Towards Robust Situation Awareness in Autonomous Vehicles

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Call for submission. This editorial introduces the third issue of 2020 for *Embedded Selforganising Systems (ESS)* journal. The focus of this issue is Situation Awareness and Autonomous Vehicles.

Our journal uses electronic publication, which provides a flexible way to submit and review contributions of authors from all of countries. The advantages of such an e-journal are multifarious. In comparison to traditional paper journals, we replace the classic review and creation process with a new Sliding Issue model. Each issue starts with an initial editorial and an official call for papers. The submitted articles will be reviewed and, if accepted, published as soon as the final version is received by the committee. Based on this process, each sliding issue can be filled successively until the maximum number of article is reached. During this period, all accepted papers can, already be read by other researchers while other papers are still in the reviewing process. Accordingly, the time to publish shrinks to a minimum. In addition, multiple issues with different focus can co-exist at the same time, which provides completely new possibilities to react on latest research topics. The journal allows also the integration of discussions and other reactions on published articles in the same journal issue.

We are welcoming fresh ideas, on-going research technical reports and novel scientific works. We also intend to create a promising platform for creative and constructive discussions.

Towards Robust Situation Awareness in Autonomous Vehicles

Automotive Industry is having a rapid progress towards highest level of autonomy. As the industry moves up the ladder of automation, safety features are coming more and more into the focus. Different safety measurements have to be taken into consideration based on different driving situations. One of the major concerns of the highest level of autonomy is to obtain the ability of understanding both internal and external situations. In order to automate this process, first, understanding and automating the situation identification is necessary. Systems will also have to have embedded intelligence of awareness in order to reach to these situations. Situations are combination of features that can be extracted at any given point of time thus extracting individual features and reacting towards them is a rudimentary process.

The issue of accurate situations identification plays a significant role in the avoidance of accidents and traffic control. Hence, the term known as Situation Awareness becomes more and more important. Situation awareness means to extract and perceive information from internal and external environments, provide understanding towards the perceived information, take actions and predict the next states based on the taken action. It has been used widely and successfully in the aviation industry for pilots. Until recently, it has started gaining notoriety in the automotive industry as well.

This can also be classified using three levels, (I) Perception, (II) Comprehension and (III) Projection. Perception works around extracting information as features from the environment. Comprehension collects all the extracted information and provides an understanding to them. This level can also take actions based on the understanding of these features. Finally, projection is used to predict the future state based on the action taken in the comprehension level.

Previously, it was difficult to perceive information from the environment but with the advancement of sensors and actuators in modern automotive vehicles, extracting features has become significantly easier. There are several techniques to extract features for the perception level of situation awareness. Out of all the sensors, the camera sensors have gained most popularity. The reason being, it is possible to execute multiple tasks using this single

sensor. With the combination of computer vision and artificial intelligence techniques, camera sensors has become the go to sensors for researchers.

Traditional computer vision is a combination of several image processing algorithms which utilizes different filters in order to detect or recognize an object. Although it is possible to detect or recognize multiple objects using computer vision, it increases the computation significantly and reduces the performance.

Artificial Intelligence techniques like Machine Learning and Deep Learning on the other hand, are widely used in the automotive industry. It is possible to train a machine learning model using "Support Vector Machines" for example, in order to inspect and recognize several objects in a frame as it serves as a feature extractor and a classifier. In contrast, deep learning neural networks like "Convolutional Neural Network (CNN)", it automatically identifies complicated patterns and perceives information from the frame and them classifies them into individual classes. Based on the performance requirements, any of these mentioned techniques can be used to perceive information from the environment.

Perceiving multiple information from the environment still is not enough to define a driving situation. It is the meaningful combination of these perceived information that results in a driving situation. Using similar deep learning techniques, the comprehension level of situation awareness can achieve this understanding. Forward chain rule based systems like expert systems can also be useful in order to provide a meaning for these features and predict the future states of these features.

While there are still considerable difficulties in the design of human-quality situation analysis system, significant improvements can be made by utilizing and optimizing artificial intelligence and sensor fusion. Although, camera sensors are used widely and artificial intelligence support for these sensors are improving day by day, using other sensors is also important, so that all the dependency does not fall only on a single sensor. Once, this is made possible, a robust situation awareness system would be able to provide all the safety features and measurement required for highly autonomous vehicles.

The areas of self-awareness and situationally aware system has had a continuous and steady development over the past few years. This constant improvement has been intensified through the innovative research and contribution of researchers, developers, and practitioners from academia, industry, governmental and scientific organizations. The Embedded Self-organizing Systems (ESS) journal aims to enable synergy between these areas and provides the premier venue to publish the latest research and developments related to research issues of the robust situation awareness in autonomous vehicles and its applications.

The Embedded Self-organizing Systems (ESS) journal comprises a set of carefully selected tracks that focus on the particular challenges regarding deep learning and machine learning in computer vision applications. Topics of (ESS) journal include (but not limited to):

- Situation Awareness, Self-Awareness
- Computer Vision and Image Processing
- Machine learning and artificial intelligent systems analysis, modeling, simulation, and application in computer vision.
- Cloud Based Platform
- 3D computer vision.
- Image retrieval.
- Detection and Recognition.
- Machine learning for video and Image Processing.

SUBMISSION INSTRUCTIONS

Submissions for the journal must be made as complete papers (there is no abstract submission stage) submitted as PDF documents. Authors are requested to submit papers reporting original research results and experience. The page limit for regular papers is 4 to 6 pages and short papers are from 2 to 4 pages. Papers should be prepared using the IEEE two-column template. An MS Word template or ESS online journal is available here https://www.bibliothek.tu-chemnitz.de/ojs/index.php/cs/information/authors

Papers should submit following link of journal:

https://www.bibliothek.tu-chemnitz.de/ojs/index.php/cs/about/submissions

Submission Deadline: 31.07.2020

There is no charge for submission. Accepted papers are publishing free.

Review in 2 weeks after submission.

Camera ready paper for publication should be submit in 2 weeks after review notes.

Thanks in advance for Your Contribution!