Multistage Vision System for Road Lane Markings and Obstacle Detection

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ABSTRACT

This paper is to introduce a multistage vision system to detect relevant information for road driving. The system applies fuzzy theory in order to handle less information per image that classical methods use to do. The image processing is based on the fact that the image is splitted up into six horizontal bands and consists of three basic stages: local, regional and global analysis. Firstly, pattern matching is applied to the information obtained from edge detection of the image in order to determine local appearances of lines on the road. Secondly, and with the aim of increasing the final reliability on data, regional analysis (at the level of a band) of the coherence of the local appearances is performed. Thirdly, results of previous stages are globally analysed, making up a fuzzy description of the image from the information given at each band. In the global analysis, the information of the image being processed is combined by means of a fuzzy algorithm, with the information detected in previous images in order to conclude a final description of the road lane markings.

1. INTRODUCTION

Several approaches to the analysis and processing of images for road driving has been held. They go from the most classical systems [1-4] to the most recent computational models such as neural networks, and others [7-17]. Several drawbacks arise in such processes: time costly algorithms, out-of-control results, soundness, reliability, ...

In this paper an innovative approach, based on the use of fuzzy methods for image analysis, is introduced. The main goal of our research is to build a robust vision system for a supervision driving system (SDS), in the case of two lane roads. In a SDS the information provided by the vision system is used to make decisions about the movement of a vehicle. The image processing, then, must be fast. For this reason, our bet has been to choose edge detection and pattern matching methods of low cost. This kind of methods handle big amount of data. So edge detection and pattern matching here only perform a simple icon processing on the information captured by a video camera. However, the information process is completed at a symbolic level where the amount of data is reduced from thousands of pixels (256x256) to eighteen relevant points of information. Fuzzy methods allows the system to deal with the incompleteness problem (biased information) arising when performing such a reduction of data. Furthermore, this approach allows to take advantage of the information of a complete sequence of images, instead from a single one as other methods do. Information changes between two consecutive images are minimal, and the analysis performed in one images provides guidelines to the analysis of the next one, making the processing of the image easier, and consequently, faster.

This paper is organized as follows. Firstly (section 2) an overview of the architecture of the system is introduced. Then all the components of the system (local analysis, regional analysis and global modules), are respectively detailed in sections 3, 4 and 5. Following, first results of the system are supplied in section 6. And finally, section 7 is devoted to discussion and future work.