# Title : Design of a Quantum inspired Fuzzy based Neural Network and its hardware realization for signature verification

**Keywords: Fuzzy C-Means, Clustering, Quantum Computing, VLSI accelerators**

## 1. Summary :

Propose to design a Quantum inspired Fuzzy based Neural Network (Q-FNN) algorithm and its dedicated hardware for signature verification application. It is a three-layer neural network architecture which uses the concept of Fuzzy c-Means (FCM) clustering to evolve the connection weights and the number of neurons in the hidden layer. The initial weights of the hidden layer will be taken as the cluster centroids to perform the learning of hidden layer using FCM. A modified step activation function is proposed, which forms the hidden layer neurons by considering overlapping of the samples belonging to different class regions. To get the optimal connection weights in terms of cluster centroids, the appropriate value of the fuzziness parameter (m) is required during the execution of FCM, which is evolved using quantum computing concept. The Quantum computing concept is based on the probabilistic model, which provide better characteristic of population diversity than other evolutionary representations. Thus, it provides the large search space for selection of an optimal fuzziness parameter. In Q-FNN, the final cluster centroids generated after execution of FCM for several generations will represent the final connection weights of the hidden layer.

Several methods and technologies have been proposed for signature verification include elastic matching, synthetic discriminate functions and grid features [1,2,3]. Finding appropriate static features from a signature image is still an open field of research. With the advancement of technology, extraction of features gets a whole new dimension. Moreover, the efficiency of matching two signatures images is an important parameter in any signature verification technique. To make this task more efficient, Q-FNN algorithm is further proposed to realize with dedicated hardware/VLSI accelerators in terms of dedicated memory controllers, implementation, input/output interface for real time signature verification.

## 2. Objectives:

(i) To develop a Quantum inspired fuzzy based Neural Network algorithm and its dedicated hardware for signature verification application.

(ii) To decide connection weights using Quantum and Fuzzy concept

(iii) To decide fuzzyfication parameter using quantum computing concept.

(iv) To develop a dedicated hardware/VLSI accelerator to achieve real time performance with limited computational resources and constrained power budget.

**References:**


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