A Method of Calculating Odometers based on SLAM with Binoplastic Vision

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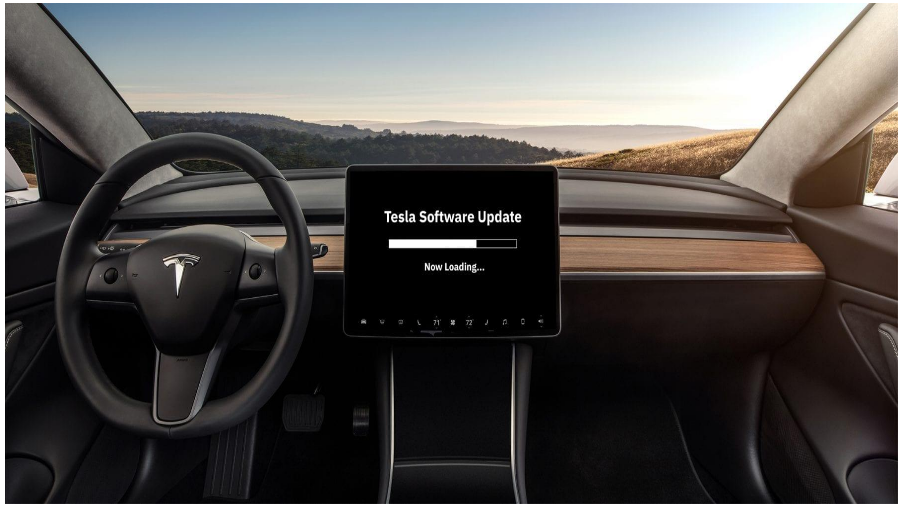
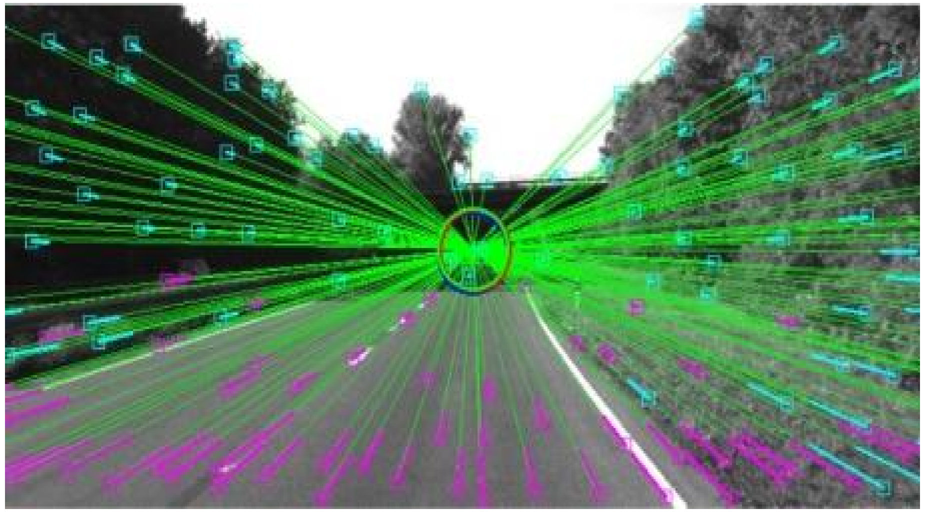
Summary

- The automotive industry is in an era of change, and the development of autonomous driving related technologies has huge market potential. Navigation and positioning is important for automatic driving in cities. Visual positioning is a key part of mobile robots and automatic driving, providing rich information at low cost.
- We reviewed papers to understand algorithms for autonomous navigation:
  - Stereo Visual Odometry for Road Vehicles Based on a Point-to-Epipolar-Line Metric & Legged Locomotion in Challenging Terrains using Egocentric Vision
- We plan to use the KITTI2015 and Middlebury Stereo dataset for model training. The former contains a rich real traffic environment data, while the latter collect mainly indoor environment data.
- We are going to propose currently the highest-ranking algorithm on the KITTI score-board: SOFT2.
- We decided to evaluate our method based on the following variables:
  - Misclassification rate, Precision and recall, Calculate F1, ROC curve, ROC_AUC, and k-fold cross-validation.

Problem

Navigation of automatic driving based on visual positioning





Navigation and positioning is important for automatic driving in cities.

Previous method mostly rely on the **fusion of sensor** such as IMUs and cameras, LIDAR and millimeter-wave radar which each part's data should be percise.

Visual positioning is a key part of mobile robots and automatic driving, providing rich information at low cost.

Reading to Examine

- SLAM algorithm
- Public dataset of road vehicle

  e.g. KITTI-360 dataset,Oxford Robotics Car dataset
- Stereo Visual Odometry

- Reference:

Cvisic, Markovic, I., & Petrovic, I. (2022). SOFT2: Stereo Visual Odometry for Road Vehicles Based on a Point-to-Epipolar-Line Metric. IEEE Transactions on Robotics, 1–16. https://doi.org/10.1109/TRO.2022.3188121

Agarwal, Kumar, A., Malik, J., & Pathak, D. (2022). Legged Locomotion in Challenging Terrains using Egocentric Vision. arXiv.org.

Data

- We plan to use the following dataset for model training:
  - KITTI 2015: Real traffic environment for autonomous driving.
  - Middlebury Stereo Datasets: Indoor environment data for stereo matching and depth estimation.

