

Automatic distance regulation in vehicles -how perceptual psychology can be applied

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Abstract

The common technique of how distances between two vehicles are automatically regulated is based on measuring the time difference between an emitted and a reflected radar or laser signal. This time difference is used to calculate the distance between vehicles. The ecological theory of perception shows that when an object is approached, the expansion rate of the retinal image specifies how much time is left before a collision with this object takes place. This idea was chosen as a base for solving the problem of distance regulation when driving vehicles. For this purpose a camera system has to be mounted on a car so that the expansion rate of an object within the camera image when approaching another vehicle can be calculated. In order to be able to make such a calculation, it is mandatory that the shape of the vehicle in front is detected very fast. This can be realized by means of digital image processing, but these procedures are very time consuming. Therefore other, much lower level structural features within the camera image needed to be found. These features have to show obvious characteristic changes if the distance to an object changes. One promising candidate is the measure of complexity. First results of the suitability of this variable for implementing a distance regulation system are reported.

Introduction

Within the last decade, more and more modern vehicles are equipped with distance regulation devices. These systems enable the vehicle to keep a constant distance to the vehicle in front which is especially useful when travelling on motorways or when the streets are very busy as e.g. in traffic jams. One main development objective of the automotive industry is to increase the automation of driving procedures in order to reduce the drivers' mental demands. The developed systems for automatic distance regulation have become generally known as 'Adaptive Cruise Control' (ACC).

The technical realization of such a system consists of a radar transmitter-receiver combination which emits a radar beam. This beam is reflected by the car in front and the time until the reflected signal reaches the receiver is measured. From this time measure the distance can be calculated.

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