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NEW MODELING APPROACHES IN AGRICULTURAL AND BIOLOGICAL SCIENCES

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Abstract
So far, in many researches in agricultural and biological sciences the emphasis has been placed on conventional regression models to model a parameter indirectly from other data whilst they can only fit a linear function to input-output data pairs. However, the effect of the predictors on the parameter is not usually linear in nature. During the last decade, scientists have shown a keen interest in developing nonlinear indirect approaches to overcome this problem. Among the proposed indirect techniques, machine learning (ML) approaches have recently attracted greater interest in agricultural and biological engineering works. The ML techniques such as artificial neural networks (ANNs), support vector machines (SVMs), fuzzy logic (FL), adoptive neuro fuzzy inference system (ANFIS), and evolutionary algorithms can be used to achieve tractability, robustness, to provide a low cost solution with a tolerance of imprecision, uncertainty and approximation, and to avoid over-fitting problems. This makes the ML capable of analyzing long-time-series and large-scale data and thus solving the problems which conventional methods have not yet been able to solve in a satisfactory cost-effective and analytical manner. Hence, it is distinctly desirable to introduce expertise in the system with a view to helping neophytes to select and manipulate an appropriate ML technique. This study reviews the development of ML techniques. With the concepts and methods, applications of soft computing in the field of agricultural and biological engineering are presented, especially in the soil and water context for crop management and decision support in precision agriculture. The future of development and application of soft computing in agricultural and biological engineering is also discussed.

Keywords: artificial neural networks (ANNs), support vector machines (SVMs), fuzzy logic (FL), adoptive neuro fuzzy inference system (ANFIS), and evolutionary algorithms**.**