



Professional **SLAM** solutions

Custom Computer Vision, Machine Learning
and SLAM software development



What is **SLAM**?

Simultaneous Localization And Mapping

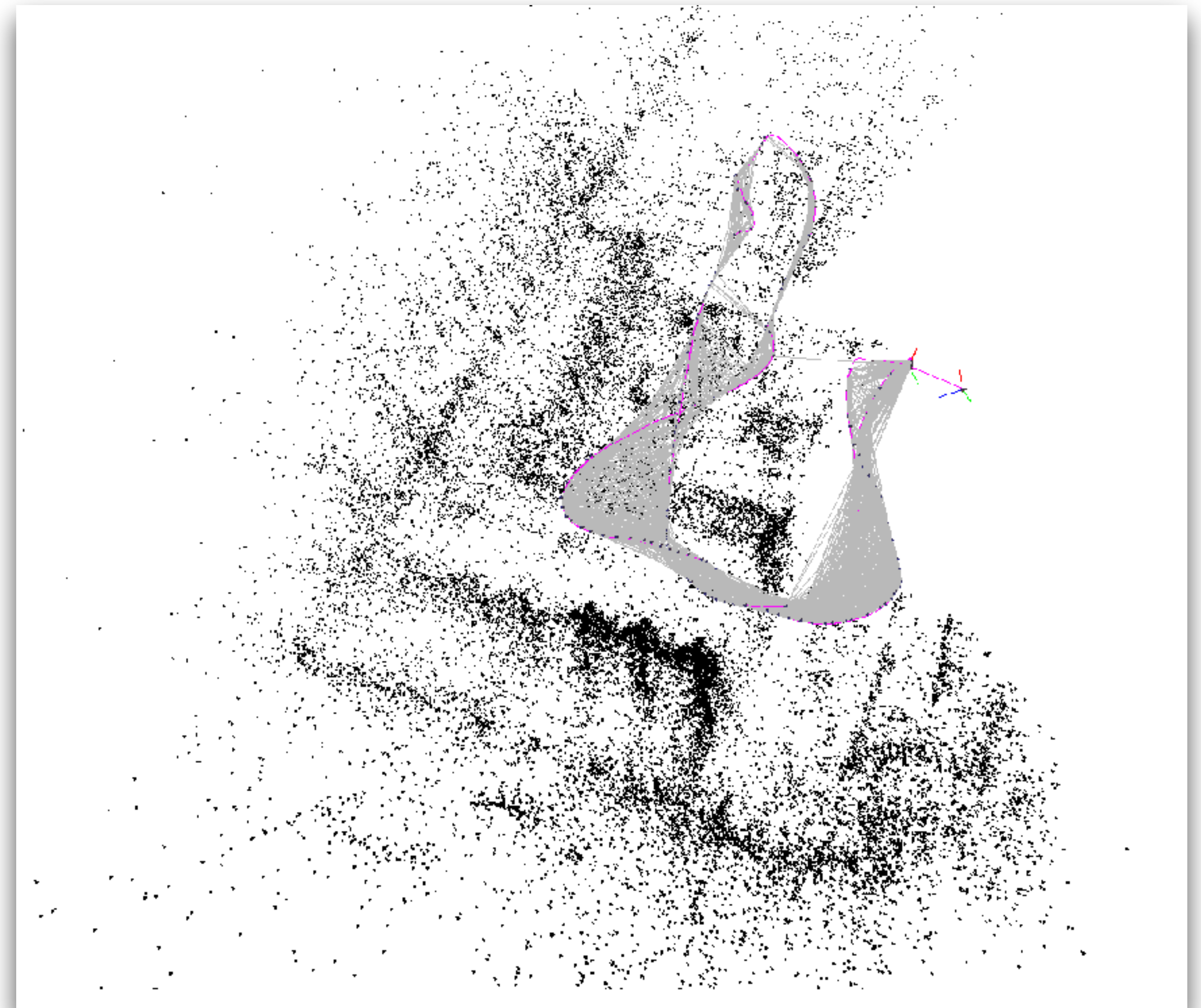
3D point cloud to create a constantly improving map of environment while localizing the device and its trajectory

Solving problems:

- Environmental mapping(sparse or dense)
- Relocalization in an existing map
- Precise 6DoF tracking

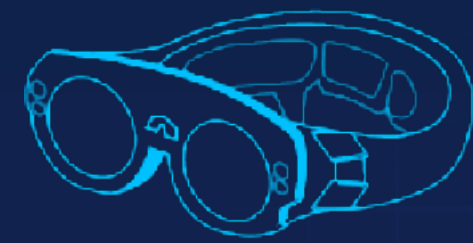
Dioram main tech is **visual-inertial SLAM**:

No expensive lidars just vision cameras + IMUs



Who does **need** SLAM?

