

THE OPTIMAL DELAUNAY TRIANGULATION OF CHEESY SONGS

A thesis submitted to the Delft University of Technology in partial fulfillment
of the requirements for the degree of

Master of Science in Geomatics

by

Céline Dion

May 2015

Céline Dion: *The optimal Delaunay triangulation of cheesy songs* (2015)
© This work is licensed under a Creative Commons Attribution 4.0 International License. To view a copy of this license, visit
<http://creativecommons.org/licenses/by/4.0/>.

ISBN 999-99-9999-999-9

The work in this thesis was made in the:



3D geoinformation group
Department of Urbanism
Faculty of Architecture & the Built Environment
Delft University of Technology

Supervisors: Prof.dr. Jan Smit
Dr. Gerard Joling
ir. Gordon Heuckeroth
Co-reader: Dr. Pietje de Piet

ABSTRACT

[Should fit on one page.]

Bacon ipsum dolour sit amet porchetta beef turkey, bacon turducken boudin hamburger venison ball tip. Brisket pork loin bresaola short loin ground round leberkas pastrami tongue jerky cow turducken beef ribs. Pork ribeye landjaeger prosciutto pig venison tenderloin. Swine beef ribs kielbasa, porchetta tenderloin salami venison pork belly tail. Bacon ipsum dolour sit amet porchetta beef turkey, bacon turducken boudin hamburger venison ball tip. Brisket pork loin bresaola short loin ground round leberkas pastrami tongue jerky cow turducken beef ribs. Pork ribeye landjaeger prosciutto pig venison tenderloin. Swine beef ribs kielbasa, porchetta tenderloin salami venison pork belly tail. Bacon ipsum dolour sit amet porchetta beef turkey, bacon turducken boudin hamburger venison ball tip. Brisket pork loin bresaola short loin ground round leberkas pastrami tongue jerky cow turducken beef ribs. Pork ribeye landjaeger prosciutto pig venison tenderloin. Swine beef ribs kielbasa, porchetta tenderloin salami venison pork belly tail.

ACKNOWLEDGEMENTS

Thanks to everyone, especially to my supervisors and my mum. And obviously to the one who made that great template.

Bacon ipsum dolour sit amet porchetta beef turkey, bacon turducken boudin hamburger venison ball tip. Brisket pork loin bresaola short loin ground round leberkas pastrami tongue jerky cow turducken beef ribs. Pork ribeye landjaeger prosciutto pig venison tenderloin. Swine beef ribs kielbasa, porchetta tenderloin salami venison pork belly tail.

Bacon ipsum dolour sit amet porchetta beef turkey, bacon turducken boudin hamburger venison ball tip. Brisket pork loin bresaola short loin ground round leberkas pastrami tongue jerky cow turducken beef ribs. Pork ribeye landjaeger prosciutto pig venison tenderloin. Swine beef ribs kielbasa, porchetta tenderloin salami venison pork belly tail.

Bacon ipsum dolour sit amet porchetta beef turkey, bacon turducken boudin hamburger venison ball tip. Brisket pork loin bresaola short loin ground round leberkas pastrami tongue jerky cow turducken beef ribs. Pork ribeye landjaeger prosciutto pig venison tenderloin. Swine beef ribs kielbasa, porchetta tenderloin salami venison pork belly tail.

...

CONTENTS

1	INTRODUCTION	1
1.1	How to get started with L ^A T _E X?	1
1.2	Cross-references	1
1.3	Figures	1
1.3.1	Shorter section name for the TOC	1
1.4	How to add references?	3
1.5	Tables	3
1.6	Pseudo-code	3
1.7	Acronyms	4
2	RELATED WORK	5
A	REFLECTION	9

LIST OF FIGURES

Figure 1	One nice figure	2
Figure 2	Shortened title for the list of figures	2
Figure 3	Three PDF figures.	2

LIST OF TABLES

Table 1	Details concerning the datasets used for the experiments.	3
---------	---	---

