FORECASTING OF PHOTOVOLTAIC SYSTEM OUTPUT USING HYBRID PARTICLE SWARM OPTIMIZATION-ARTICIFIAL NEURAL NETWORK MODEL

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ABSTRACT

Backpropagation (BP) algorithm is widely used to solve many real world problems by using the concept of Multilayer Perception (MLP). However, major disadvantages of BP are its convergence rate is relatively slow and always being trapped at the local minima. To overcome these problems, Particle Swarm Optimization (PSO) has been used to determine optimal value for BP parameters such as learning rate and momentum rate and also for weighting optimization. In Backpropagation Neural Network (BPNN), there are many elements to be considered such as the number of input, hidden and output nodes, learning rate, momentum rate, bias, minimum error and activation/transfer functions. These entire elements will affect the speed of natural network learning. In this study, the optimization algorithm, PSO is chosen and applied in feedforward neural network to enhance the learning process. Two model have been develop: Classical Artificial Neural Network (ANN) and Particle Swarm Optimization (PSO) for the prediction of total AC power output from a grid connected photovoltaic system. The result showed that the prediction of the total AC power output of grid connected photovoltaic system could be optimized and accelerated using PSO-ANN.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

An Artificial Neural Network (ANN) or commonly referred as Neural Network (NN) is an information processing paradigm that is inspired by the way biological nervous systems process the information. The computation is highly complex, nonlinear and parallel. Many applications have been developed using ANN algorithm and most of the applications are on predicting future events based on historical data. Processing power in ANN allows the network to learn and adapt, in addition to making it particularly well suited to tasks such as classification, pattern recognition, memory recall, prediction, optimization, and noise filtering [1].

The primary significance for an ANN is the ability of the network to learn from its environment and to improve its performance through learning [2]. Learning is a process of modifying the weights and biases to the neurons and continued until a preset condition is met such as defined error function. Learning process is usually referred as training process in ANN. The objective of training process is to classify certain input data patterns to certain outputs before testing with another group of related data. The backpropagation (BP) algorithm is a commonly used learning algorithm for training ANN [3]. BP algorithm is used in ANN learning process for supervised or associative learning. Supervised learning learns based on the target value or the desired outputs. During training, the network tries to match the outputs with the desired target values.

With the latest research in softcomputing, Swarm Intelligence (SI) technique was introduced in 1995 by James Kennedy who is a social psychologist and Russell C.