



Title: **Seeing the Unseen: Real-Time 3D World Reconstruction - From Static Scenes to Dynamic SLAM**

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Disaster environments such as earthquake-stricken areas are chaotic, unstructured, and constantly evolving, with moving people, shifting rubble, and rapidly changing conditions. Yet these are exactly the places where accurate 3 dimensional (3D) scene understanding and situational awareness are essential for safe and effective rescue operations.

This talk explores how standard cameras can be transformed into powerful tools for 3D world reconstruction using Simultaneous Localization and Mapping (SLAM). After shortly introducing the principles of SLAM and the foundations of classical approaches, I will explain why these methods struggle in real-world environments, where dynamic objects and complex motion violate their core assumptions. Building on this motivation, I will then focus on recent advances in dynamic SLAM, a growing research area that aims to robustly reconstruct scenes that are not only unknown, but also continuously changing. By combining visual cues, motion segmentation, and deep learning-based estimations, dynamic SLAM methods can distinguish moving objects from the static environment while maintaining accurate and consistent 3D maps. I will present state-of-the-art approaches, discuss the remaining challenges, and share insights from my own research on improving SLAM robustness in highly dynamic, disaster-like environments.

Ultimately, this work aims to bring us closer to enabling robots and first responders to safely explore hazardous environments, locate survivors rapidly, and build reliable 3D representations of spaces where human access is difficult or unsafe.

