images
- Extract high-quality depth maps from MPIs for real-time rendering of novel views

References

[1] Abe Davis, Marc Levoy, and Frédo Durand. 2012. Unstructured Light Fields

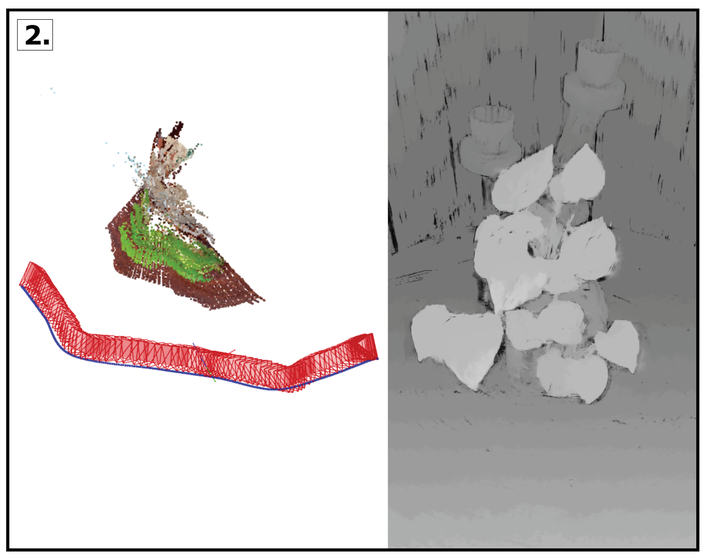
[2] Ben Mildenhall, Pratul P. Srinivasan, Rodrigo Ortiz-Cayon, Nima Khademi Kalantari, Ravi Ramamoorthi, Ren Ng, and Abhishek Kar. 2019. Local Light Field Fusion

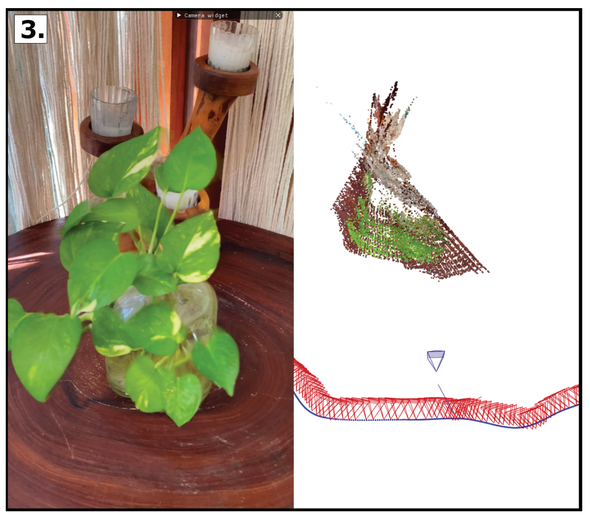
[3] Overbeck, R. S., Erickson, D., Evangelakos, D., Pharr, M., & Debevec, P. 2018. A system for acquiring, processing, and rendering panoramic light field stills for virtual reality

[4] Peter Hedman and Johannes Kopf. 2018. Instant 3D Photography

[5] Tinghui Zhou, Richard Tucker, John Flynn, Graham Fyffe, and Noah Snavely. 2018. Stereo Magnification: Learning View Synthesis using Multiplane Images

Pipeline





Visualization in VR

1. **Scene Capture**
   We developed a custom AR app to guide the user to casually capture a scene, i.e. a plant
2. **Scene Processing**
   Perform camera pose estimation, frame selection, MPIs prediction, and depth map extraction per MPI
3. **Real-time Rendering in VR**
   Render dense triangulated meshes obtained from each depth maps per-view. Blend them with penalties depending on how much the texture gets stretched

Results