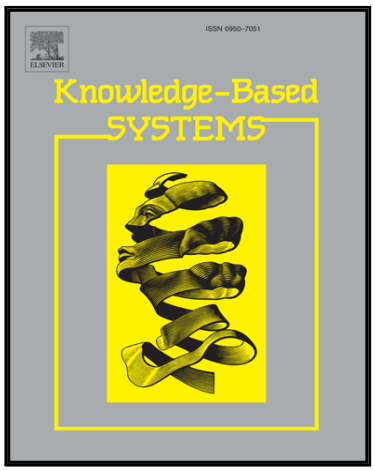

Teaching a Vehicle to Autonomously Drift: A Data-based Approach Using Neural Networks

Manuel Acosta, Stratis Kanarachos

PII: S0950-7051(18)30183-7
DOI: 10.1016/j.knosys.2018.04.015
Reference: KNOSYS 4297

To appear in: *Knowledge-Based Systems*

Received date: 17 November 2017
Revised date: 7 April 2018
Accepted date: 9 April 2018

Please cite this article as: Manuel Acosta, Stratis Kanarachos, Teaching a Vehicle to Autonomously Drift: A Data-based Approach Using Neural Networks, *Knowledge-Based Systems* (2018), doi: 10.1016/j.knosys.2018.04.015

Teaching a Vehicle to Autonomously Drift: A Data-based Approach Using Neural Networks

Manuel Acosta[1], Stratis Kanarachos

Department of Mechanical, Aerospace and Automotive Engineering,Coventry University, Coventry, United Kingdom

Abstract

This paper presents a novel approach to teach a vehicle how to drift, in a similar manner that professional drivers do. Specifically, a hybrid structure formed by a Model Predictive Controller and feedforward Neural Networks is employed for this purpose. The novelty of this work lies in a) the adoption of a data-based approach to achieve autonomous drifting along a wide range of road radii and body slip angles, and b) in the implementation of a road terrain classifier to adjust the system actuation depending on the current friction characteristics. The presented drift control system is implemented in a multi-actuated ground vehicle equipped with active front steering and in-wheel electric motors and trained to drift by a real test driver using a driver-in-the-loop setup. Its performance is verified in the simulation environment IPG-CarMaker through different open loop and path following drifting manoeuvres.

Keywords: Neural Networks, Autonomous Drift control, Autonomous Vehicles, Multi-Actuated Ground Vehicles, Model Predictive Control

1. Introduction

Future autonomous vehicles will be required to operate safely at the limits of handling under all environmental and roadway conditions (Level 5 autonomy, [1]). Among these conditions, automated driving on limited manoeuvrability surfaces such as deep snow or gravel is still challenging and unexplored. The friction characteristics exhibited by the tyres on these surfaces

[1]ac3354@coventry.ac.uk