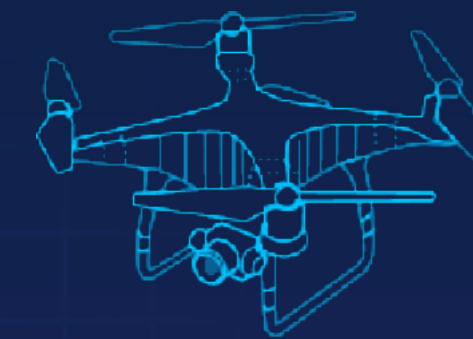
Dioram SLAM tech, research and custom developments could benefit a variety of markets



AR/VR/XR

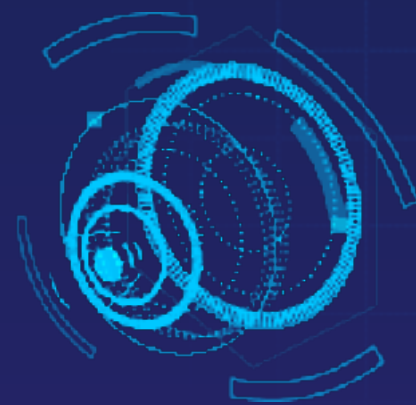


NEXTGEN SLAM TECH

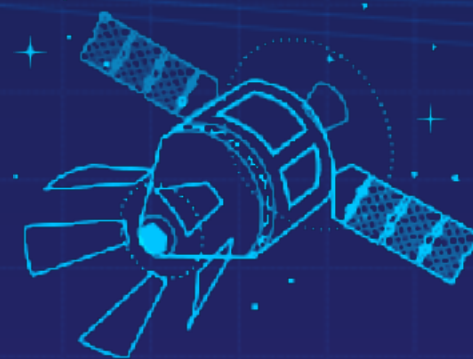


DRONES

**Demos available
on demand!**

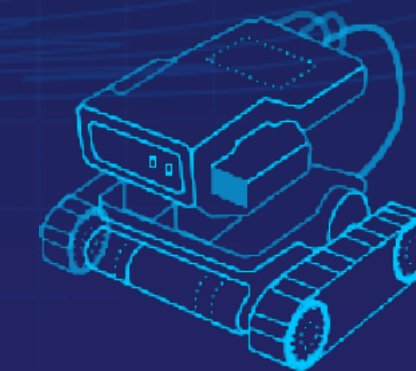


SELF-DRIVING CARS



AEROSPACE

Well, it's space!



MOBILE ROBOTICS

Why Dioram?

Nextgen 6-DoF inside-out positional tracking for hardware manufacturers in emerging markets

Improve your current SLAM to make it more accurate, robust and efficient outdoors.

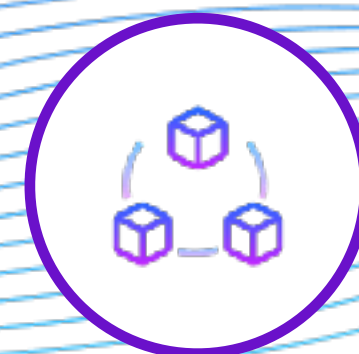
Dioram develops custom Computer Vision, Machine Learning, SLAM solutions for

AR/VR, robotics, drones and autonomous vehicles



The Science Team

World class math scientists team with unique expertise in computer vision, machine learning and algorithms



Platform independent

Dioram solutions do not lock vendors into particular software or hardware ecosystem



Affordable components

No need in expensive IMU, RGBd, lidars or Time of Flight cameras. Work outdoors or under direct sunlight



Awesome performance

Dioram Computer Vision tech outperforms all Open Source competitors. We are ready to help with tests and evaluation

Product Updates



- Completely rewritten viSLAM, which is now feature complete
- Works equally well both indoors and outdoors
- The cumulative error during long-term tracking with existing outdoor map is no more than 10 cm, indoors is no more than 1 cm. The momentary error is several times smaller.
- Support for x86, ARM, mobile platforms(Snapdragon, Xavier)
- Supports mono, stereo and multi-camera configurations
- Optional support for fusion data from lidars(WIP)
- Precise inertial-only tracking (when cameras are obscured) lasts up to 10 sec



