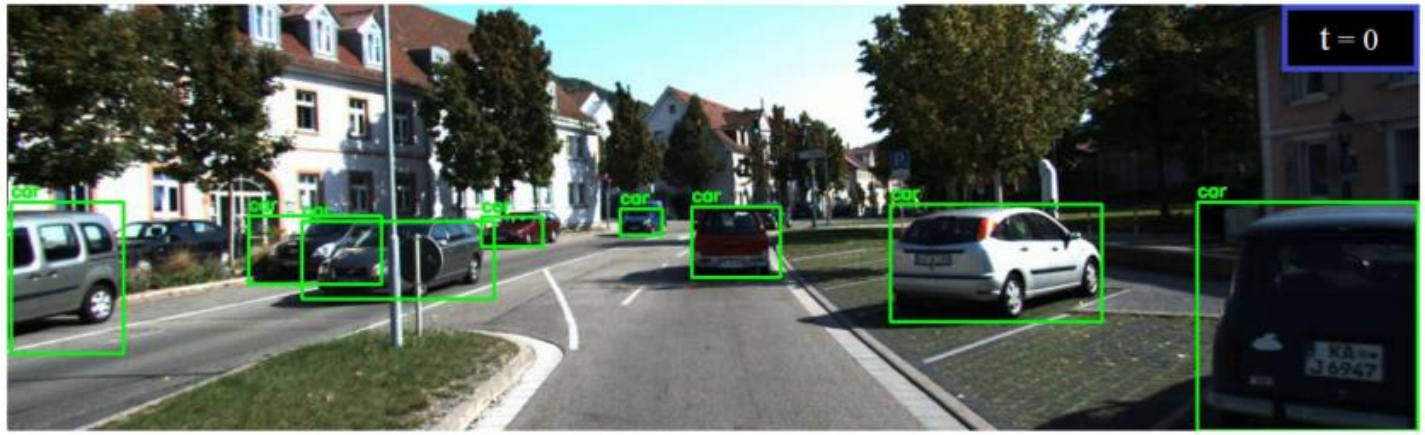
# Real-time Object Detection and Tracking for Autonomous Vehicles

## Description

- The primary objective of this project is to develop a high-performance, real-time object detection and tracking system tailored for integration into autonomous vehicles. The system aims to provide robust and accurate perception capabilities, enabling autonomous vehicles to identify and track objects in their surroundings.
- It will leverage deep learning-based object detection models and advanced tracking algorithms to ensure safe and efficient navigation in complex real-world scenarios.




Hoffmann, Joao Eduardo, et al. "Real-time adaptive object detection and tracking for autonomous vehicles." IEEE Transactions on Intelligent Vehicles 6.3 (2020): 450-459.

# Real-time Object Detection and Tracking for Autonomous Vehicles

## Tasks

- Investigate state-of-the-art approaches for Real-time Object Detection.
- Tackle how to optimize the object detection model for real-time performance, ensuring that it can run efficiently on the computational hardware available in autonomous vehicles.
- Implement a robust object tracking algorithm capable of associating objects detected in consecutive frames.
- Performance evaluation results and metrics.

## Desired Requirements

- Experience in Python, Deep Learning Frameworks (e.g., TensorFlow, PyTorch)
- Knowledge of object detection/ computer vision

## Supervisor


- Shahenda Youssef, MEng. Shahenda.youssef@iosb.fraunhofer.de

# Causal Representation Learning with Variational Autoencoders

## Description

- Causal representation learning combines representation learning with a priori knowledge about the causal relations between variables in a system. A variational autoencoder is a neural network architecture which generates a representation of a system from which it attempts to recreate its input. Enforcing causal a priori knowledge on the latent space of a variational autoencoder leads to a more suffisticatet model, which is able to apply reason to its generative process.
- The objective of this course is to implement a demonstrator with a state-of-the-art causal variational autoencoder model. Different ideas and approaches will be investigated and tested for this purpose.


A. Komanduri, Y. Wu, W. Huang, F. Chen and X. Wu, "SCM-VAE: Learning Identifiable Causal Representations via Structural Knowledge," *2022 IEEE International Conference on Big Data (Big Data)*, Osaka, Japan, 2022, pp. 1014-1023

# Causal Representation Learning with Variational Autoencoders

Karlsruher Institut für Technologie

- **Tasks**
  - Investigate state-of-the-art approaches for causal representation learning
  - Adapt and apply those approaches to a suitable toy example
  - Investigate the requirements, restrictions and limitations of your approach
- **Desired Requirements**
  - Experience in Python, Linux, PyTorch
  - Knowledge of Variational Autoencoders / computer vision
- **Supervisor**
  - Frank Döhner, M.Sc. frank.doehner@iosb.fraunhofer.de