**POWER SYSTEM FAULT DIAGNOSIS USING MACHINE LEARNING**

# Abstract:

Power Systems has many challenges which include fault diagnosis, load frequency control, unit commitment, load scheduling, optimization etc. In the above-mentioned fault diagnosis is one of the major issue. This can be resolved by using traditional and artificial intelligence-based techniques. This paper focus on fault detection, classification and location identification in electrical transmission systems using machine learning. The simulation results concluded that the present method is efficient in detection, classification and location estimation of the faults on the transmission lines with satisfactory performance.

Keywords: Fault Diagnosis, Artificial Intelligence, Deep Neural Network, Recurrent Neural Network.

# I. Introduction:

Electrical power systems important asset of every nation, We mostly depend on the electrical power. The electrical power systems were are grown very rapidly in the past few decades that resulted in a large increase in the number of lines in operation and their length. The transmission lines are exposed to open environment so that the faults are unavoidable. These faults as a result of lightning, short circuits, faulty equipment, mis-operation, human errors, overloading and ageing etc.

When a fault occurs in transmission lines it is very important to detect, classify and to find the fault location to restore the power delivery. The time needed for the restoration of the power will reflect in power quality. Therefore a sophisticated detection technique and an accurate location on the line is an important requirement for fault detection.

Most of the faults can cause large currents or voltage changes so that they can be detected using the traditional protective relays. But some faults, such as high impedance faults will cause small current and voltage changes. So that it is difficult to detect by a traditional protective relay. For those problems, we need an efficient fault detection, classification and location methods.

# II. Power System Faults:

Fault is an abnormal condition in the electrical systems. The faults in the electric transmission lines are short circuit faults and open circuit faults etc. Open circuit faults are very rare in the transmission lines but the short circuit faults are very common these faults are may be due to natural climatic conditions and mis-operation. The transmission of electric power is doing in 3 phase lines. The short circuit faults in the 3 phase transmission lines are classified as symmetrical faults and unsymmetrical faults.

## A. Symmetrical faults:

Symmetrical faults are most severe faults and rarely occurs in the power system. These faults are balanced. These faults are of two types LLL fault and LLL-G faults, When ground involves in the fault then that is called as LLL-G fault else called as LLL fault. These faults remain balanced in the system. The analysis can be done by using per phase analysis.

## B. Un-symmetrical faults:

These faults are very common and less severe than the symmetrical faults. These faults are classified as the line to ground (L-G), line to line (L-L), double line to ground fault (LL-G) faults. These faults are unbalanced in nature and cause unbalanced currents to flow in the phases. The study of un-symmetrical faults can be done by using symmetrical components.

# III. Fault Detection and Classification Techniques:

There are plenty of techniques proposed over the past years. Those techniques have their own advantages and disadvantages. The fault classification and location identification must be very fast in order to improve the power quality.

## A. Discrete Wavelet Transform:

Discrete wavelet transform (DWT) is a very important technique for the feature extraction from certain frequency bands in signals. Discrete wavelet transforms with Multi-Resolution Analysis (MRA) can be used to analyze the high-frequency signals for a short duration. The main drawbacks of DWT are the choice if appropriate mother function suitable for the application, computational complexity and time etc.

## B. Artificial Neural Networks:

Artificial neural networks are (ANN) are a family of non-linear statistical models and learning algorithms that are intended to imitate the behavior of connected neurons in biological neural systems. Different ANN models have been used for different applications. Feedforward neural network (FNN) the simplest neural network configuration which can be characterized as a single layer or multi-layer perceptrons. An FNN often has an input layer, output layer and at least one hidden layer. The node or neurons will fully connected with adjacent layer to process in data. The weights will be assigned and the bias for the nodes decides the output of the network given an input.

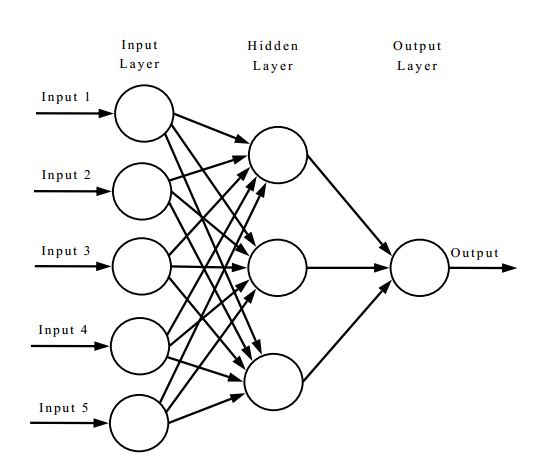


Fig. 1 Artificial neural network

Fig. 1 shows the artificial neural network with multi-input and a single output. From the late 1980’s researchers are using Back-propagation algorithm with FNN. There are several types of FNN networks such as Radial basis function networks (RBFN), Probabilistic neural networks (PNN) etc.

## C. Support Vector Machines:

Support vector machine are the superior classification technique that can capable to classify the faults very efficiently. But support vector machines are very expansive in terms of training time.

## D. Decision Trees:

Decision trees are the easier to understand by a human. These are limited by their stability.

## E. Fault Location Identification Techniques:

There are several methods to determine fault location in the transmission lines. Those are very

# IV. Deep Neural Networks:

Deep neural networks are improved version of the artificial neural networks. These networks need to be trained with large amount of data. These networks consist of hidden layers more than two to three. Deep neural networks are capable to extract features by their self and can provide better results when compared to many other techniques.

# V. Simulation Results and Discussions:

The power system studied in this paper is shown in the fig. x.

# VI. Conclusions:

From the results we can conclude that these results are satisfied

# REFERENCES