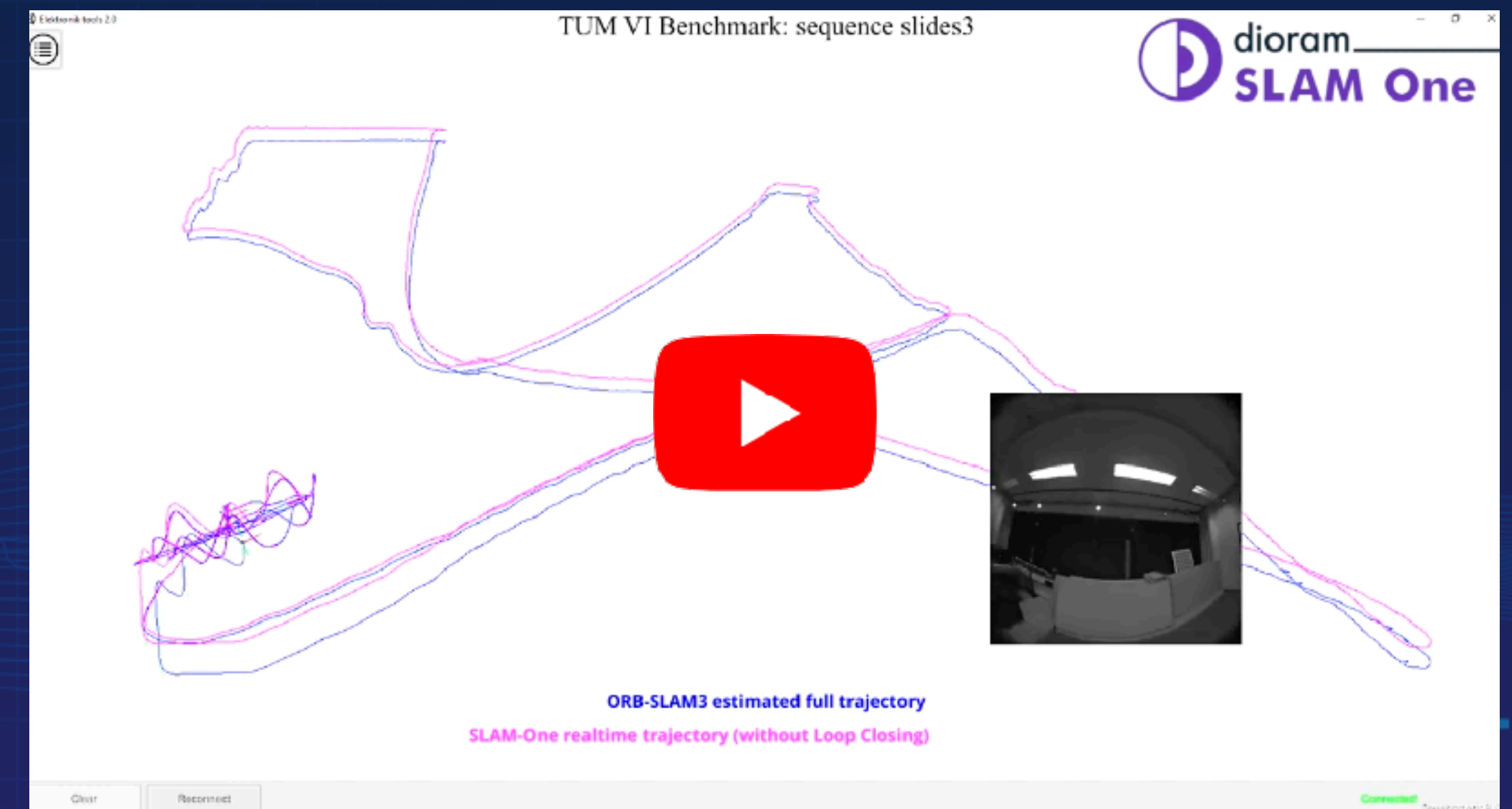
Dioram SLAM One vs ORB-SLAM3*

Video benchmark comparison using TUM** dataset, 'slides3' sequence

Benchmark results:

- Dioram SLAM One has x4 better accuracy
- ORB-SLAM3 has spiky artifacts, jitter and accumulated a significant drift on its vertical axis, while Dioram SLAM One is solid
- In a scene where vision is obstructed ORB-SLAM3 shows significant errors in trajectory, while Dioram SLAM One continues to track well with inertial data only

WATCH THE VIDEO BENCHMARK



*ORB-SLAM3(released in Summer'20) is the cutting edge viSLAM algorithm widely recognized as the best

**Technical University of Munich SLAM benchmark dataset <https://vision.in.tum.de/data/datasets/visual-inertial-dataset>

Dioram SLAM One outdoor tracking and relocalization test

Relocalization is one of most important SLAM features.

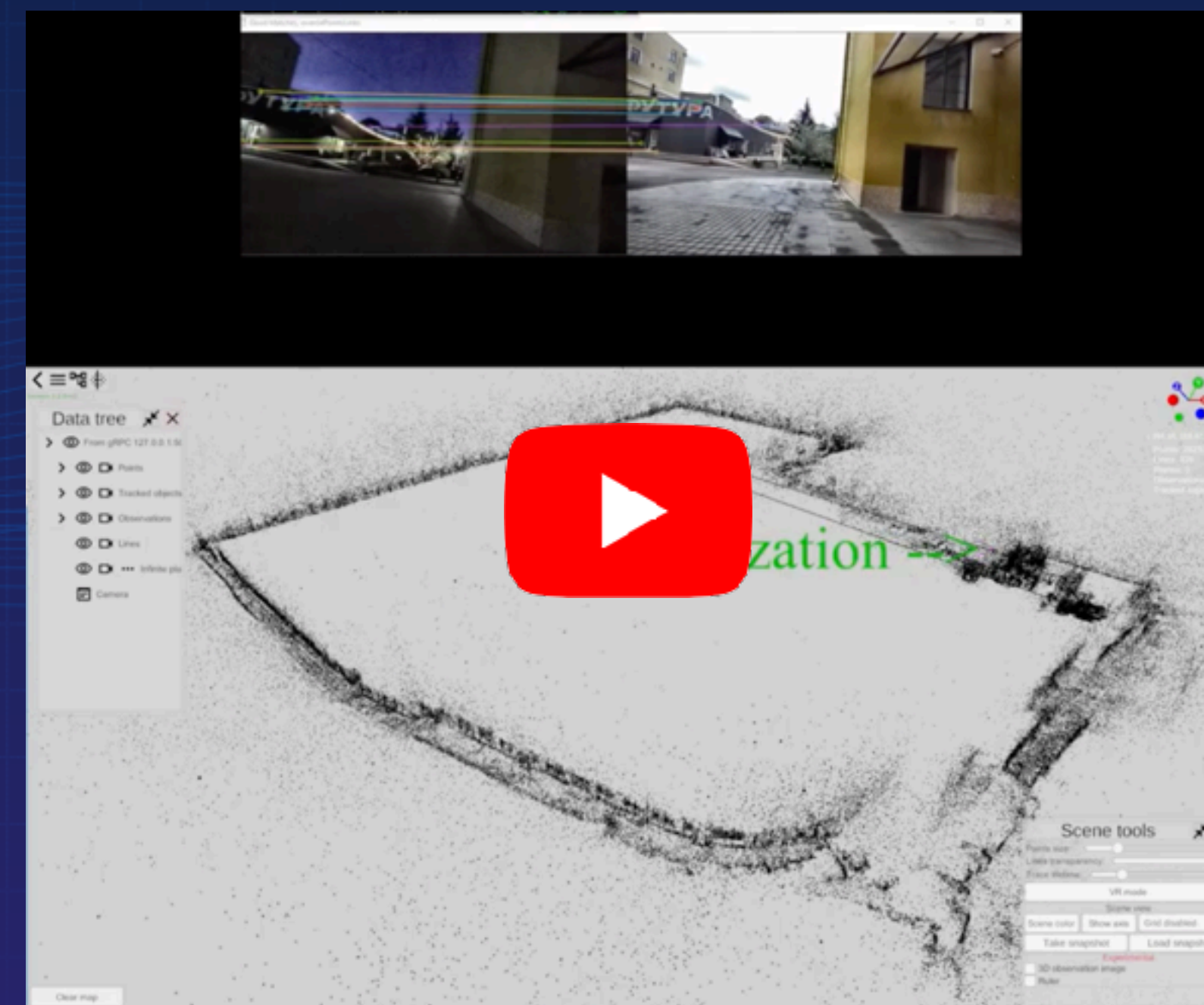
It reduces a number of SLAM maps created each time the environment changes and greatly increases accuracy

