Comparing the Performance of Finite-State Machines with Different Numbers of States on TORCS

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***Abstract*—This work presents two different approaches developed to control a self-driving car in the racing environment**

***Index Terms*—finite state machines, computer games, TORCS, artificial intelligence, genetic algorithms, self-driving car Finish keywords**

I. Introduction

Automation of day to day tasks is an endeavour that has moved a large amount of scientific resources in the recent history. One specific example is target of studies around the globe by a lot of universities, companies and industries, which is the automation of vehicles, more specifically, automobiles. The objective of such attempts is the development of artificial intelligences capable of driving a car safely, with traffic law enforcement, real-time decision making, efficiency and, in addition, resource economy - as with gas or even time. The practical applications of such controllers in autonomous vehicles are enormous.referencia sobre o que foi dito

The Simulated Car Racing Championship (SCRC), using the platform TORCS (The Open Racing Car Simulator), has brought an excellent environment for benchmarking AI approaches for the problem of autonomous car controllers. Notwithstanding, the optimum behaviour of a controller is a complex matter in its full extent; for this purpose, the strategy adopted to deal with it was to divide the problem into smaller portions, i.e., less complicated subproblems, in order to implement a finite-state machine that admittedly covers all necessary behaviours. Later on this paper, each of those subproblems are treated as the states of the referenced finite-state machine, which individually incorporate different but complementary parts of the integral behaviour.

Computers are more suited for applications that require testing different sets of parameters or configurations for a given problem, and although hand-coded methods might present satisfactory outcomes in questions of such intricacy such as the one discussed in this paper, they will hardly ever outperform the ones that are computer-aided.referencia Considering this, after an initial structure of the controller was designed, a method of fine tuning was assimilated to it, which was a genetic algorithm.

Apart from this Introduction, this paper is structured as follows: Section II introduces TORCS, the working environment used in the context of this task, along with the competition, SCR Championship, that currently represents the utmost metric to evaluate the performance of the controller proposed; Section III presents what is already being done at this context in related works, highlighting the strategies that are standing out and analyzing the characteristics responsible for it; Section IV then explains the proposal of the developed controllers, clarifying their behaviour and structure; Section V defines how these proposals were improved by the computer-aided method of a genetic algorithm; Section VI describes how the validation process occurred, through the methodology, the experiments and the results achieved; Section VII analyzes the results originated from Section VI and provides conclusions about them, which establish the comparison between the finite state machines with few and with moderate number of states; and Section VIII points out prospects about what is yet to be done in future works.

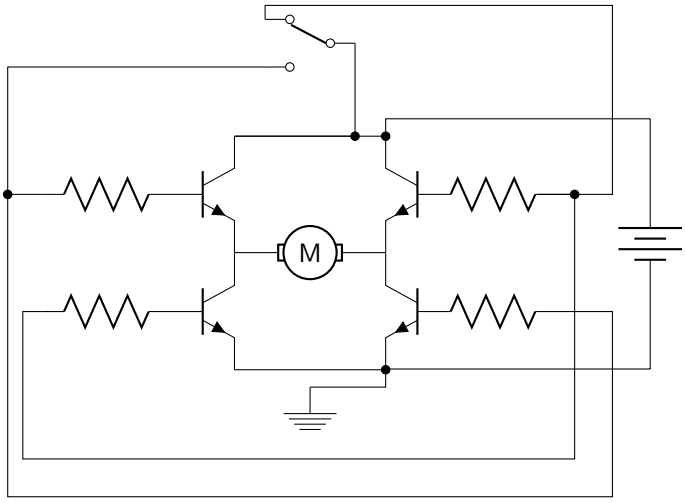

Fig. 1: Ponte H

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