

# Fuzzy Communication and Cooperation of Mobile Robots

László T. Kóczy<sup>1,2</sup>, Áron Ballagi<sup>3</sup>

<sup>1</sup>Department of Telecommunications and Media Informatics,  
Budapest University of Technology and Economics,  
H-1117, Budapest, Magyar tudósok krt. 2., Hungary  
Email: koczy@tmit.bme.hu

<sup>2</sup>Inst. of Mechanical, Electrical Engineering and Information Technology,  
Széchenyi István University,  
H-9026, Győr, Egyetem tér 1., Hungary

<sup>3</sup>Department of Automation,  
Széchenyi István University,  
H-9026, Győr, Egyetem tér 1., Hungary  
Email: aronball@gmail.com

## ABSTRACT

Intelligent cooperation of agents/entities in autonomous robotics is a new and very exiting research field. If one plans/implements a cooperating robot system with intelligent behavior, not all scenarios appearing in the “life of robots” can be programmed in advance and thus effective, fast and compact communication is one of the most important cornerstones of the high-end cooperating system. Communication itself is very expensive so, generally speaking, it is much more advisable to build up as big as possible contextual knowledge bases and codebooks in distant on-board robot controller computers in order to shorten the communication process if it essentially reduces the amount of information that must be transmitted from one to another, than to concentrate all contextual knowledge in one of them and then to export its respective parts whenever they are needed in the other(s). It seems to be very important in the cooperation and communication of intelligent robots or physical agents that the information exchange among them is as effective and compressed as possible.

We propose a context dependent reconstructive or fuzzy communication system where the codebooks are built up by fuzzy signatures. Fuzzy signatures structure data into vectors of fuzzy values, each of which can be a further vector, have been introduced in order to handle complex structured data. This will widen the application of fuzzy theory to many areas where objects are complex and sometimes interdependent features are to be classified and thus similarities/dissimilarities are evaluated. Often, human experts can and must make decisions based on comparisons of cases with different numbers of data components, even with some missing components. Fuzzy signatures have been created with this objective in mind. This tree structure is a generalization of fuzzy sets and vector valued fuzzy sets in a way modeling the human approach to complex problems. However, when dealing with a very large data set, it is possible that they hide hierarchical structures that appear in the sub-variable structures.

Apart from the application of fuzzy signatures, another modeling structure of intention guessing is designed for the further intentional inference of cooperative robot communication. By the combination of these two theoretical issues, a codebook for intelligent robot decision making has been developed, as well as its implementation in some real scenarios of autonomous mobile robot cooperation has been examined.

Research towards extending this fuzzy communication method to more complex robot cooperation is going on currently.