Method

SOFT2: currently the highest-ranking algorithm on the KITTI score-board.

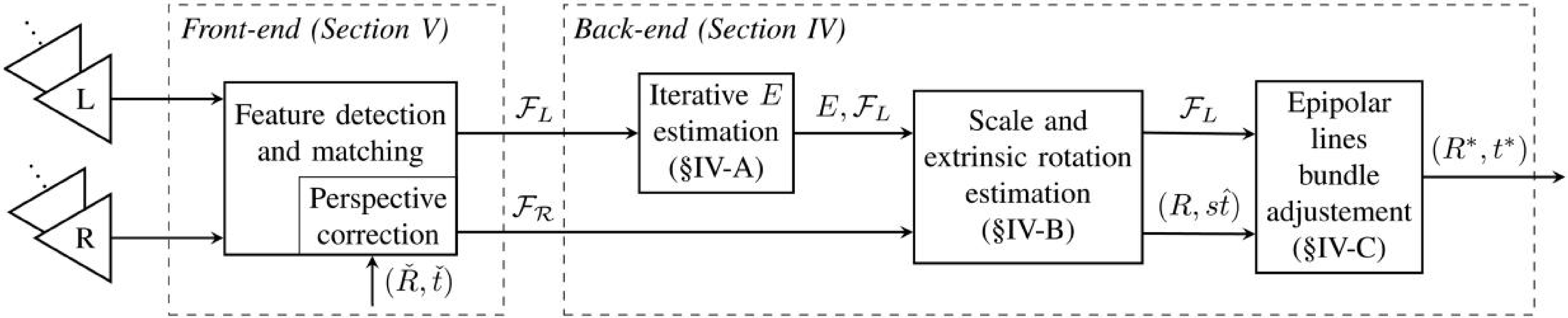


Fig. 2. Pipeline of the proposed stereo odometry approach. Triangles represent left and right cameras (L and R), respectively.

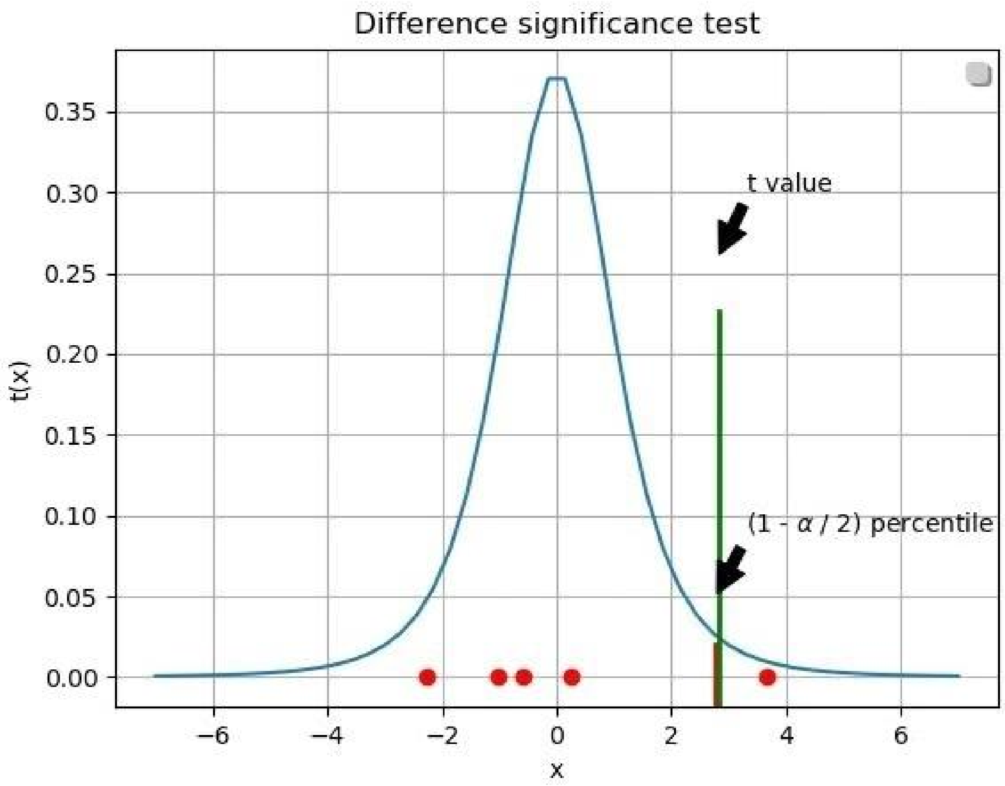
SOFT2 relies on the constraints imposed by the epipolar geometry and kinematics.

Method

- Minimize point-to-epipolar-line distances.
- Propose to jointly estimate the absolute scale and the extrinsic rotation of the second camera in order to alleviate the effects of varying stereo rig extrinsics.
- Smooth the motion estimates in a temporal window of frames by using the proposed epipolar line bundle adjustment procedure.

Evaluation

- We decided to evaluate our method based on the following variables:
  - Misclassification rate (misclassification rate), that is, accuracy.
  - Precision and recall
  - Calculate F1
  - ROC curve, ROC_AUC
  - k-fold cross-validation



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Thank You

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