LIST OF ALGORITHMS

1.1	WALK	3
-----	----------------	---

ACRONYMS

DEM digital elevation model

DT Delaunay triangulation

GDAL Geospatial Data Abstraction Library

GIS geographical information system

GISs geographical information systems

GUI graphical user interface

TIN triangular irregular network

VD Voronoi diagram

1

INTRODUCTION

This is a complete template for the MSc Geomatics thesis. It contains all the parts that are required and is structured in such a way that most/all supervisors expect. Observe that the MSc Geomatics at TU Delft has no formal requirements (except the reflection part, which I put as an Appendix), so I took the liberty of formatting it the way I like. I basically took the template `arsclassica` (by Lorenzo Pantieri), which is an adaption of the original `classicthesis` package from André Miede, added the front/back matters (cover page, copyright, abstract, etc.), and gave examples for the insertion of figures, tables and algorithms.

It is not an official template and it is not mandatory to use it.

But I hope it will encourage everyone the use of \LaTeX for writing their thesis, and I also hope that it will *discourage* some from using Word...

If you run into mistakes/problems/issues, please report them on the GitHub page, and if you fix an error, then please submit a pull request.

<https://github.com/tudelft3d/MScGeomaticsThesisTemplate>.

1.1 HOW TO GET STARTED WITH \LaTeX ?

Basically everything you need to know—from installation to details—is there: <http://en.wikibooks.org/wiki/LaTeX>

To compile this template, you need a full installation of MiKTeX or TeXLive or MacTeX.

1.2 CROSS-REFERENCES

Chapter 1 is what you're currently reading, and its name is `INTRODUCTION`. Section 1.6 is about pseudo-code. The next Chapter (`RELATED WORK`), is on page 5.

1.3 FIGURES

As shown in Figure 2, it is possible to have two figures (or more) side by side. You can also refer to a subfigure: see Figure 2b.

1.3.1 Figures in PDF are possible and even encouraged!

If you use Adobe Illustrator or Ipe you can make your figures vectorial and save them in PDF.

You include a PDF the same way as you do for a PNG, see Figure 3,

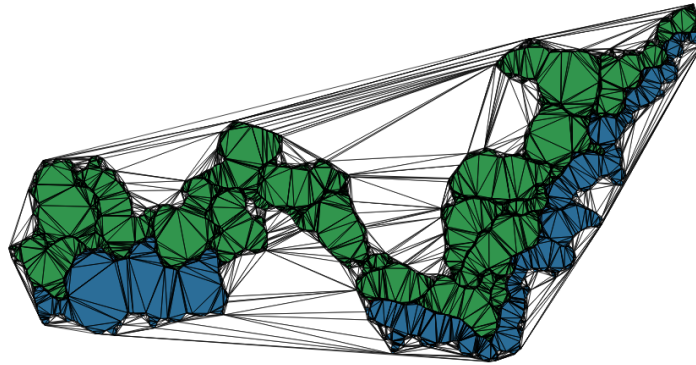
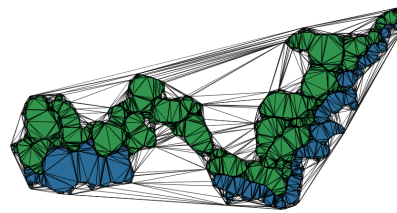
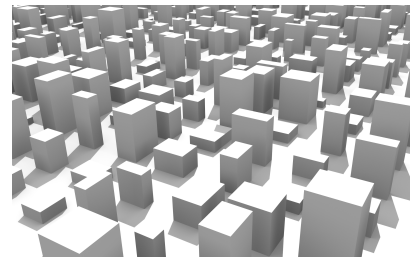


Figure 1: One nice figure

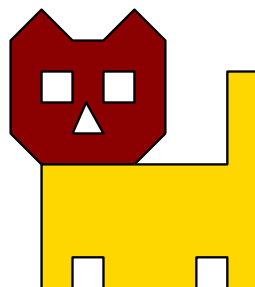


(a)

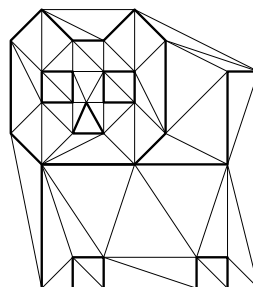


(b)

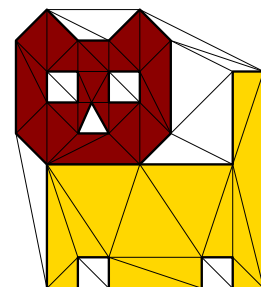
Figure 2: Two figures side-by-side. (a) A triangulation of 2 polygons. (b) Something not related at all.