- Awesome outdoors tracking accuracy
- 2 datasets relocalization test – day, which is a basis for a main SLAM map, and a night
- Night frames are fed to the algorithm which tries to find a tracked object position in a main day-time SLAM map

Total distance(by feet): 0.94 km, total time 13m 27s

Equipment used – ZED2 stereo camera(12 cm stereo base with integrated IMU)

WATCH THE OUTDOOR VIDEO TEST



Product Updates

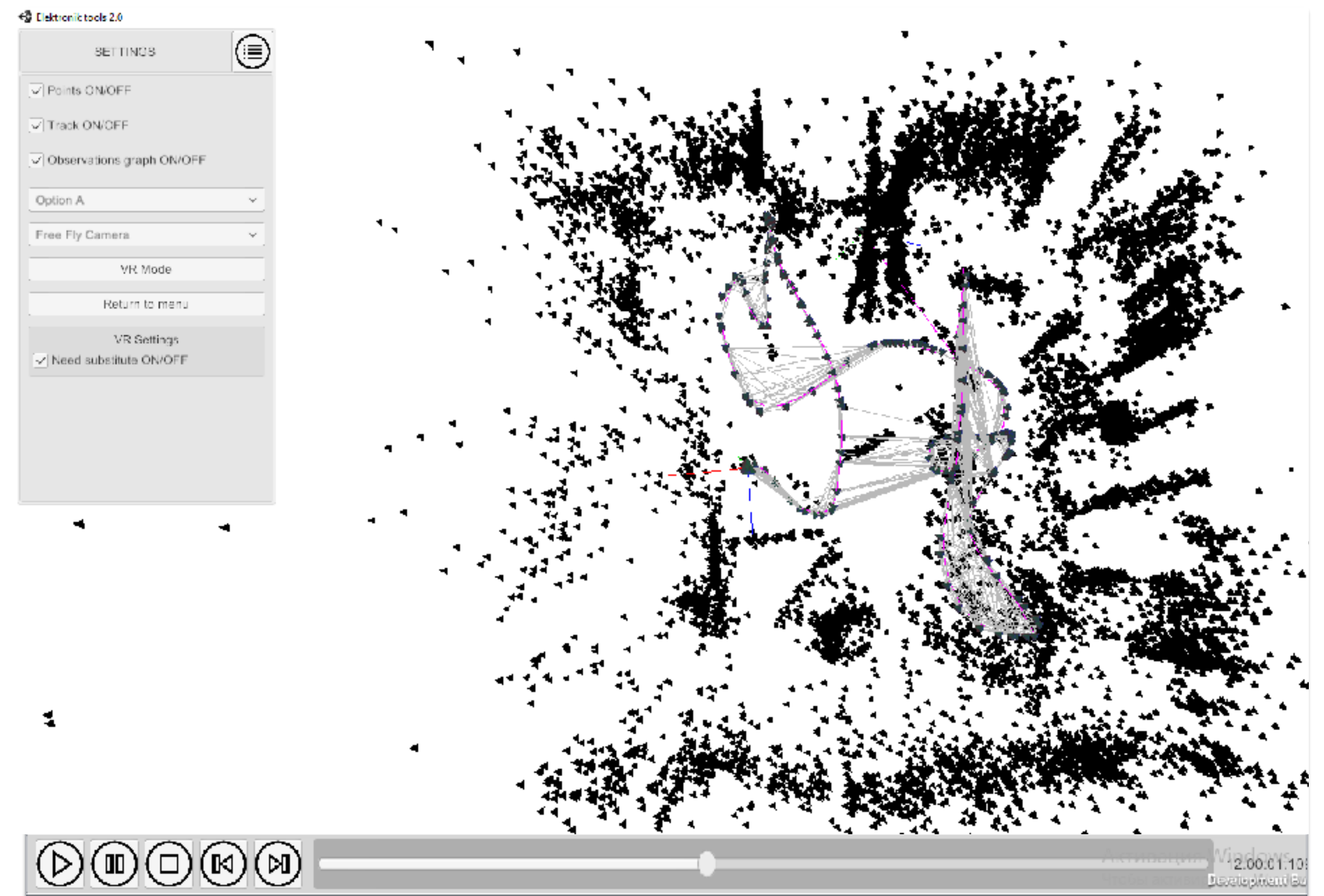


A sophisticated professional tool for SLAM, machine vision, robotics developers

- Point cloud map debugging
- Real-time processing or pre-saved maps
- Event history player
- Comparing of different SLAM algorithms
- ROS-bag and plugin support
- Meshing and 3D-reconstruction
- Scene analysis and plane detection

