**ABSTRACT**

**Problem:** This thesis presents the methods for identifying the movement of a person while walking (Gait). Many techniques have been evolved over period of time to identify behavior of human. However, still there are many situations where in, the human movement cannot be properly recognized. Hence, this thesis has taken gait recognition problem into consideration.

**Importance of selecting the problem:** For security reasons, automatic recognition of human movement is carried out using surveillance video cameras installed at sensitive points. The images acquired through these cameras should be correctly processed and to be decided if there is any unusual activity of human.

**Investigation of the human gait recognition problem:** Videos were shot at different conditions like, Stumbling, faltering, drunkard, and stealthy conditions. These videos were used to perform the recognition capacity of the proposed algorithms.

**Outputs of the proposed algorithms:** The proposed algorithms showed human gait identification to the expected performance. Hence, the thesis recommends the implementation of the proposed algorithms for real time gait recognition.

Applications of Artificial Neural Networks (ANN) to Gait analysis for human identification has been considered in this research work. The purpose of using artificial neural network is because, existing methods are based on statistical parameters. The purpose of using ANN for Gait registration is due to the following reasons:

1. The working concepts of ANN are based on statistics like using linear summation between layers to propagate information from input to output layers,
2. ANN use transformation function like exponential function in Radial basis function network to squash output values from neurons.
3. ANN uses objective function for finding optimal weights between layers for mapping inputs (features) to outputs (person). Because of the working properties of ANN are based on statistical concepts, ANN assures correct identification of human using GAIT.

ANN is the mathematical representation of the functioning of neural connections in the human brain. The mathematical representation varies depending upon the application. The ANN uses training algorithms. These algorithms are grouped under supervised, unsupervised and recurrent algorithms. The supervised algorithms use inputs and target outputs, the unsupervised algorithm use only inputs, and recurrent algorithms use inputs and target outputs along with previous outputs for training the topology of the ANN.

A multilayer feed forward network that uses an exponential activation function is called radial basis function (RBF). The RBF uses the concept of distance between patterns and the various centers of the patterns. The number of nodes in the hidden layer of the RBF network is equivalent to number of centers used to find the distance. A bias value of 1 is appended to the hidden layer nodes for convenience of weights processing. The final weights are obtained between hidden layer and the output layer. These weights are used for Gait identification.

A counter propagation (CPN) algorithms is used for human identification through Gait. The CPN has one unsupervised layer and one supervised layer.

The major combinations of the algorithms used for human identification through Gait are as follows:

1. Hidden Markov model (HMM) for extracting the features of Gait.
2. Radial basis function (RBF) for human identification.
3. Counter propagation (CPN) for human identification.
4. HMM+ RBF for human identification.
5. HMM + CPN for human identification.
Justification of methods implemented in this thesis with respect to problem of Gait is as follows:

1. The ANN can identify Gait even if there is slight change in Gait appearance.
2. The ANN can be trained with minimum patterns (<100 with unique Gait styles) and the ANN can identify similar Gaits.

Experimental data were collected from the internet resource. The method of training patterns and testing patterns used for the implemented ANN are as follows:

1. Same number of training patterns and same number of test patterns are used for all the implemented algorithms.
2. Different number of training patterns and different number of test patterns are also used for training the different algorithms.

The reason for choosing training and testing data into two different combinations are for evaluating the performance of the implemented algorithms for small number of training patterns and for large number of training patterns.

In order to find the optimum number of nodes required in the hidden layer of CPN, a method has been proposed, based on the change in the mean squared error dynamically, during the successive sets of iterations. By this process, optimum number of nodes in the hidden layer is obtained meeting the convergence criteria and maximum Gait identification.

The number of centers in the hidden layer of ANN trained by RBF algorithm is based on the maximum number of Gaits identified.

The contribution of thesis in implementing HMM with ANN for Gait identification is a promising direction of research for the scientific community. The combinations HMM with RBF, the combination of HMM with CPN have given different possibilities of combining HMM with ANN for improving Gait identification.