



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم



HANAA ALY



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شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلم



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جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

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BUILDING ROOFTOPS EXTRACTION FROM SATELLITE IMAGES USING MACHINE LEARNING ALGORITHMS FOR SOLAR PHOTOVOLTAIC POTENTIAL ESTIMATION

By

Eslam Mustafa Mahmoud Muhammed

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
Civil Engineering – Public Works

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Title of Thesis:

Building Rooftops Extraction from Satellite Images Using Machine Learning Algorithms for Solar Photovoltaic Potential Estimation

Key Words:

Rooftops extraction; Machine learning; Image processing; Solar PV potential; Green energy

Summary:

This research involves the extraction of buildings from satellite images to be used for solar PV potential estimation. Pre-processing algorithms were used to enhance the image of a city in Cairo, Egypt called Madinaty. Then, two machine learning techniques were used to extract the buildings' rooftops. SVM exceeded Naïve Bayes in terms of the detection accuracy with an F1 score of 94.7%. The detected gross areas of the rooftops were used in the second phase of this thesis, which is the PV potential estimation of PV panels mounted over the detected rooftops. Three methods were used for the solar modeling of the study area which are PVWatts calculator, PVGIS, and ArcGIS. The estimated PV potentials were calculated to be 21, 24.9, and 22.3 GWh/year for the three methods respectively. CO2 was reduced by an average of 62% after using solar panels instead of depending on traditional energy sources.

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.

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Table of Contents

iv

Disclaimer	i
Acknowledgments	ii
Table of Contents	iii
List of Tables	viii
List of Figures	ix
Abstract	xi
Chapter 1 : Introduction	1
1.1. Energy and Environmental issues	2
1.2. Solar Energy in Egypt	3
1.3. Contributions of this research	4
Chapter 2 : Literature Review	5
2.1. Correlations, Extrapolation and Manual digitizing	5
2.2. Automatic extraction of buildings	8
2.3. PV technology	14
Chapter 3 : Methodology	19
3.1. Materials	20
3.1.1. Study area and datasets	20
3.1.2. Traditional Approach	22
3.1.3. Reference Data	23
3.2. Detection of rooftops	24
3.2.1. Pre-processing	25
i. Gamma correction	25
ii. Shadow Masking	26
iii. Gaussian Blur, Bilateral filtering and Mean shift segmentation	27
iv. Vegetation Masking	30
v. K-means	31
vi. Connected Components	33
vii. Morphological transformations	34
3.2.2. Machine learning	36
(a) Applying SVM:	39

(b)	Applying Naïve Bayes (NB):.....	40
3.2.3.	Evaluation	41
(i)	Cross-Validation	41
(ii)	Detection Accuracy Assessment.....	42
(iii)	Relative root mean square error (RRMSE).....	42
3.3.	Solar PV potentials estimation.....	43
3.3.1.	Preparation of the areas of the rooftops	43
•	Ground Coverage Ratio (GCR)	44
3.3.2.	Parameters used for the PV module.....	46
a)	Rooftop area determination.....	46
b)	Solar Irradiance	46
c)	Module and Array Type.....	46
d)	Array Tilt:	47
e)	Array Orientation (Azimuth)	47
f)	System Size:.....	47
g)	Energy Yield:	47
3.3.3.	Applications used for solar radiation modeling.....	49
3.3.3.1.	PVWatts calculator	49
(a)	Data resources used by the PVWatts calculator	49
(b)	Energy yield.....	50
3.3.3.2.	PVGIS	50
(a)	Databases used in PVGIS	51
•	European database used in PVGIS	51
•	African database used in PVGIS.....	51
3.3.3.3.	ArcGIS	52
3.3.4.	Carbon emission impact.....	54
Chapter 4 :	Results and Discussion.....	55
4.1.	Detection of rooftops	55
4.1.1.	Machine learning output results.....	55
4.1.1.1.	Support Vector Machine	55
4.1.1.2.	Naïve Bayes	57
4.1.2.	Cross-validation	58
4.1.3.	Detection accuracy assessment	59
4.1.4.	Relative root mean square error (RRMSE).....	60

1)	B3 division	61
2)	B7 division	62
3)	Villas division	62
4.2.	Solar PV potential estimation	64
4.2.1.	Preparation of the areas of the rooftops	64
4.2.1.1.	Ground Coverage Ratio	65
4.2.1.2.	System losses	65
4.2.1.3.	System size.....	66
4.2.2.	The output of using the three PV applications.....	66
Chapter 5 :	Summary, Conclusions and Recommendations.....	71
5.1.	Summary	71
5.2.	Conclusion	71
5.3.	Recommendations.....	73
References.....		74
Appendices.....		85
Appendix A:	Typical monocrystalline PV module.....	85
Appendix B:	PV potential report using PVWatts calculator	86

PVWatts Calculator

RESULTS

21,102,266 kWh/Year*

Month	Solar Radiation (kWh / m ² / day)	AC Energy (kWh)	Value (\$)
January	3.93	1,301,998	N/A
February	5.03	1,494,866	N/A
March	5.57	1,811,361	N/A
April	6.18	1,893,225	N/A
May	6.60	2,060,852	N/A
June	6.87	2,051,734	N/A
July	6.86	2,112,760	N/A
August	6.68	2,060,834	N/A
September	6.65	1,998,473	N/A
October	5.08	1,600,630	N/A
November	4.35	1,363,987	N/A
December	4.13	1,351,549	N/A
Annual	5.66	21,102,269	0

Location and Station Identification

Requested Location	madinaty	
Weather Data Source	(INTL) CAIRO, EGYPT	13 mi
Latitude	30.13° N	
Longitude	31.40° E	

PV System Specifications (Residential)

DC System Size	13206.68695 kW
Module Type	Premium
Array Type	Fixed (open rack)
Array Tilt	30°
Array Azimuth	180°
System Losses	14%
Inverter Efficiency	96%
DC to AC Size Ratio	1.2

86

Appendix C: PV potential report using PVGIS87

4

List of Tables

Table 3. 1: A simple diagram that shows how k-folds cross-validation works [73].	41
Table 3. 2: Different Solar radiation Databases available for PVGIS [87].	52
Table 4. 1: Cross-validation for SVM and NB	58
Table 4. 2: The difference in the precision assessment results by both ML techniques.	59
Table 4. 3: Summary of RRMSE for the four different cases.	60
Table 4. 4: Accuracy assessment for SVM and NB for the other divisions.	64
Table 4. 5: An example of the calculations made to get the usable areas of the rooftops.	65
Table 4. 6: System losses in the PV system.	66
Table 4. 7: The PV potential using the three methods.	69