GRAZPER

GRAZPER

Master thesis proposals

About Grazper

- Our primary system, Realm3D is a **multi-camera** setup for **real time 3D pose estimation**.
- For each camera we output multi-person 2D pose estimation.
- 2D pose estimates are gathered and combined to form a 3D pose estimate.
- This is possible because cameras are precisely synchronized and calibrated.
- Networks are trained on a dataset made with 16 cameras and multiple subjects recorded in our in-house recording studio.

Key challenges

- Improving quality of the dataset.
- Calibration.
- Using the real time 3D poses in other applications.
- Improving 3D tracking.
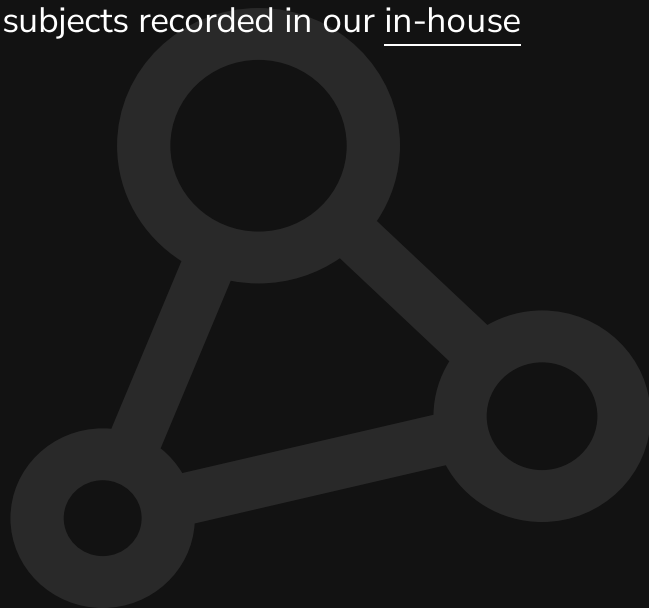
What we are looking for

- Motivated ambitious student looking for a master thesis project/internship.

- Interested in solving real-world computer vision problems using cutting edge tools and state of the art models.

- Opportunity to work on cutting edge technology within **computer vision** and **machine learning**.

- Experience in Python coding.

- **Mentorship** by experienced engineers.

- Unique **dataset** for 2D and 3D pose estimation.

- Unique **recording studio** with 16 synchronized cameras.

- Send us your CV and proposition here!

Suggested research topics

Automatic calibration

- Cameras need precise calibration but sometimes get moved accidentally.

- Design a system to identify when a camera is no longer calibrated.

- Recalibrate automatically using features in the scene.

Key technologies

- Camera calibration.

- Classical computer vision.

- Photogrammetry.
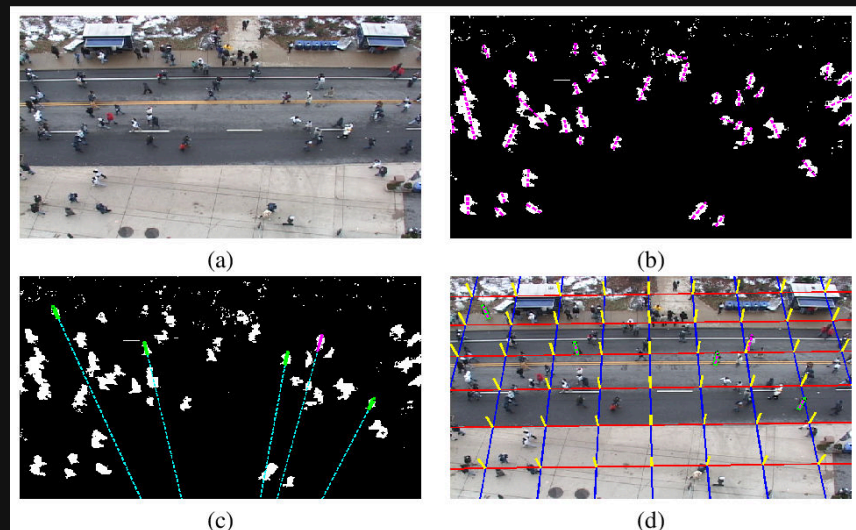
Liu, Jingchen et al. "Surveillance Camera Autocalibration based on Pedestrian Height Distributions." (2011).