OPEN-SOURCE SINCE AUGUST 2019

<https://github.com/dioram/Elektronik-Tools-2.0>



Product Updates

Open-source solutions (like g2o) have problems:

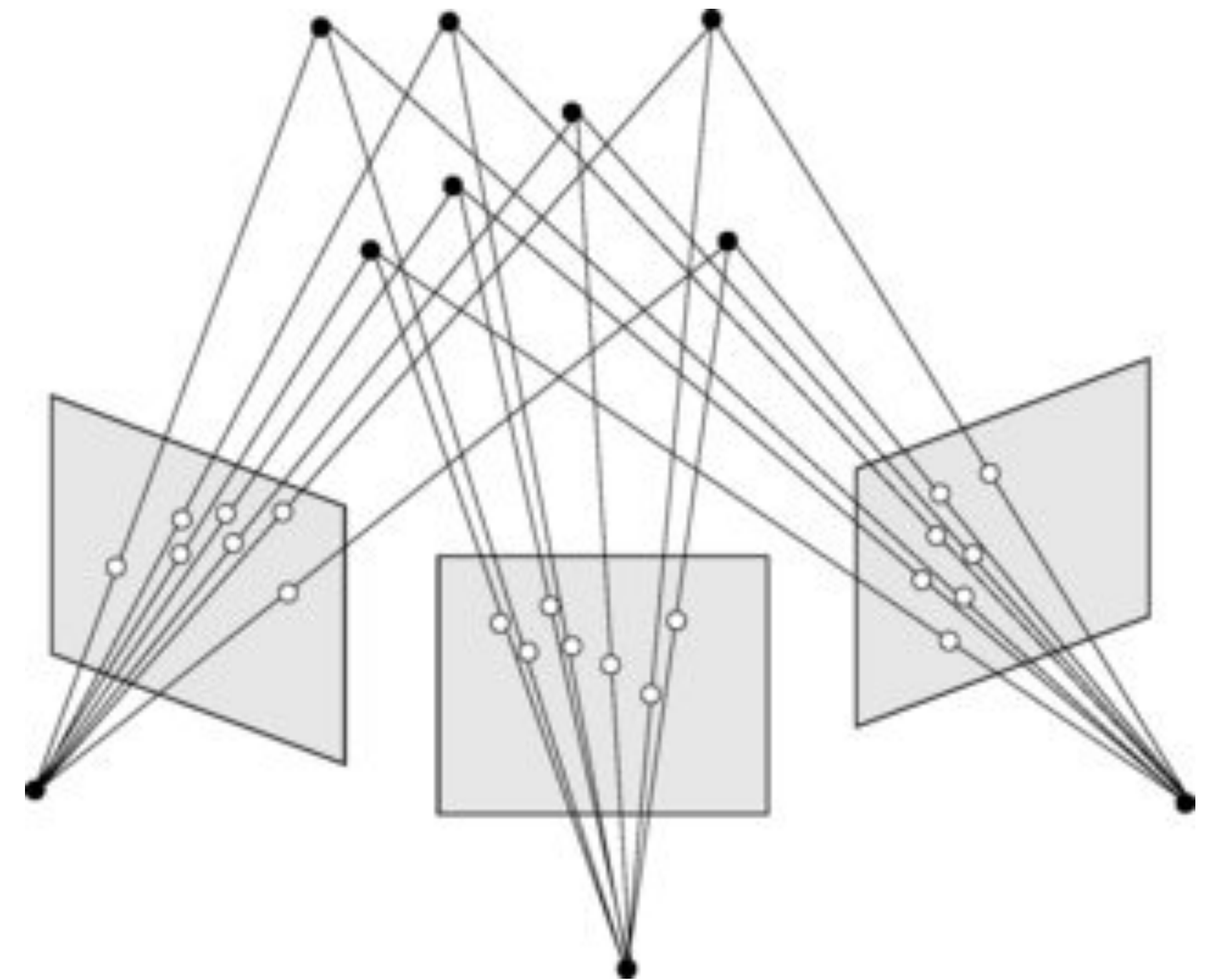
- Very general and inaccurate
- Lack Bundle Adjustment specific optimizations
- Require pre-compilation

Why Diopter?:

- Bundle Adjustment specialized – more accurate
- FASTER (like MUCH FASTER)
- Lightweight, header-only
- Flexible, easily modifiable
- Based on the latest papers, all the best features
- Depends only on Eigen



A nextgen optimization library made from scratch specifically for Bundle Adjustment



