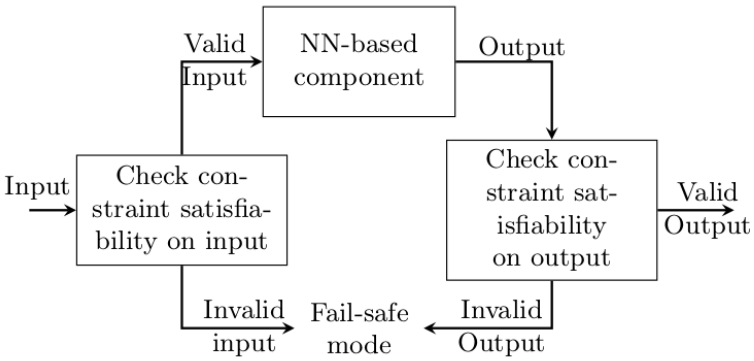
# Ontology-based Framework for Defining Environmental Constraints in Safety Critical Applications (Use Case: Highly Automated Driving)

## Background

With recent efforts to make vehicles intelligent, solutions based on machine learning have been accepted to the ecosystem. These systems in the automotive domain are growing fast, speeding up the promising future of highly and fully automated driving, and respectively, raising new challenges regarding safety assurance approaches. Uncertainty in data and the machine learning methods is a key point to investigate one of the main origins of safety-related concerns.

## Description

Ontologies are a way to model the entities and relations in a system. The concepts stored in ontologies can be internally translated into machine-readable first-order logic (e.g. Prolog code) thereby making it simpler for describing constraints that the system must obey in the environment. Ontologies can be seen akin to a 'safety blanket' around each ML-based component. Inputs to the component and outputs generated thereby would be tested against the set of environmental constraints to ensure that they are fulfilled, if not, the system enters a fail-safe mode.




## Tasks

This student project consists of the following tasks:

- Extensive literature review on constraint satisfaction for Neural Networks
- Designing an architecture for the safety limiter framework
- Developing the ontology-based framework
- Integrating the Prolog constraint satisfaction
- Evaluating the framework on a real scenario of autonomous driving (provided two scenarios based on NN, easy vs. complex scenario set)
- Testing the whole set up for a real X5 test car and documenting the work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**Research project:**
OSBORNE

**Type:**
Master Thesis, Guided Research

**Research area:**
Safety, Autonomous Driving, Machine Learning

**Programming language:**
Python, Prolog

**Required skills:**
Python, Machine Learning, Ontology

**Language:**
English

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