

Reihe 10

Informatik/  
Kommunikation

Nr. 864

Herwig Unger (Ed.)

## Autonomous Systems 2019: An Almanac



**FernUniversität in Hagen**  
**Schriften zur Informations-  
und Kommunikationstechnik**



# Fortschritt-Berichte VDI

Reihe 10

Informatik/  
Kommunikation

Herwig Unger (Ed.)

Nr. 864

Autonomous Systems 2019:  
An Almanac



**FernUniversität in Hagen**  
Schriften zur Informations-  
und Kommunikationstechnik

Unger, Herwig (Ed.)

## **Autonomous Systems 2019: An Almanac**

Fortschr.-Ber. VDI Reihe 10 Nr. 864. Düsseldorf: VDI Verlag 2019.

218 Seiten, 75 Bilder, 26 Tabellen.

ISBN 978-3-18-386410-2, ISSN 0178-9627,

€ 76,00/VDI-Mitgliederpreis € 68,40.

**Keywords:** Autonomous Systems – Natural Language Processing – Image Processing – Complex Systems – Machine Learning – Deep Learning – Simulation – Clustering – Safety – Ethical Aspects

Since 2010 it became a good tradition that colleagues from different research areas publish articles about their unsolved scientific problems, on-going work or research results in a joint book with the title "Autonomous Systems". Those systems exist in several areas of science, describing self-contained and self-controlled groups of possibly interacting or interrelated entities that form unified ensembles acting in given environment without outer control of any higher instances, leaders or managers.

In this year, three major topics are presented, which are valiant, strongly interfering with politics and everyone's discussion and are, therefore, rarely considered without emotions or political and financial concerns: the climate on our planet earth, ethics in the context of applying and using autonomous systems as well as problems of (mostly individual) road traffic. The following contributions deal with various topics related to theory, fundamentals, natural language and image processing as well as simulation.

### **Bibliographische Information der Deutschen Bibliothek**

Die Deutsche Bibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliographie; detaillierte bibliographische Daten sind im Internet unter [www.dnb.de](http://www.dnb.de) abrufbar.

### **Bibliographic information published by the Deutsche Bibliothek**

(German National library)

The Deutsche Bibliothek lists this publication in the Deutsche Nationalbibliographie (German National Bibliography); detailed bibliographic data is available via Internet at [www.dnb.de](http://www.dnb.de).

Schriften zur Informations- und Kommunikationstechnik

Herausgeber:

Wolfgang A. Halang, ehemaliger Lehrstuhl für Informationstechnik

Herwig Unger, Lehrstuhl für Kommunikationsnetze

FernUniversität in Hagen

© VDI Verlag GmbH · Düsseldorf 2019

Alle Rechte, auch das des auszugsweisen Nachdruckes, der auszugsweisen oder vollständigen Wiedergabe (Fotokopie, Mikrokopie), der Speicherung in Datenverarbeitungsanlagen, im Internet und das der Übersetzung, vorbehalten.

Als Manuskript gedruckt. Printed in Germany.

ISSN 0178-9627

ISBN 978-3-18-386410-2

## Preface

Since 2010 it became a good tradition that colleagues from different research areas submit and publish articles about their unsolved scientific problems, ongoing work or research results in a joint book “Autonomous Systems” published by VDI-Verlag in Düsseldorf. When the editors were looking for a suitable title as a framework for these contributions they found that the term “autonomous systems” exists in several areas of science, describing self-contained and self-controlled groups of possibly interacting or interrelated entities that form unified ensembles acting in given environment without outer control of any higher instances, leaders or managers. The books prepared in the beginning as proceedings of the workshop and conference with the same title held each year on Majorca Island in October slowly changed their character to real, interdisciplinary almanacs. Now, authors can contribute to it without an obligation to participate or present their work at the conference. Moreover, the book is free of any reviews or censorship what shall motivate especially people thinking off the mainstream to submit their work. The book is distributed among the conference participants and shall be a motivation for free, unbiased discussion at the conference in Cala Millor. It shall remind everyone that dispute and competition of opinions is one, maybe the most important root of science, where decisions cannot be made by majority voting or compromises. Therefore, the search for the truth or the best, most efficient solution can even significantly be guided by the opinion or ideas of a single outsider or specialist in a completely other area of science, which may win over the majority of renowned specialists.

