ETH
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Prediction of Photovoltaic Power Generation from Cloud Imaging

Master Thesis

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Abstract

Managing fluctuation in renewable power is one of the big challenges that need to be solved in order to significantly increase the penetration of renewables into the power grid. For photovoltaics, one possible approach to predict short term variations is vision based. Such systems have been studied for about 5 years, and the state of the art is a fish eye camera pointing into the sky (see illustration sample.jpeg) and taking image sequences. Given such image sequences and their extrapolation into the near future (which has been already developed), the aim of this Master Thesis project is to develop and compare algorithms to predict the short term power production of a PV plant, making use of Image Processing and Machine Learning. Specifically, the role of the cloudiness predictions in both shielding the direct sun irradiation and reflecting the sunlight (increasing the diffuse component) needs to be addressed.

Contents

Chapter 1

Introduction

This is version `v1.4` of the template.

We assume that you found this template on our institute's website, so we do not repeat everything stated there. Consult the website again for pointers to further reading about LaTeX. This chapter only gives a brief overview of the files you are looking at.

1.1 Features

The rest of this document shows off a few features of the template files. Look at the source code to see which macros we used!

The template is divided into TeX files as follows:

1. `thesis.tex` is the main file.
2. `extrapackages.tex` holds extra package includes.
3. `layoutsetup.tex` defines the style used in this document.
4. `theoremsetup.tex` declares the theorem-like environments.
5. `macrosetup.tex` defines extra macros that you may find useful.
6. `introduction.tex` contains this text.
7. `sections.tex` is a quick demo of each sectioning level available.
8. `refs.bib` is an example bibliography file. You can use BibTeX to quote references. For example, read [1] if you can get a hold of it.

1.1.1 Extra package includes

The file `extrapackages.tex` lists some packages that usually come in handy. Simply have a look at the source code. We have added the following comments based on our experiences:

REC This package is recommended.

OPT This package is optional. It usually solves a specific problem in a clever way.

ADV This package is for the advanced user, but solves a problem frequent enough that we mention it. Consult the package's documentation.

As a small example, here is a reference to the Section *Features* typeset with the recommended *varioref* package:

> See Section 1.1 on the preceding page.

1.1.2 Layout setup

This defines the overall look of the document – for example, it changes the chapter and section heading appearance. We consider this a 'do not touch' area. Take a look at the excellent *Memoir* documentation before changing it.

In fact, take a look at the excellent *Memoir* documentation, full stop.

1.1.3 Theorem setup

This file defines a bunch of theorem-like environments.

Theorem 1.1 *An example theorem.*

Proof Proof text goes here. □

Note that the q.e.d. symbol moves to the correct place automatically if you end the proof with an `enumerate` or `displaymath`. You do not need to use `\qedhere` as with *amsthm*.

Theorem 1.2 (Some Famous Guy) *Another example theorem.*

Proof This proof

1. ends in an enumerate. □

Proposition 1.3 *Note that all theorem-like environments are by default numbered on the same counter.*

Proof This proof ends in a display like so:

$$f(x) = x^2. \qquad \square$$

1.1.4 Macro setup

For now the macro setup only shows how to define some basic macros, and how to use a neat feature of the *mathtools* package:

$$|a|, \quad \left|\frac{a}{b}\right|, \quad |\frac{a}{b}|.$$

Chapter 2

Related work

Chapter 3

Irradiance estimation from sky image

Chapter 4

Results

Chapter 5

Discusion

Chapter 6

Conclusion

Dummy text.

Appendix A

Dummy Appendix

You can defer lengthy calculations that would otherwise only interrupt the flow of your thesis to an appendix.

Bibliography

[1] Robert Bringhurst. *The Elements of Typographic Style*. Hartley & Marks, 1996.

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