Automatic 3D annotation

- Dataset consists of videos from 16 camera angles, annotated with 3D poses.
- Annotation can be performed automatically by first performing 2D pose and then combining information from all angles.
- Improve annotation system for robust estimation and efficient global optimization.

Key technologies

- Numerical optimization.
- Statistical modeling.
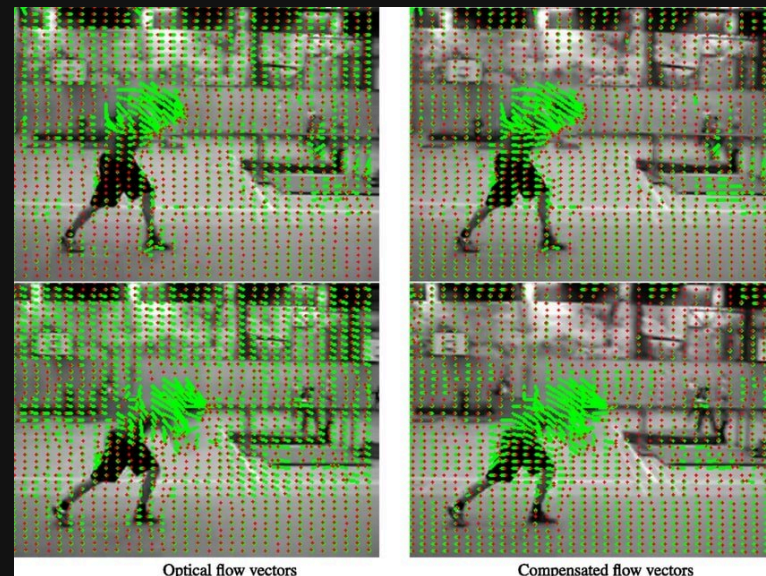- Mathematical modeling.

Optical flow tracking

- Grazper has an annotation tool for manually annotating our in-house dataset.

- Incorporate optical flow into our existing tool.

- Improvements based on the specific domain of the dataset.

Key technologies

- Optical flow.

Optical flow vectors   Compensated flow vectors

Jain, Mihir & Jégou, Hervé & Bouthemy, Patrick. (2015). Improved Motion Description for Action Classification.

Advanced 3D tracking algorithms

- Grazper currently uses a Kalman filter for 3D tracking (turning 2D poses into 3D poses).

- Experiment with advanced tracking algorithms such as particle filters or neural network-based trackers.

- Incorporate natural priors.

- Make high performance implementation.

Key technologies

- Particle filters.

- Machine learning.