The editors are glad that the three keynotes presentation contained in this volume are touching three research fields, which are valiant, strongly interfering with politics and everyone’s discussion and are, therefore, rarely considered without emotions or political and financial concerns: the climate on our planet earth, ethics in the context of applying and using autonomous systems as well as problems of (mostly individual) road traffic.

The following three chapters deal with natural language processing, fundamentals and theory as well as image processing. Although at first glance these topics seems to be very different, they are connected by two facts the authors emphasize. First, interfaces become increasingly human-like: people get used to program or to interact with machines in their natural languages, either in written

or in spoken form, and cameras are employed as eyes of or visual interfaces to computers. Secondly, as a consequence, the amount of data available in big data bases, the size of the systems to be managed as well as the computing performance needed are increasing rapidly.

As in the last years, the editor wants to say thank you to Mrs. Barbara Kleine and Mrs. Jutta Düring for their caring support in all technical and organisational details needed to finish this book and bring all authors and interested people together at our conference in Cala Millor. We hope that all of you will enjoy the results of our work and support us with your ideas and work in 2020 again.

Hagen, August 2019  
Herwig Unger

# Contents

## Keynotes

Is Global Warming Men-made? The Atmosphere Seen as an Autonomous System G. K. Heinz . . . . .	3
Ethical Aspects of Autonomous Systems G. Schiedermeier . . . . .	27
A Road Traffic "Behavioral Analysis": Mathematical Modeling and Numerical Simulation J. Ch. Chedjou, K. Kyamakya . . . . .	35

## Natural Language Processing

Dynamic Clustering for Segregation of Co-occurrence Graphs S. Simcharoen, H. Unger . . . . .	53
Sequential Clustering using Centroid Terms M. Hloch, M. Kubek . . . . .	72
Dynamic Generation of Links and Forwarding to Related Web-based Content G. Ph. Roßbrucker . . . . .	89
Balancing Data Access Frequencies in P2P Systems with Error-prone Communication D. Samorukov . . . . .	106
Thai Word Segmentation by Automatic Ranking Trie with Misspelling Correction C. Tapsai, P. Meesad, C. Haruechaiyasak . . . . .	121

## Fundamentals and Theory

An Information Flow Model to Support NIS Mandated Reporting G. Quirchmayr, V. Kupfersberger, G. Langner, Th. Schaberreiter . . . . .	137
Automatic Evaluation of Programming Tasks for Blended Learning and E-Assessment B. Hass, C. Yuan, Z. Li . . . . .	144
Matrix-based Feature Selection for Dynamic Multi-source Hybrid Data Y. Huang . . . . .	146
SafeBigNum – Arbitrary-precision Arithmetic with Integrity Checking S. Widmann . . . . .	147
Evaluation of Hybrid Measurement Structures G. Sartorius, St. R. Talbot . . . . .	159

## Image Processing

A Comparative Study of Visual and Visual-inertial SLAM X. Xu, C. Yuan, Z. Li . . . . .	173
Design of a Small-scale Ground Vehicle for Autonomous Navigation M. A. De Muirier, C. Yuan, Z. Li . . . . .	175
A Comprehensive Analysis of Document-Image Distortions and their Respective Impact on Distorted Text/Character-Image Recognition Quality P. De Silva, K. Abhiram, V. Tavakkoli et al. . . . .	176
On the Introduction of Nonlinear Dynamics in Image Processing with Applications M. S. Zahan, J. Ch. Chedjou, K. Kyamakya . . . . .	199
<i>Index of Authors</i> . . . . .	213