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Cross-domain applications of fuzzy logic and machine learning

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The special issue **"Cross-domain Applications of Fuzzy Logic and Machine Learning"** takes up the challenge of overviewing the current state of interdisciplinary research in the field of Intelligent & Fuzzy Systems applied to the most urgent problems of modern life. The volume comprises the latest achievements of academics, working professionals, and developers. Most of them are acknowledge and supported by various scientific foundations. The aim of the special issue is to disseminate knowledge about feasibility of intelligent and fuzzy methods for solution of real-life problems.

The issue provides a wide range of implementations of intelligent and fuzzy systems in *Education and teaching*; *Economics, business, and Industry*; *Personal and social security*; *Environmental protection*; *Culture, media, and sports*; *Innovation and scientific advances*; *Transport and traffic*; and *Language and Linguistics*.

The papers, devoted to the application of intelligent and fuzzy systems in the field of *Education and teaching* analyze such factors of the educational process efficiency as entrepreneurial performance of teachers, teaching ability, and classroom teaching quality. These aspects are considered in the context of University and Colleague education and academic entrepreneurship, online and network education, remote learning, foreign languages teaching, music teaching, and others. The way to maintain the success of educational process is found in the development of systems evaluating learners' preferences, correspondence of teaching with student's expectations, and instant emotional feedback. This is done with the help of support vector machines, emotional-state and face-recognition systems, and prediction software. The solution for the problem of inaccessibility of education due to distance and financial factors, is found in the development of online systems with the function of personalized recommendation.

The papers devoted to *Economics, business, and industry* suggest strategic decisions for evaluating economical risks and the effectiveness of enterprises. For instance, significant factors in trademark infringement, altruistic motivation of workers, industry finance integration of manufacturing enterprises, and technological innovation have been examined with the focus on the perspectives of development of an intelligent industrial system. Qualitative and quantitative estimation of risks and profit in the sphere of intellectual property pledge financing, technology innovation in high-tech enterprises, which include mining, pharmaceutical, and medical industries has been carried out. The authors also suggest a new development of the interpretive structure modelling in the emergency industry, the methods of deep learning and fuzzy algorithms of statistical optimization tested on the supply chain financial credit. The results achieved will contribute to the optimization of industry and energy economies, as well as to the enhancement of international trade.

The problem of *Personal and social security* has been analyzed from multiple angles, particularly as

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inherent in emergency logistics, aviation, food supply, and medicine. Such approaches as the risk and emergency factors evaluation, and the design of intelligent community security system, as well as Information network security have been introduced through the prism of fuzzy analysis and machine learning. This includes text-mining, image and video tracking, and knowledge extraction employed in creation of smart systems for personal health and social security monitoring. The former results in predicting risks in chronic diseases, establishing relationship between a geographical region and the population well-being, while the latter results in simulating suspicious portraits.

Environment protection is a relevant topic of modern cross-domain projects. The current volume also provides ideas for reflections on this theme, namely evaluation of radiation and the influence of industrial development on ecological environment, as well as the measures to be taken to struggle the problem of unsatisfactory ecological responsibility of resource-oriented enterprises. Considerable results can be achieved through establishing evaluation index systems and implementing ecologically oriented government policy based on the results of the ecological responsibility performance assessment.

The research is further extended to the analysis of recent *innovation and scientific advances*, i.e., innovation efficiency, interorganizational learning, social capital, prediction of the failure in technology advances, and finding ways for re-innovation. In this framework, the impact of the capital stock on sustainable innovation capacity in industries has been examined, modelling of innovation and re-innovation support systems has been realized, several evaluation index systems for estimating sustainable innovation capability and the interorganizational collaboration effectiveness have been suggested.

Related to the previous theme is the topic of *Transport and traffic* focused on the development of intelligent transportation systems. The authors describe the key criteria and define the optimal evaluation period of the application effectiveness for an intelligent transportation system. The urban traffic problem has also been considered from the perspective of optimization of a dispatch delay control system based on the results obtained from multi-data source analysis and imbedded into intelligent media. The system helps to calculate the most preferable path by means of vehicle monitoring and the GIS module. The findings are expected to benefit to maximization of the efficiency of road use.

The volume includes a number of articles connected with the sphere of *Culture, media, and sports*. For instance, bibliometric analysis and visualization have been applied for ethnogenetic studies. Another direction of research in this area is ventured around neural network simulation and fuzzy algorithms. They have been employed for accurate web page ranking, efficient extraction of knowledge from online news, and precise prediction of people's news reading habits, as well as potential readers' expectations and interests. Such an approach to the development of innovative mode of news delivering is expected to attract more online news readers. The subfield of sports provides advancement in visual recognition and classification of athletes' movements during the game. The results have been achieved with the help of support vector machine, could be applied for optimization of athletic training, and are of significant national value.

The area of *Language and linguistics* is also represented in the current special issue as the subject field to which various methods of artificial intelligent have been applied. It is worth while mentioning the attempt made to improve mobile translation with special attention to speech recognition. This is implemented through the usage of support vector machine for syllables recognition and their specific pronunciation in words. Another linguistic model is applied to English grammar, especially for the correction of errors typically made by second language learners. This approach comprised the use of genetic algorithm and the k-Nearest Neighbor Classification algorithm for higher accuracy of automated error correction.

A cross-domain approach is suggested for the research of psychological mechanisms of language activity implemented with the latest achievements in the usage of deep machine learning. Cognitive mechanism underpinning language and speech activity, including language switch, has been analyzed, and physical reactions to information processing have been recorded. The data received has been used to predict the speed and the direction of the language switch.

All the afore listed achievements became possible due to the use of intellectual methods and the fuzzy logic approach. In this context two major directions of scientific thinking can be highlighted, namely fuzzy evaluation and machine learning. The former comprises development of effective evaluation index systems and evaluation models based on fuzzy mathematics, the principle component analysis, etc. The latter is extensively represented with diverse tech-

nics of big data analysis, data mining, text mining, and knowledge retrieval, including deep learning, and neural network modelling. These methods are rarely implemented as sole features of a particular study but are rather taken as a set of intercomplementary sustainable stages for sound and consistent multidisciplinary, both fundamental and practically oriented research.

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