KARLO KOLEDIĆ

Computer Vision and Robotics Researcher

🌐 koledickarlo.github.io   ✉ kkoledic@gmail.com

📍 Zagreb, Croatia   in linkedin.com/in/kkoledic/

RESEARCH INTERESTS

I am a researcher working at the intersection of computer vision and robotics, with focus on 3D perception. I throw novel deep learning architectures such as Transformers or Diffusion at traditional robotics problems, including SLAM, 3D reconstruction and sensor fusion

EXPERIENCE

Researcher
Faculty of Electrical Engineering and Computing

March 2021 – Present
Zagreb, Croatia

- Developed a novel monocular visual odometry algorithm, fusing self-supervised depth estimation with traditional epipolar geometry optimization Outperforms all state-of-the-art methods on the KITTI dataset.
- Created a novel monocular depth estimation method, solving a long-standing problem of generalization for arbitrary camera parameters. Approach uses diverse simulation data and adversarial domain adaptation
- Conducting research on diffusion based generative neural fields for surround-view autonomous driving scenes
- Coursework: Estimation Theory, Autonomous Mobile Robots, 3D Vision, Sensors and Perception in Robotics
- Creating and conducting exams and exercises, mentoring students during projects and master theses

Junior R&D Engineer
Visage Technologies AB

August 2020 – March 2021
Zagreb, Croatia

- Researched and developed various Extended/Unscented Kalman filter methods for state-constrained estimation
- Worked in an autonomous driving team focused on multiple object tracking for a major automobile company.

Computer Vision Intern
RealNetworks, Inc.

July 2018 – July 2019
Zagreb, Croatia

- Implemented face detection/face recognition networks in native CUDA/cuDNN/cuBLAS code. Achieved a 2.5 times faster performance than the TensorFlow CUDA implementation
- Implemented face detection algorithm for Android NDK using TensorFlow Lite
- Research on various frequency and movement based techniques for face liveness detection
- Generated synthetic data in MakeHuman/Blender and implemented a face pose estimator in TensorFlow

EDUCATION

Ph.D. in Electrical Engineering and Computer Science
University of Zagreb

Feb 2022 – Present

M.Sc. in Electrical Engineering (Robotics)
University of Zagreb

Sep 2018 – July 2021

- Thesis: Visual-inertial Odometry based on Factor Graph Optimization

Student exchange
Politecnico di Milano

Sep 2019 – July 2020

B.Sc. in Computer Science
University of Zagreb

Sep 2015 – July 2018

- Thesis: Detection and Classification of Teeth in Panoramic X-ray Images Using Faster-RCNN Architecture

SKILLS

Programming: Python, C++, Java, MATLAB, bash
Software: Linux, Git, Docker, Numpy, PyTorch, TensorFlow, CVX, ROS, OpenCV, CUDA, LaTeX, Eigen, gtsam
Computer Vision: Monocular/Stereo Depth Estimation, Domain Adaptation, Multi-view Geometry, Diffusion, Transformers, Gaussian Splatting, NeRF
Robotics: Sensor Fusion, Visual Odometry, SLAM, Nonlinear Optimization, Model Predictive Control
Languages: Croatian (native), English (C1-C2), German (B1)

PUBLICATIONS

GenDepth: Generalizing Monocular Depth Estimation for Arbitrary Camera Parameters via Ground Plane Embedding
Karlo Koledić, Luka Petrović, Ivan Petrović, Ivan Marković
under review in International Journal of Computer Vision (**IJCV**)

MOFT: Monocular Odometry based on Deep Depth and Careful Feature Selection and tracking
Karlo Koledić, Igor Cvišić, Ivan Marković, Ivan Petrović
2023 International Conference on Robotics and Automation (**ICRA**)

Towards Camera Parameters Invariant Monocular Depth Estimation in Autonomous Driving
Karlo Koledić, Ivan Marković, Ivan Petrović
2023 European Conference on Mobile Robots (**ECMR**)

PROJECTS

F1tenth autonomous racing: Development of Model Predictive Contouring Control algorithm for autonomous racing,
4th fastest time at **IROS 2020**
UWB/IMU sensor fusion: Trajectory estimation during sport activities. Fusion via factor-graph optimization in gtsam
Multi-robot search and rescue: POMDP-based algorithm with consensus message communication in ROS

TEACHING AND MENTORING

Created topics and mentored students on 7 bachelor theses and 9 master theses. Topics include Gaussian Splatting SLAM, Conditional NeRFs, Surround-view Depth Estimation, MPC for autonomous racing, Direct Visual Odometry
Modernized and introduced novel lab exercises for multiple courses:

- Autonomous Mobile Robots – **EKF-SLAM algorithm**
- Estimation Theory – **Cramér–Rao bound analysis**
- Sensors and Perception in Robotics – **Feature detection and optical flow, Camera calibration**

AWARDS

Rector's Award for best project
Dental State Estimation using Deep Learning

- Analyzed dental images to predict biological traits with the accuracy of 98% and age with a median error of 3 years.
- Assessed dental state via object detection and classification