

16-833 SLAM Paper Summary 2

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KinectFusion: Real-Time Dense Surface Mapping and Tracking

KinectFusion is a system for accurate real-time mapping that utilizes low-cost depth cameras and commodity graphics hardware. Compared to other SLAM methodologies, the use of depth data can eliminate the physical scene limitation from low lighting conditions. The overall framework consists of 4 components: Surface measurement, Surface reconstruction update, Surface prediction, and Sensor pose estimation. The system provides an always up-to-date surface representation by fusing various scan data. It also handles camera pose by aligning each depth point with the complete scene model. This framework provides a novel solution for dense 3D reconstruction with favorable hardware requirements.

NeRF: Representing Scenes as Neural Radiance Fields for View Synthesis

NeRF (Neural Radiance Fields) is a state-of-the-art methodology that utilizes neural networks, specifically multilayer perceptron (MLP), to synthesize novel views of complex scenes. The NeRF scene is represented as a continuous 5D vector-valued function that consists of 3D spatial coordinates and 2D viewing directions as inputs. The function's outputs are emitted color and volume density. To achieve quality image rendering, positional encoding, and hierarchical volume sampling were used during implementation. The framework was compared to previously proposed techniques such as Neural Volumes, Scene Representation Networks, and Local Light Field Fusion and outperformed in almost every metric. Overall, NeRF proves to be a significant progress toward achieving photo-realistic view synthesis.

References

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- [2] Mildenhall, B., Srinivasan, P. P., Tancik, M., Barron, J. T., Ramamoorthi, R., & Ng, R. (2020). NeRF: Representing Scenes as Neural Radiance Fields for View Synthesis (arXiv:2003.08934). arXiv. <http://arxiv.org/abs/2003.08934>