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# 3D-MODEL RECONSTRUCTION WITH USE OF MONOCULAR RGB CAMERA

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Today the creation of three-dimensional content is a very difficult and painstaking work. Designers and 3D illustrators spend a lot of resources to develop even a simple model despite the fact that we see many of them in our daily lives, and those we don't see are often only modifications of objects from the real world.

This paper provides overview of modern method for 3D models of physical objects real time reconstruction that can be used in present-day mobile solutions. It can be used to create a revolutionary cheap, fast and convenient solution for introduced problem.

Large-Scale Direct Monocular SLAM (LSD-SLAM) [1] – a direct (feature-less) monocular SLAM algorithm. Along with highly accurate pose estimation based on direct image alignment, it provides the 3D environment real-time reconstruction as a graph of key frames with semi-dense depth maps. These are obtained by a huge number of pixel-by-pixel comparisons.

The algorithm consists of three major components: tracking, depth map estimation and map optimization. The tracking component continuously tracks new camera images. That is, it estimates their position with respect to the current key frame, using the pose of the previous frame as initialization. The depth map estimation component uses tracked frames to either refine or replace the current key frame. Depth is refined by filtering over many per-pixel, small-baseline stereo comparisons coupled with interleaved spatial regularization. If the camera moves too far away from the existing map, a new key frame is created from the most recent tracked image. Each key frame consists of a camera image, an inverse depth map and the variance of the inverse depth. Once a key frame is replaced as tracking reference – and hence its depth map will not be refined further – it is incorporated into the global map by the map optimization component. This component is also responsible for loop closures and scale-drift detection.

Running LSD-SLAM system is demonstrated on figure 1. At the top left corner there is a current frame captured by the camera. At the bottom left there is a current key frame with color-coded depth map (from red – close objects, to blue – far objects). At the right side there is a built point cloud with red square as a current camera position and blue ones as camera trajectory.

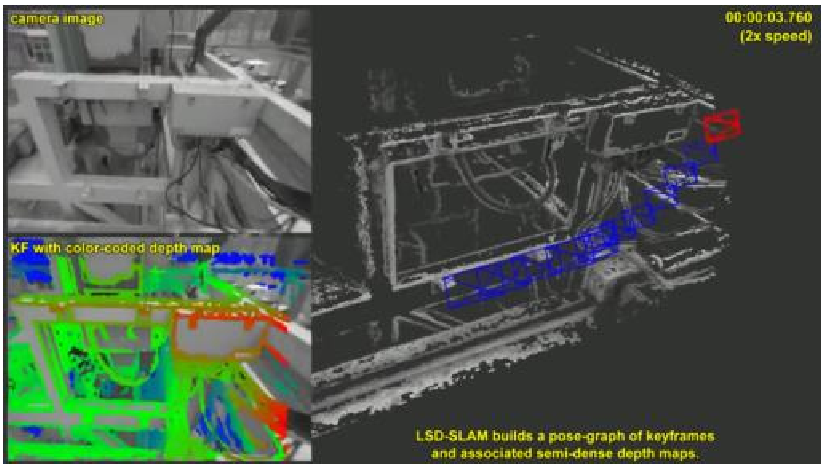


Fig 1. Running LSD-SLAM system

The authors of this work were able to obtain promising results using the LSD-SLAM method (see figures 2-5).

Fig 2. Experiment 1. Object

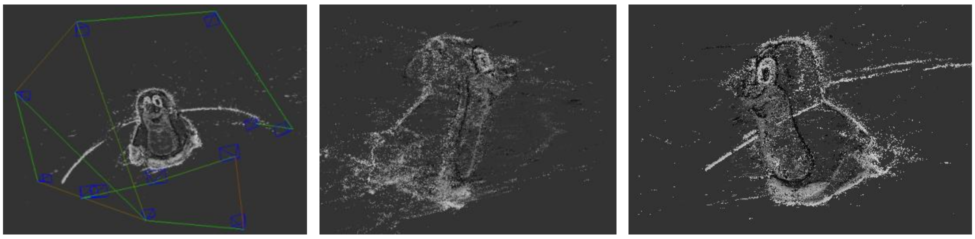

Fig 3. Experiment 1. Result

Fig 4. Experiment 2. Object

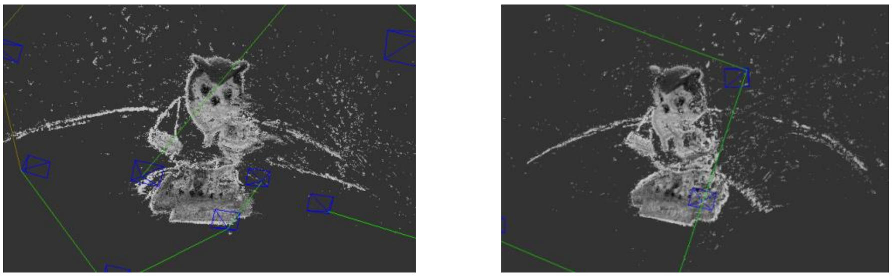

Fig 5. Experiment 2. Result.

REFERENCES

1. LSD-SLAM: Large-Scale Direct Monocular SLAM / J. Engel, T. Schöps, D. Cremers. // European Conference on Computer Vision (ECCV). – 2014.