Product Updates

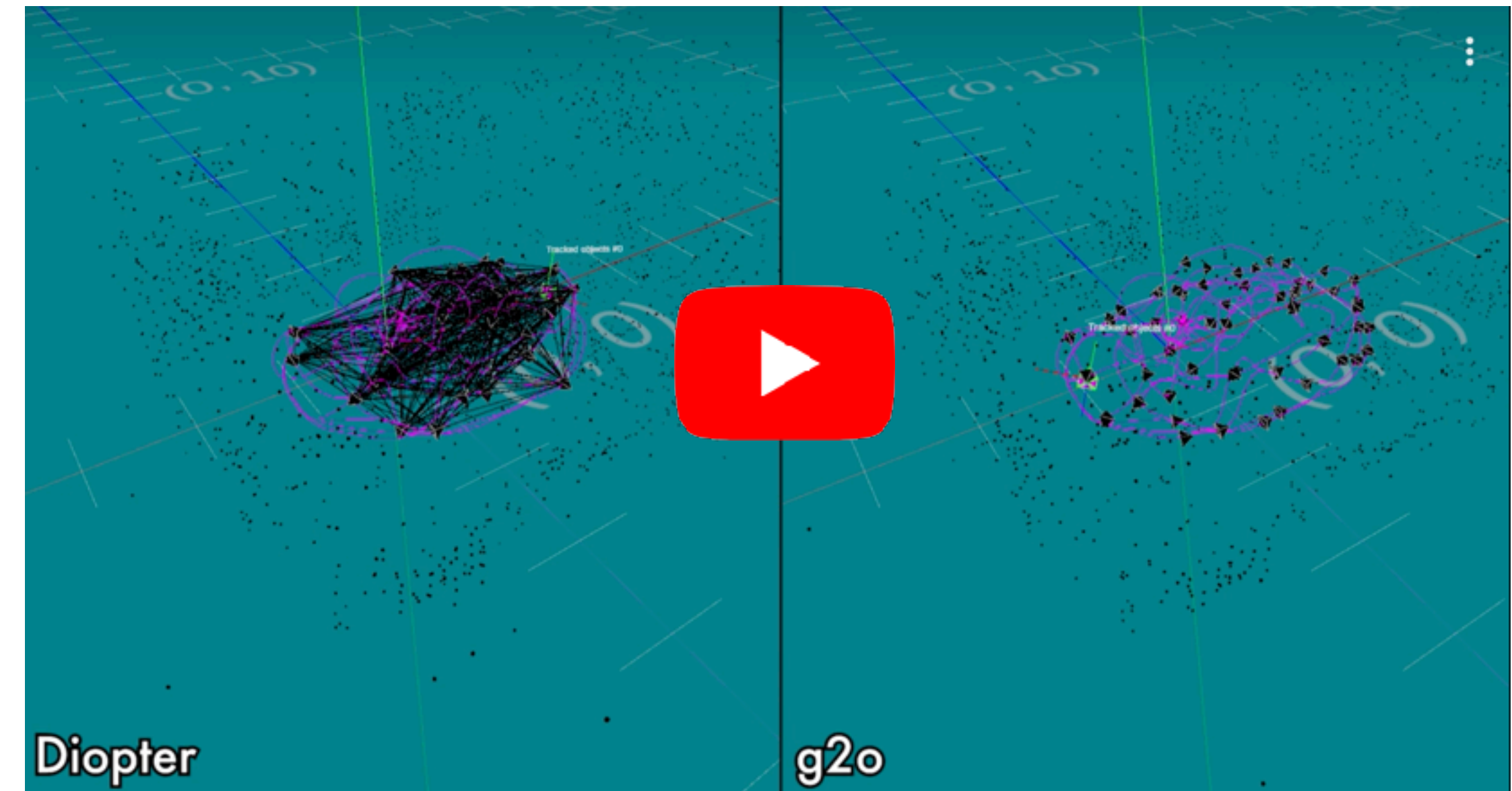


A nextgen optimization library made from scratch specifically for Bundle Adjustment

Average visual stereo SLAM performance with TUM dataset

	g2o	Diopter
BA solve time	42 ms	37 ms
PO solve time	13 ms	3 ms
Final count of observations**	90%	46%
ATE	27 mm	19 mm

** - higher BA precision leads to more landmarks being recognized and thus more redundant observations are removed, which gives a much more compact and accurate map



Product Updates

Which problems does it solve?

- Mitigates human-factor in sensors calibration by automatization
- Decreases number of mistakes in calibration and avoids performance loss
- Simplifies detection of miscalibration errors

Solution of these problems is crucial for autonomous vehicles and mobile robots

Features:

- Based on Dioram SLAM One framework
- Detects problems with sensors configuration and calibration in realtime
- Detects a-sync between cameras and IMU
- Auto-calibration of extrinsic parameters

dioram
Calibration Toolbox

An unique tool for Computer Vision-based hardware products prototyping and R&D pipeline



Product Updates

- Visual-inertial Dioram SLAM One for point cloud mapping and localization
- No expensive lidars!
- R&D is started to develop full-stack software architecture for Rover-style mobile robots (our own obstacle map, route planning and vision segmentation)
- Additional equipment: ZED2 computer vision camera + HTC Vive tracker for Ground Truth



Delivery robot prototype for R&D and demonstration



Product Updates



Topological navigation in a city without GPS just with visual-inertial SLAM

GPS is great but isn't really reliable tech:

- Prone to spoofing
- Isn't precise enough, RTK is expensive
- Problems in tunnels and downtown

