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Titel der Master-Arbeit: Mapping for online path planning and 3D Reconstruction
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Zusammenfassung von Yue PAN:

Creating accurate maps of complex, unknown environments is of utmost importance for truly autonomous navigation and surveying robot. However, building these maps online is far from trivial, especially when dealing with large amounts of raw sensor readings on a computation and energy-constrained mobile system, such as a small drone. While numerous approaches tackling this problem have emerged in recent years, the mapping accuracy is often sacrificed as systematic approximation errors are tolerated for efficiency's sake. Motivated by these challenges, we propose Voxfield, a mapping framework that can generate maps online with higher accuracy and lower computational burden than the state-of-the-art. Built upon the novel formulation of non-projective truncated signed distance fields (TSDFs), our approach produces more accurate and complete maps, suitable for surface reconstruction. Additionally, it enables efficient generation of Euclidean signed distance fields (ESDFs), useful e.g., for path planning, that does not suffer from typical approximation errors. Through a series of experiments with public datasets, both real-world and synthetic, we demonstrate that our method beats the state-of-the-art in map coverage, accuracy and computational time. Moreover, we show that Voxfield can be utilized as a back-end in recent multi-resolution semantic mapping frameworks, producing high-quality maps even in city-scale experiments.

Finally, we validate our method by running it onboard a quadrotor, showing it can generate accurate ESDF maps usable for real-time path planning and obstacle avoidance.

The related paper 'Voxfield: Non-Projective Signed Distance Fields for Online Planning and 3D Reconstruction' has been accepted by IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2022.

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