- Mathematical modeling.
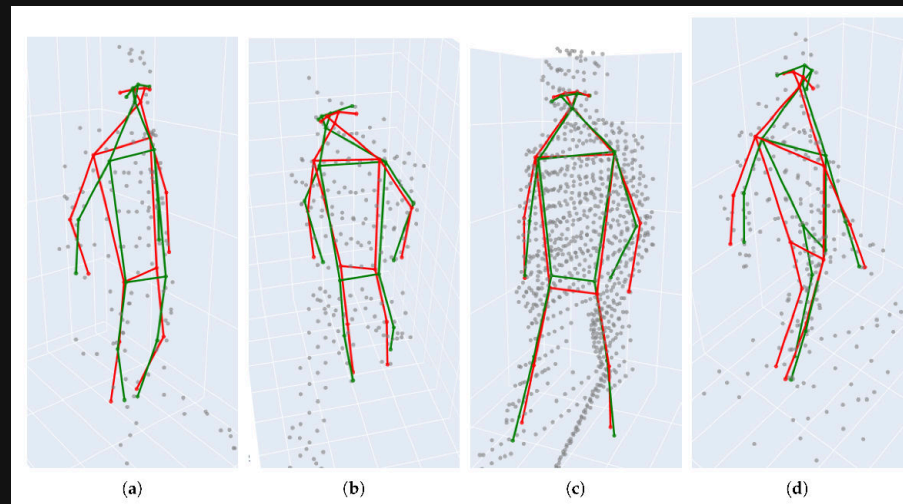
Kovács, L.; Bódis, B.M.; Benedek, C. LidPose: Real-Time 3D Human Pose Estimation in Sparse Lidar Point Clouds with Non-Repetitive Circular Scanning Pattern.
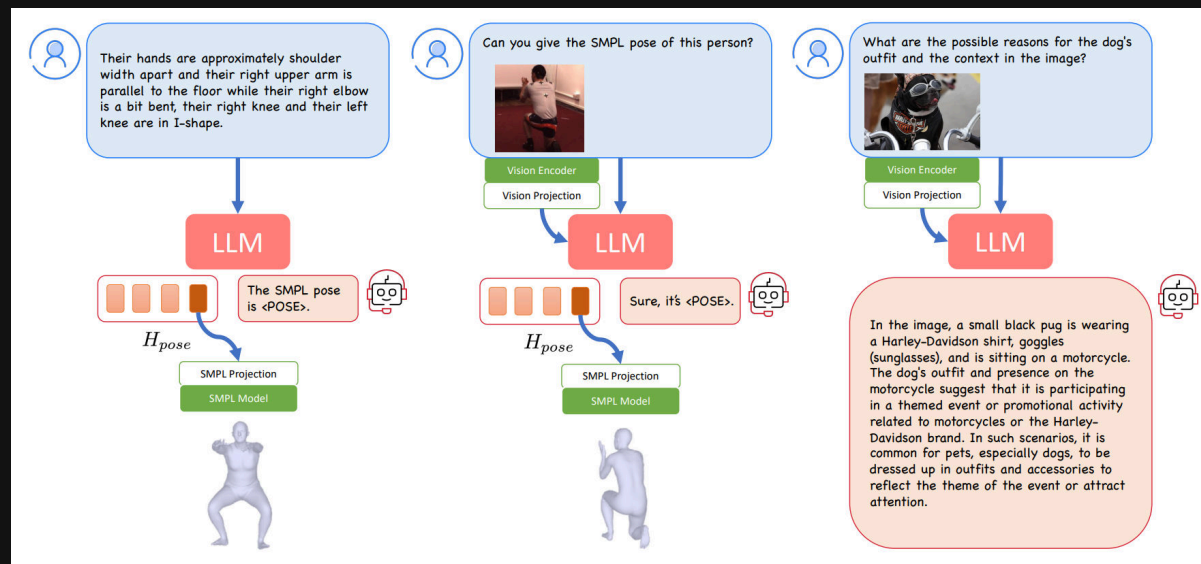
Human poses and LLMs

- Combine LLMs and human poses.
- Train on publicly available data.

Key technologies

- LLMs.
- Machine learning.
- Transformers.

Yao Feng, Jing Lin, Sai Kumar Dwivedi, Yu Sun, Priyanka Patel, Michael J. Black ChatPose: Chatting about 3D Human Pose
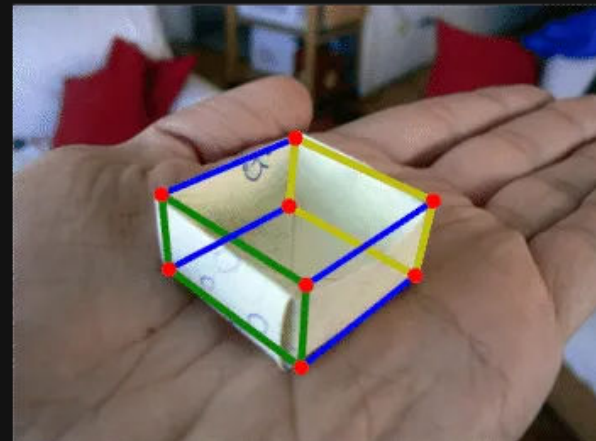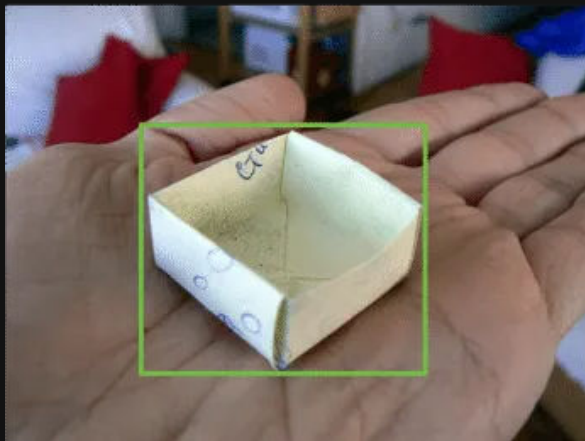
3D object detection

