Message from the Workshop Chairs
Workshop D. Computational Intelligence

The world economy is at a threshold of a new era of intelligent systems. Many enterprises only will maintain their hold on the increasing global market in future if they succeed to equip their products and processes with a high "machine intelligent quotient." Especially industrialized countries with high salaries and small natural resources have to rely on quick technology transfers of progressive methods and paradigms to secure economical wealth. New methodical approaches in computer science play a central role when developing intelligent products and processes.

In addition to micro-electronic and micro-system techniques, including micro-sensoric as fundamental technologies, fuzzy logic, neural networks, and evolutionary algorithms belong to these new approaches and will serve as problem solving techniques for the demanded intelligent products. These three research areas together with parts of related fields like machine learning are described by computational intelligence.

The term "computational intelligence" was introduced by Bezdek in this context. In his work he wrote in the strictest sense, computational intelligence depends on numerical data supplied by manufacturers and does not rely on knowledge, to dissociate from artificial intelligence and biological intelligence. It has been proposed to use terms like "intelligent machines" or "intelligent systems"; but they are either already occupied or did not gain acceptance. By the way, the word "intelligent" is only appropriate here if used as a metaphor; actually "smart" would be at least as good.

But computational intelligence is not only an abstract bracket for the three areas of fuzzy logic, neural networks and evolutionary algorithms. Very important are combinations of two or all of these methods. There is not enough room to study in detail how all these combinations may look like and how they are used but maybe some sample observations are useful to get a first feeling.

Fuzzy controllers and controllers based on neural networks are both interpolation methods and have (among others) the following properties:

- Neural Networks learn from scratch and eventually need a lot of learning steps until satisfying results are yielded.
- Fuzzy systems formulate the existing fuzzy a priori knowledge of an expert by the structure of the problem. It is difficult to systematically tune resp. adapt them stepwise.

On the other hand, genetic algorithms are excellently suited to optimize parameters of a problem solution, but they are very costly and do not use a priori knowledge about their solution spaces. Therefore it is not surprising that many approaches

- use fuzzy rules (a priori knowledge) to determine the start configuration of a neural network and thereby decrease the number of learning steps;
- use special neural nets to learn the structure of fuzzy rules resp. the fuzzy sets used;
- use genetic algorithms to optimize parameters of neural nets resp. fuzzy sets; and,
- use a priori knowledge in form of fuzzy rules to accelerate the convergence of genetic algorithms.

This workshop presents several theoretical and practical approaches from the three areas of computational intelligence, although the field of fuzzy logic is a little bit underrepresented. Theoretical results as well as technological implementations will be reported. Indeed, real-world applications of computational intelligence have become possible with the advent of sufficiently powerful hardware-implemented intelligent systems, and future applications will likely require more powerful systems. The keynote speech by Prof. Glesner will provide an interesting perspective of the three areas. The concluding panel session will give opportunity to discuss open questions and future trends.

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