Benchmarking Cameras for OpenVSLAM Indoors

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About this work

- **Help** to select the **type of camera** to use for an **indoor localization**
- Quantitative **evaluation** of localization within **pre-built** map using **OpenVSLAM** with various cameras

RGB-D

Microsoft
Azure Kinect

Stereo RGB-D

IntelRealSense
D435i

Stereo Fisheye

IntelRealSense
T265

360°

Ricoh
Theta S

Experimental setup: cameras

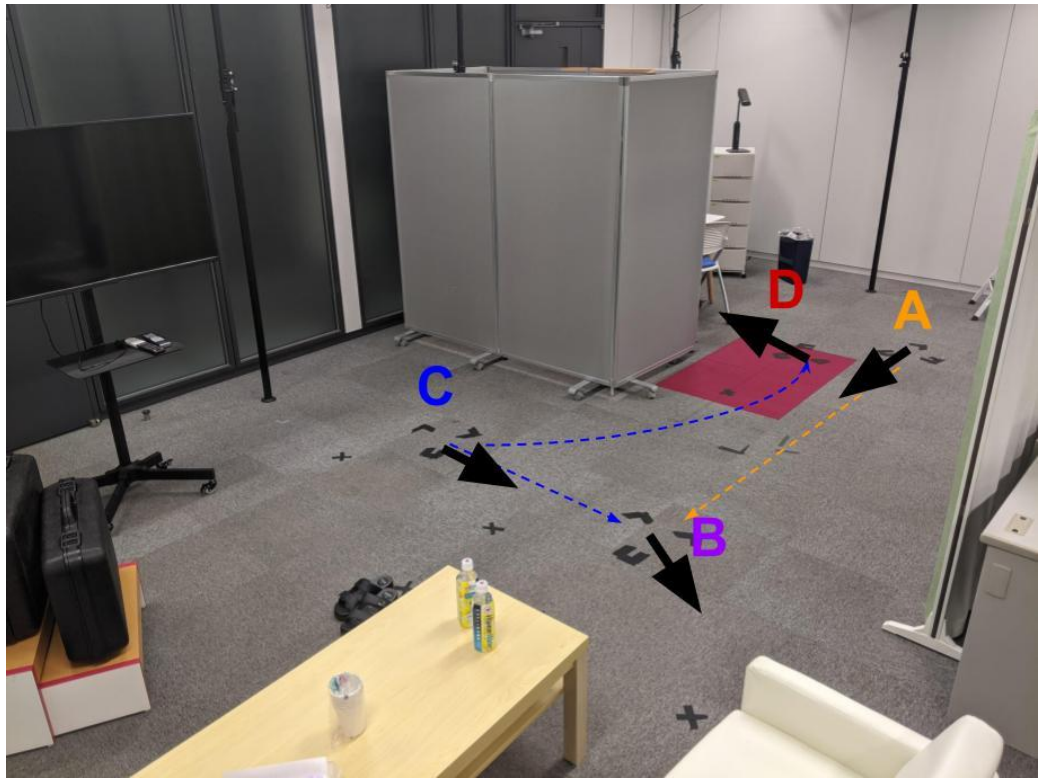
- Allows recording of images in **one-go**
- **Same trajectory** for every camera, up to a constant rigid transformation
- IR camera/markers motion capture for **ground truth**: 3D position and orientation