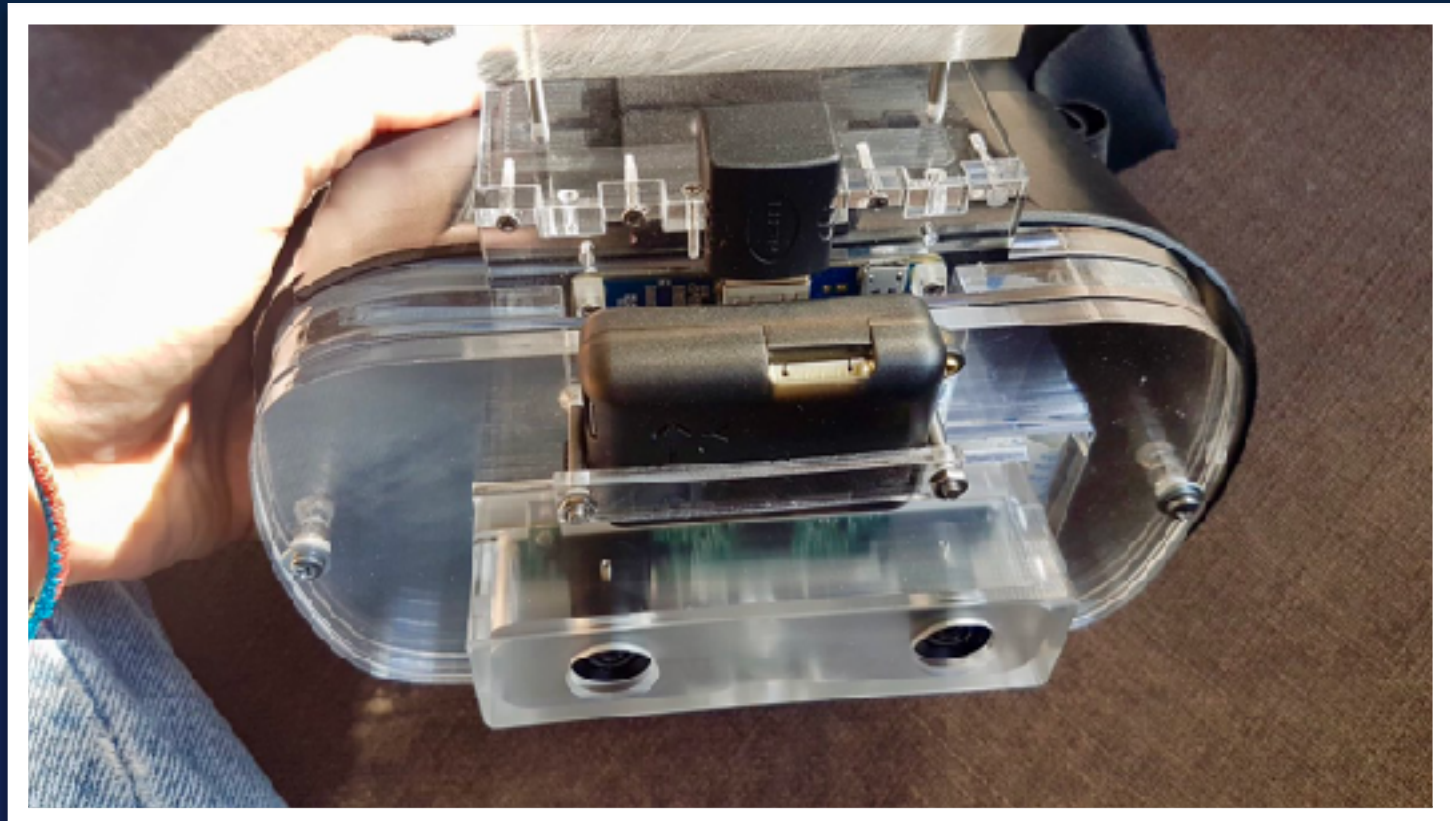
Dioram SLAM One solves these problems for autonomous vehicles and delivery robots

VPS is an option for global landmarks anchors



Dioram SLAM One VR Prototyping

VR-headset for testing and demos



The founding team



10+ team including high-level math scientists and C++ developers

BUSSINESS



Alex
Mentor

19+ years in IT. Founded 10 companies with 500+ employees, combined revenue \$200m/year
ADTech, VR/AR, Bisdev



Vas
CEO

12+ years in IT-management
ex. CEO CoinKeeper
ex. Pre-seed VC fund i-Free
B2B bisdev, VR/AR, mobile

SCIENCE



Oleg
Head of Science

Ph.D (ITMO University)
12+ years in CV/ML R&D
Academic publishing and patents



Nick
CTO

8+ years in industrial development
Academic publishing

STRATEGY

OPERATIONS

Key competence as a team

Full cycle R&D management.
Custom and outsourcing development.

