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INTELLIGENT SYSTEMS ENGINEERING

Intelligent systems engineering is a complex and challenging process. Why? What is an intelligent system and how does any system become intelligent? Moreover, how could we keep the level of system intelligence during time i.e. during a system operation? There is no doubt that interest in developing intelligent systems for civilian and military uses constantly growing. Scientists and engineers are looking for the new approaches to enhance our current way of information processing. Intelligent systems engineering, as an attempt to match some functions of the brain in processing, controlling and interacting with dynamic changes in the environment, is a non-trivial task. It could be clear if we only take into consideration that the important attributes of an intelligent system would consist of words such as: learning, creativity, quickness of mind, reasoning, understanding, autonomous behaviour, adaptive, ability to self-organize, coordinate and possess knowledge. Could man-made systems (machines, assemblies, sub-assemblies, components etc.) currently fulfil all the above requirements? Some think that if a system could fulfil a subset of the attributed words, the system would have to possess some form of intelligence (or sub-intelligence). It is believed if a system could perform quickly with a certain logical reasoning, it may be classified as 'clever' or 'smart'. So, what is an intelligent system? Many agree that the definition of intelligent systems depends on expectations and the current status of knowledge in the specific area: perhaps the "intelligent systems" of today are the "classical systems" of tomorrow. It could be said that an intelligent system could receive sensory information and has the ability to process this information with one or more smart or intelligent algorithms for performing functions, such as control, diagnostic and/or decision-making. Sensor technology plays an important role in the process of an intelligent system development in order to "see" status of the system operation and its environment. Hence the growing importance of intelligent systems is in line with the increase usage and improvement in sensory technology.

In traditional hard computing, the prime objectives of the computations are precision and certainty. However, in soft computing, the precision and certainty carry a cost. Therefore, it is realistic to consider the integration of computation, reasoning and decision making as various partners in a consortium in order to provide a framework for the trade-off between precision and uncertainty. It is believed that this integration of methodologies provides a foundation for the conceptual design and deployment of intelligent systems. The principal partners in such a consortium are fuzzy logic, neural network computing, generic algorithms and probabilistic reasoning. Furthermore, these methodologies, in most part, are complementary rather than competitive. Increasingly, these approaches are also utilized in combination, referred to as "hybrid". According to researchers in the area of intelligent system engineering, hybrid intelligent systems are likely to play a critical role for many years to come. Why? Contrary to analytical methods, it is believed that soft computing methodologies mimic consciousness and cognition in several important respects: they can learn from experience, they can generalize into domains where direct experience is absent, they can perform mapping from inputs to the outputs. What is a problem? The trade off, however, is a decrease in accuracy. If a tendency towards imprecision could be tolerated, then it should be possible to extend the scope of the applications even to those problems where the analytical and mathematical representations are readily available. The most important engineering task in the 21st century will be the process of a system engineering which offering advanced system abilities such as learning, generalizing and an adaptation to the changes in the environment i.e. intelligence.

Sincerely yours,
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