Multi-camera rig

Experimental setup: environment

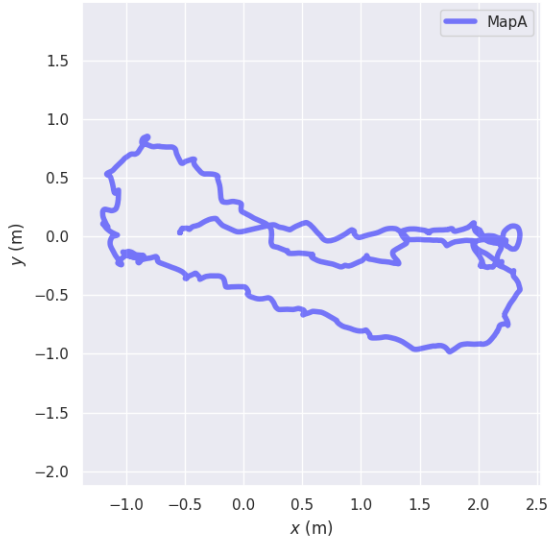
- Two spaces connected by a "corridor" in a motion capture room with **13 IR cameras**
- **Poses** defined on the ground as: **A**, **B**, **C** and **D**
- Considered **paths**:
  - **A** to **B**
  - **C** to **B**
  - **C** to **D**

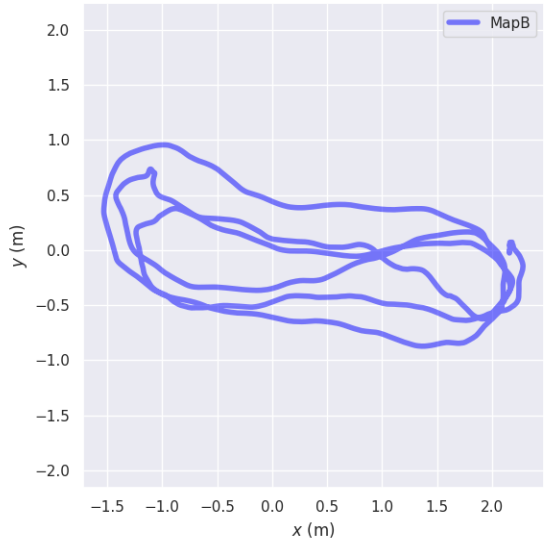
House/Office environment

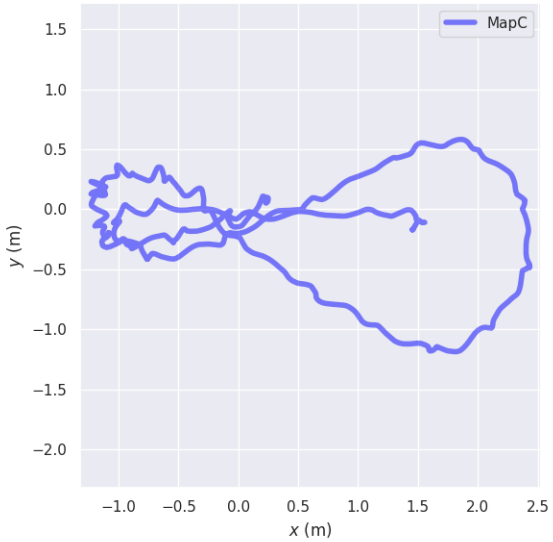


Data acquisition: mapping

- Several mapping of the same environment by moving the cameras rig on **various paths**
- The estimated trajectory accuracy allows selecting the **most reliable** map for localization







Data acquisition: localization

- Acquisition repeated **3 times** at static poses: **A**, **B**, **C** and **D**
- Acquisition repeated **3 times** for each path **A** to **B**, **C** to **B** and **C** to **D**
- Repeat these steps for various scene states:
  - **Nominal**
  - **Lighting changes**
  - **Scenery changes**
- Total of **21** datasets per camera

Scene changes: Scenery

Before **After**

Evaluation with OpenVSLAM

- Compare estimated trajectory to the ground truth with the **evo** framework
- Absolute Pose Error (**APE**): global accuracy/consistency
- Relative Pose Error (**RPE**): local accuracy/drift per frame
- Localization rate (**%**): percentage of estimated trajectory

Concluding results

Global Accuracy
thanks to
depth information

Local Accuracy
thanks to framerate
and Field-of-View

Localization Rate
thanks to
Field-of-View

Best trade-off based on evaluation criteria in
indoor environment with scenery and light changes

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