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Title of thesis: Neutrosophic Neural Networks

Abstract

This thesis deals with proposing the extension of Fuzzy Inference System in the form of Neutrosophic Inference Systems (NIS) and subsequent integration of Neutrosophic Logic and Neural Networks.

Fuzzy Logic is a dominant component of the soft computing domain; that takes imprecise inputs and generates a precise output, which is a closer representation of real world executions. First part of the thesis focuses on employing Neutrosophic Logic for inference mechanism. Fuzzy logic can only deal with fuzzy, vague information but not with incomplete and inconsistent information. This thesis explores the possibility of extending the capabilities of the existing fuzzy models by incorporating neutrosophic logic in the inference process. Mathematical foundations and working of three neutrosophic inference models are discussed: Mamadani NIS, Takagi-Sugeno NIS and Tsukamoto NIS. All the three models can work with fuzzy, incomplete and inconsistent information without danger of trivialization.

Latter part of the thesis concentrates on presenting an extension of Fuzzy Neural Networks by combining Smarandache's Neutrosophic Logic with neural networks for handling incomplete, indeterminate and inconsistent data that would be helpful in many real life problems of computer science, especially AI.

This research focuses on developing the architecture and theoretical grounds for working of Neutrosophic neural network which is more generalized in its interpretation and working as compared to neuro-fuzzy systems due to following reasons:

a. Existing fuzzy neural networks are capable of handling fuzzy data; it has been replaced by Neutrosophic data which is much more generalized than fuzzy data.
b. Neutrosophic theory is a powerful logic to deal with fuzzy, incomplete, indeterminate and inconsistent data. So the gaps created by Fuzzy neural network due to uncertainty, imprecision or incompleteness or vagueness of data can be filled by Neutrosophic Logic. Problems involving such data can be best justified with the integration of Neutrosophic Logic to neural networks.

Neutrosophic neural networks would be able to characterize the imprecision or inexactitude of knowledge received by various observers, uncertainty due to incomplete knowledge or acquisition errors or stochastic and vagueness due to lack of clear contour or limits.

So far there is no neural network proposed which is able to handle incomplete, vague, imprecise and indeterminate data all together, so there is an obvious need to modify the existing fuzzy neural network techniques for them to model human brain reasoning more closely.

Data sets obtained from UCI machine repository are experimented with the proposed approaches. Also the suitability of utilizing Neutrosophic Logic to medical domain is discussed. Possible hybridization of Neutrosophic Logic and Genetic Algorithms is also detailed along with suggested architectures. This thesis addresses mainly these important and unexplored issues using the powerful logic Neutrosophic Logic.