شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

HANAA ALY

شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

HANAA ALY

FORECASTING OF RENEWABLE ENERGY USING ANN, GPANN AND ANFIS (A COMPARATIVE STUDY AND PERFORMANCE ANALYSIS)

By

Omnia Abd Al-Azeem Hussieny Ahmed

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Engineering Mathematics

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2021

FORECASTING OF RENEWABLE ENERGY USING ANN, GPANN AND ANFIS (A COMPARATIVE STUDY AND PERFORMANCE ANALYSIS)

By

Omnia Abd Al-Azeem Hussieny Ahmed

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Engineering Mathematics

Under the Supervision of

Prof. Mohamed A. El-Beltagy

Engineering Mathematics and Physics Department.
Faculty of Engineering, Cairo University.

Dr. Samah El-Tantawy

Engineering Mathematics and Physics Department.
Faculty of Engineering, Cairo University.

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2021

FORECASTING OF RENEWABLE ENERGY USING ANN, GPANN AND ANFIS (A COMPARATIVE STUDY AND PERFORMANCE ANALYSIS)

By

Omnia Abd Al-Azeem Hussieny Ahmed

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Engineering Mathematics

Approved by the
Examining Committee

Prof. Mohamed A. El-Beltagy **(Thesis Main Advisor)**
Engineering Mathematics and Physics Department
Faculty of Engineering, Cairo University.

Dr. Samah El-Tantawy **(Advisor)**
Engineering Mathematics and Physics Department
Faculty of Engineering, Cairo University.

Prof. Doaa Mohamed Shawky **(Internal Examiner)**
Engineering Mathematics and Physics Department
Faculty of Engineering, Cairo University.

Prof. Said Wahsh **(External Examiner)**
Prof. of Power Electronics, Electronics Research Institute.

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2021

Engineer's Name: Omnia Abd Al-Azeem Hussieny Ahmed
Date of Birth: 23 / 10 / 1991
Nationality: Egyptian
E-mail: omnia.abdelazeem@outlook.com
omnia.abdelazem@iaet.edu.eg
Phone: 01092464912
01022227032
Address: 13 St, El-Shorouk School, Mohandeseen , Giza

Registration Date: 1 / 3 / 2017
Awarding Date: …./…./2021
Degree: Master of Science
Department: Engineering Mathematics and Physics

Supervisors:

Prof. Mohamed A. El-Beltagy
Dr. Samah El-Tantawy

Examiners:

Prof. Mohamed A. El-Beltagy (Thesis main advisor)
Dr. Samah El-Tantawy (advisor)
Prof. Doaa Mohamed Shawky (Internal examiner)
Prof. Said Wahsh (External examiner)
Prof. of Power Electronics, Electronics Research Institute.

Title of Thesis:

FORECASTING OF RENEWABLE ENERGY USING ANN, GPANN AND ANFIS (A COMPARATIVE STUDY AND PERFORMANCE ANALYSIS).

Key Words:
Forecasting, Artificial Neural Network (ANN), Multilayer Perceptron (MLP), Genetic Algorithm (GA), Adaptive Neuro fuzzy inference system (ANFIS).

Summary:
The task of forecasting and prediction is deemed to be a salient task in several problems and issues. The main concentration of this thesis is to forecast different types of data based on collected previous data obtained months ago. The data gathered are the global horizontal irradiance (GHI), direct normal irradiance (DNI), diffuse horizontal irradiance (DHI), temperature, and wind speed. The two kinds of data used in this thesis are the wind speed and the temperature. Forecasting and prediction for wind speed and temperature as explored in the current work based on three several methods based on artificial neural network (ANN) and genetic programming fused with artificial neural network (GPANN) and adaptive neuro-fuzzy inference system (ANFIS).

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

Name: Omnia Abd Al-Azeem Hussieny Ahmed

Date: ../../…

Signature:

Dedication

To my father and Mother,
The reason for what I become today,
Thank you for your love, support, and care.

To my sisters,
my husband Eng. Ehab Askar, my son Yamen and my daughter Layan,
I am really grateful to all of you,
you have been my inspiration and my soul mates.

All the love and respect to you for your support.

Acknowledgments

First and above of all, I have to thank Allah for this great chance I have right now. I thank Allah for providing me with the opportunity to meet such helpful and wonderful people who helped me from the start of this thesis. All praises to Allah for giving me knowledge, strength, support, and patience to present this work.

I would like to express my deepest sense of gratitude and a special thanks to my respectable main supervisor **Prof. Mohamed A. El-Beltagy** and my respectable supervisor **Dr. Samah Elshafiey Eltantawy**; who offered me the honor to be one of their students. I thank them for their continuous advice and encouragement throughout the course of this thesis. I also thank them for the guidance, caring, patience, and constant full support throughout my thesis. I want to express my gratitude to them for their knowledge, teachings, and their expected help.

Thanks to **Prof. Adel Khalil** and **Dr. Ahmed Abo Elmagd** in the mechanical department for allowing us to use the solar data that was collected from the solar energy laboratory of Zaid CPS station.

I would like to thank **Dr. Mohamed Essa** for his guidance, caring, constant full support, and expected help to complete my thesis.

I would also like to express my deep thanks to my family especially my parents. I would like to thank them for raising me in a way to believe that I can achieve anything in life with hard work and patience. I am especially grateful to my husband, my son, and my daughter; who were always inspiring me with their support, love and patience, cheering me up and standing by me through the good and bad times.

Table of Contents

List of Tables