

Laser-Based Feature Extraction and Pattern Recognition in Intersection Management Systems

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Pattern Recognition, 2014

Introduction

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Review

Techniques and Design

Implementation

Decision and Testing

Aims and Conditions

Aims

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POSS-i

Ko-PER

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References

Context

Master's Thesis Project: Multisensor Architecture for a Vehicular Intersection Management System

Transportation Systems

Issues in traditional transportation systems

- Congestion

- Traffic rules violation

- Vehicle interaction

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- Congestion

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Intersections are critical places in transportation systems

Intelligent Transportation Systems

Objectives of ITS

Increase safety

Increase efficiency

Reduce costs

Intersection Management Systems

Tasks

Traffic Monitoring

Traffic Management

Warning Advertisement

Intersection Scenario

Pedestrians, Vehicles (Cars, Two-wheeled vehicles, Big vehicles)

Recognition, Classification, Tracking

Incident detection, Intersection Management

Objectives

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Review of the state-of-the-art of sensor fusion in IMS
Techniques review and architecture design
Laser and video sensor fusion implementation
Incident detection and warnings advertisement
Testing and Comparison

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For the course project:

In **blue** are the tasks proposed for this course project.

In **green** are the tasks proposed as plus if time allows it.

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Objectives

Objective 1. Review of the state-of-the-art of Sensor Fusion in IMS

- Intelligent Transportation Systems (ITS)
- Intersection Management Systems (IMS)
- Multisensor Data Fusion (MDF)
- Laser-Video Data Fusion
- IMS + LV-DF

Objectives

Objective 1. Review of the state-of-the-art of Sensor Fusion in IMS

Intelligent Transportation Systems (ITS)

Intersection Management Systems (IMS)

Multisensor Data Fusion (MDF)

Laser-Video Data Fusion

IMS + LV-DF

Objectives

Objective 2. Techniques review and architecture design

Feature Extraction (Laser/Video)

Pattern Recognition (Laser/Video)

Classification (Laser/Video)

Decision (Laser/Video)

Low-Level, Mid-Level and High-Level Fusion

Objectives

Objective 2. Techniques review and architecture design

Feature Extraction (Laser/Video)

Pattern Recognition (Laser/Video)

Classification (Laser/Video)

Decision (Laser/Video)

Low-Level, Mid-Level and High-Level Fusion

Objectives

Objective 3. Laser and video sensor fusion implementation

Implement chosen techniques for laser and video data

Integrate developed modules to the designed architecture for sensor fusion

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Implement chosen techniques for laser and video data

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Objective 4. Incident detection and warnings advertisement

Objective 5. *Testing and Comparison*

Objective 4 is out of the scope of the project course.

Main Objective

To develop a feature extraction and pattern recognition laser-based module for an intersection management system

Sub-objectives

Review of laser-based feature extraction and pattern recognition in ITS and IMS

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Implement at least one method

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Review of laser-based feature extraction and pattern recognition in ITS and IMS

Evaluate pros and cons of the reviewed methods

Implement at least one method

Evaluate implemented module and compare it with similar developments

Conditions

The information source will be a dataset.

Research Groups

PKU Omni Smart Sensing (POSS) Research group at Peking University (POSS-i project)

Institute of Measurement, Control and Microtechnology at Ulm University (Ko-PER program)

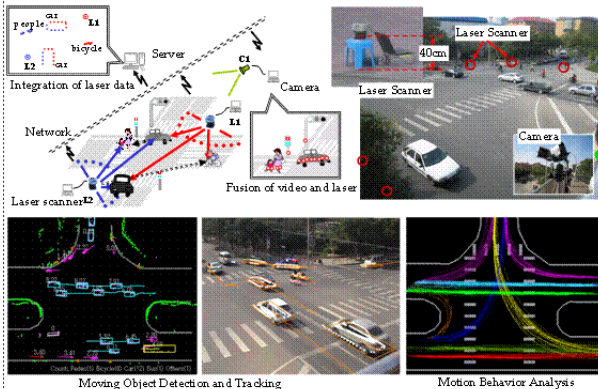
PKU Omni Smart Sensing (POSS)

POSS is leaded by Prof. Huijing Zhao, Ph.D.

Focus on perception technologies using an intelligent vehicle,
a network sensing system or a collaboration of them

POSS-i

POSS-i : Monitoring a Traffic Scene through Fusion of Laser and Vision



POSS-i project. [Zhao09][Zhao12][Song13b]

Applications

Recognition

Classification

Tracking

Methods and Techniques

Clustering

Markov Chains

Kalman Filtering

AdaBoost

Ko-PER

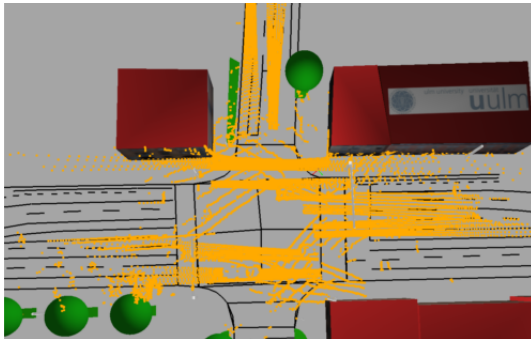
Ko-PER from Cooperative Perception

Included in Forschungsinitiative Ko-FAS from
Bundesministerium für wirtschaft und Technologie (Germany)

Cooperative and collaborative sensors system for perception
and preventive road safety.

Daniel Meissen from Ulm University as leader researcher.

Projects



3D-recreated intersection scene with laser beams depicted [Meissner12, 13a, 13b, 13c, 14][Striegel13]

Applications

Recognition

Classification

Tracking

Methods and Techniques

DBSCAN

Multi-object Bayes Filter

Sequential Monte Carlo Methods

Dempster-Shafer Theory

Multiple-Model Probability Hypothesis Density Filter (in
Gaussian Mixture representation)

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