- 3D object detection and tracking.

- Apply existing techniques to our specific domain.

Key technologies

- Detection and segmentation models.

- Computational geometry.

Debidatta Dwibedi, Tomasz Malisiewicz, Vijay Badrinarayanan, Andrew Rabinovich Deep Cuboid Detection: Beyond 2D Bounding Boxes

Monocular 3D tracking

- Monocular (single camera) 3D pose estimation models lack absolute coordinate information.

- Use natural priors to obtain absolute coordinates of monocular 3D pose estimates.

Key technologies

- Pose estimation.

- Machine learning.

Luvizon, Diogo & Picard, David & Tabia, Hedi. (2022). Consensus-Based Optimization for 3D Human Pose Estimation in Camera Coordinates.
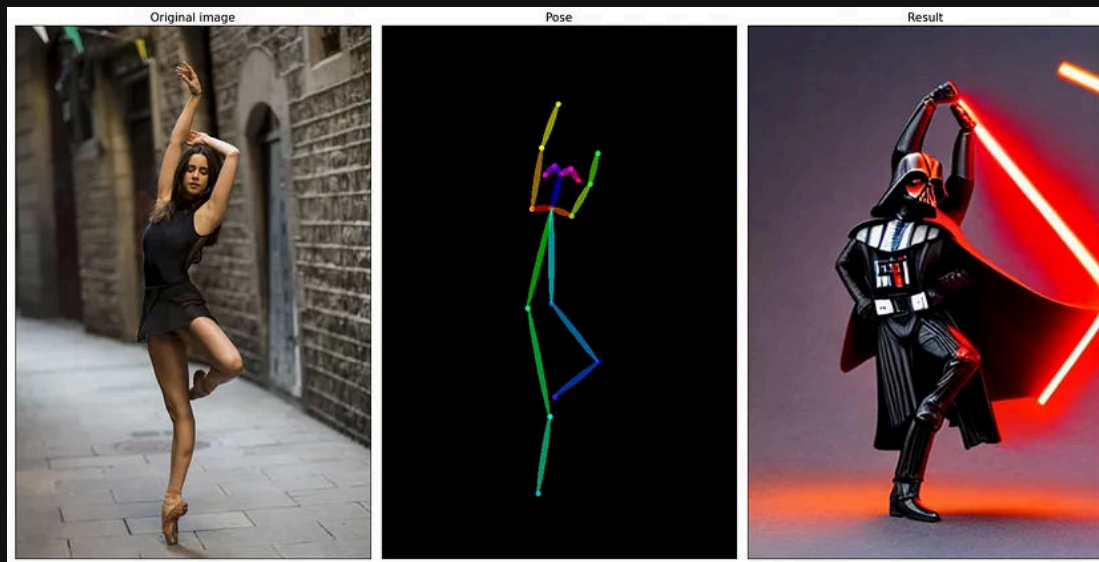
Generative AI dataset augmentation

- Dataset has limited number of characters and always same background.

- Investigate how we can use diffusion models with our existing dataset.

Key technologies

- Generative AI.

- Diffusion models.

- Machine learning.

Daddy Makers' blog on ControlNet, a generative AI-based text-to-video tool

You decide!

- If you have an exciting idea for a master thesis project that you think fits in well with our company, don't hesitate to tell us!