



## ABSTRACT

Water resources related studies involve variables, which are highly random and uncertain in nature. Most hydrological variables exhibit a high degree of temporal and spatial variability. These studies are very essential to the mankind for providing a warning of the extreme flood or drought conditions and help to optimize the operation of systems like reservoirs and power plants etc. For better hydrological design, we need proper modeling of the system using these variables. Many approaches were suggested in the past. In this research study, a new modeling approach that uses artificial neural network and fuzzy logic concepts together is proposed for modeling hydrological problems.

Hybrid systems are designed to take advantage of the strengths of each system and avoid the limitations of each system. It is natural for neural networks to learn but it is cumbersome for a fuzzy system to learn. Hence a combination of the two would result in a rule- based system that can learn and adapt. Four different hydrological problems are modeled using the proposed fuzzy – neural network approach for examining the usefulness of it. Proposed hybrid system approach, which includes an artificial neural network modeling and fuzzy logic modeling is referred as FNN (fuzzy neural network) model.

FNN model is developed for deriving the stage-discharge relationship at various gauging stations of the main stem of river Brahmaputra with the objective of generating missing data to get continuous stage-discharge record for a long period. The performance of the proposed model is compared with a conventional model, a single neural network model, a modular neural network model by simulating the system.



Second stage is carried out for river flow prediction at downstream station by using upstream gauging station data. Six experiments are planned and performed in this study. The performance of fuzzy neural network model is compared with single neural network model.

An attempt is also made to derive general operating policies of a reservoir system using fuzzy neural network modeling approach from deterministic dynamic programming results for efficient reservoir operation. Two contrasting reservoir systems one in drought prone area (Aliyar) and another in surplus system (Pagladiya) in nature are considered in this study for assessing the ability of the developed models using three different experiments. The suitability of this approach in distributed flood routing is also examined by considering a small tributary of Brahmaputra river.

The usefulness of the proposed hybrid approach has been discussed and presented in detail.