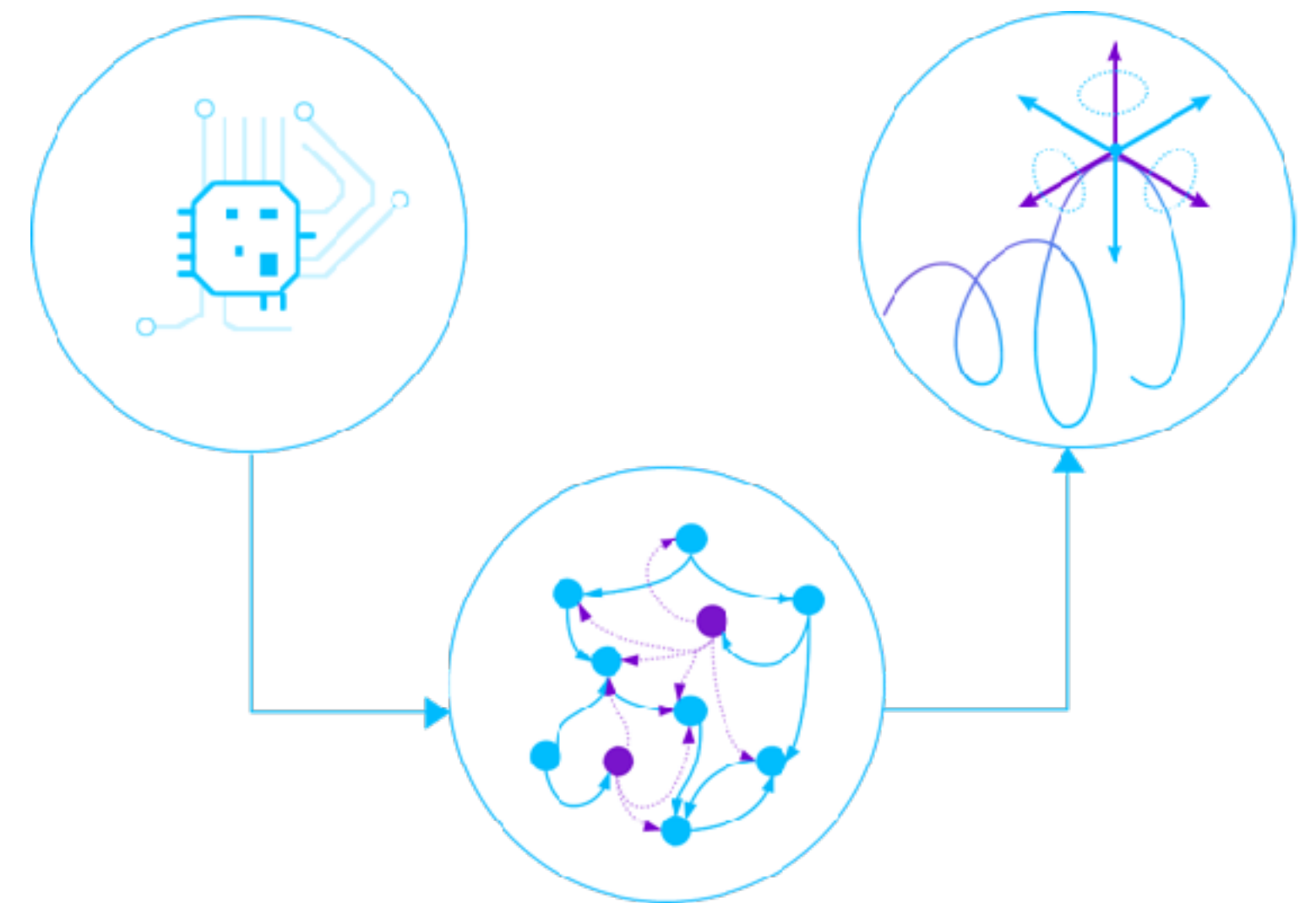
On demand cutting edge research meeting the
highest-level needs of partners.

Dioram develops Computer Vision, Machine Learning,
SLAM solutions for AR/VR, robotics, biotech, autonomous
vehicles and other emerging markets.



Possible projects for **custom software development**

- Visual-inertial or lidar SLAM, localization, tracking and mapping
- Point clouds generation and analysis
- Calibration of visual and inertial sensors
- 3D reconstruction, meshing, photogrammetry
- Mixing of multimodal data from different sensors, signal processing
- Visual segmentation, SDKs for AR/VR/XR
- Architecture of autonomous systems - obstacle maps, decision making, navigation
- Visual control systems, e.g. for unmanned systems
- Route and job planning
- JUST NAME IT!..

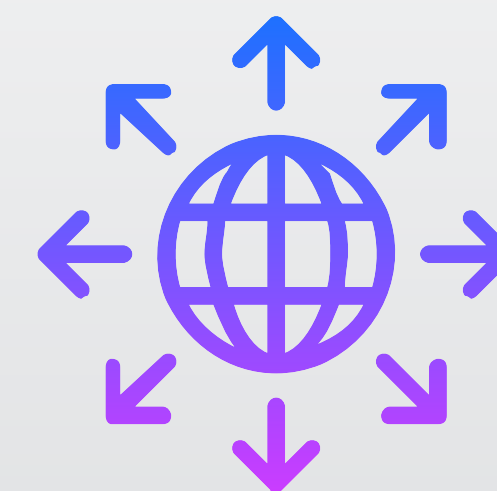
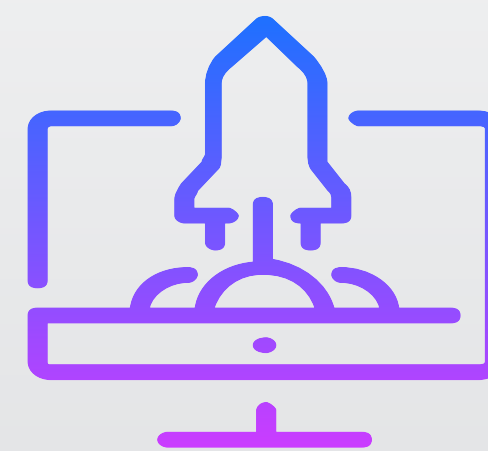


What is our goal?

Our dream is to scale out the technology and to bring it to millions of people,
improving their experience all over the world

This is a big and dangerous journey which better not to take alone

This is why we plan to join a global tech company via M&A deal



We love problems — one gets fame by solving them

 dioram is ready to take any challenge our partner needs to overcome

Our team can do **anything** in fields of **Computer Vision** and **Machine Learning**

