Abstract

- Technology for Unmanned Aerial Vehicles (UAV) have made them smaller, lighter and last longer due to better battery technology. But, we need larger and expensive vehicles for longer travel.
- Swarming technology allows for multiple smaller UAVs called Micro-UAVs (MAVs) with cheap equipment to disperse themselves among an area.
- When aerially deployed by a carrier aircraft at an area of interest, they can cover more ground with cheaper equipment for a short amount of time.
- We show a novel approach to SLAM problem using micro-UAVs.

Methodology

1. USER

![Diagram of user interaction with drones]

- LSD SLAM: Large-Scale Direct SLAM is a monocular SLAM algorithm that is split into two components, the tracker or front-end, and pose-graph optimization, the back-end. The tracker attempts to minimize the photometric residual between consecutive images.
- Multi-vehicle LSD SLAM: derivative of LSD SLAM that uses multiple pose graphs to display separate point clouds.
- CNN SLAM: A custom depth prediction network was trained on the Make3D data set and LSD SLAM is initialized with depth values.

2. LSD SLAM / Multi-vehicle LSD SLAM / CNN SLAM

![Diagram of LSD SLAM process]

- **LSD SLAM**
  - Initial setup: The user initializes the LSD SLAM algorithm.
  - Drone deployment: Each drone is deployed sequentially from the carrier drone.
  - Data collection: The drones collect data and transmit it back to the carrier drone.
  - Localization and mapping: LSD SLAM processes the data to create a 3D map.

Results

![Example results of LSD SLAM]

- **Scene photo**
  - Shows the original image captured by the drone.
- **Scene depth**
  - Displays the depth information extracted from the scene.

![Example results of depth prediction]

- **Depth prediction**
  - Shows the output of the depth prediction network for a single frame.

![Example results of 3D reconstruction]

- **3D reconstruction**
  - Demonstrates the 3D reconstruction of the scene from the captured frames.

References

[1] Jakob Engel, Thomas Schöps, and Daniel Cremers. 2014. LSD-SLAM: Large-Scale Direct Monocular SLAM. Computer Vision – ECCV 2014 Lecture Notes in Computer Science (2014), 834–849. DOI: [http://dx.doi.org/10.1007/978-3-319-10605-2_5](http://dx.doi.org/10.1007/978-3-319-10605-2_5)