(a) 2 polygons



(b) CDT



(c) with colours

Figure 3: Three PDF figures.

	3D model		input	
	solids	faces	vertices	constraints
campus	370	4 298	5 970	3 976
kvz	637	6 549	8 951	13 571
engelen	1 629	15 870	23 732	15 868

Table 1: Details concerning the datasets used for the experiments.

1.4 HOW TO ADD REFERENCES?

Descartes [1637] wrote and another one too [Voronoi, 1908]. Instead of citing the whole paper [Delaunay, 1934], it is also possible to cite only the authors (e.g. Delaunay).

1.5 TABLES

The package booktabs permits you to make nicer tables than the basic ones in L^AT_EX. See for instance Table 1.

1.6 PSEUDO-CODE

Please try to not put code (Python, C++, Fortran) in your thesis. Put pseudo-code instead. The package algorithm2e is pretty handy, see for instance the Algorithm 1.1. All your algorithms will be automatically added to the list of algorithms at the begining of the thesis. Observe that you can put

Algorithm 1.1: WALK (\mathcal{T} , τ , p)

Input: A Delaunay tetrahedralization \mathcal{T} , a starting tetrahedron τ , and a query point p

Output: τ_r : the tetrahedron in \mathcal{T} containing p

```

1 while  $\tau_r$  not found do
2   for  $i \leftarrow 0$  to 3 do
3      $\sigma_i \leftarrow$  get face opposite vertex  $i$  in  $\tau$ ;
4     if  $\text{Orient}(\sigma_i, p) < 0$  then
5        $\tau \leftarrow$  get neighbouring tetrahedron of  $\tau$  incident to  $\sigma_i$ ;
6       break;
7   end
8 end
9 if  $i = 3$  then
10  // all the faces of  $\tau$  have been tested
11  return  $\tau_r = \tau$ 
12 end
```

labels on certain lines (with) and then reference to them: on line 4 of the Algorithm 1.1 this is happening.

1.7 ACRONYMS

If you want to have a list of acronyms you use in your thesis, use the `acronym` package. The first time you speak about geographical information system ([GIS](#)), it will be spelled out. Further use, [GIS](#), you'll get the acronym plus a hyperlink to the list in the preamble of the thesis.

Add yours to `front/acronyms.tex`.

2

RELATED WORK

Bacon ipsum dolour sit amet porchetta beef turkey, bacon turducken boudin hamburger venison ball tip. Brisket pork loin bresaola short loin ground round leberkas pastrami tongue jerky cow turducken beef ribs. Pork ribeye landjaeger prosciutto pig venison tenderloin. Swine beef ribs kielbasa, porchetta tenderloin salami venison pork belly tail. Bacon ipsum dolour sit amet porchetta beef turkey, bacon turducken boudin hamburger venison ball tip. Brisket pork loin bresaola short loin ground round leberkas pastrami tongue jerky cow turducken beef ribs. Pork ribeye landjaeger prosciutto pig venison tenderloin. Swine beef ribs kielbasa, porchetta tenderloin salami venison pork belly tail. Bacon ipsum dolour sit amet porchetta beef turkey, bacon turducken boudin hamburger venison ball tip. Brisket pork loin bresaola short loin ground round leberkas pastrami tongue jerky cow turducken beef ribs. Pork ribeye landjaeger prosciutto pig venison tenderloin. Swine beef ribs kielbasa, porchetta tenderloin salami venison pork belly tail.

Bacon ipsum dolour sit amet porchetta beef turkey, bacon turducken boudin hamburger venison ball tip. Brisket pork loin bresaola short loin ground round leberkas pastrami tongue jerky cow turducken beef ribs. Pork ribeye landjaeger prosciutto pig venison tenderloin. Swine beef ribs kielbasa, porchetta tenderloin salami venison pork belly tail. Bacon ipsum dolour sit amet porchetta beef turkey, bacon turducken boudin hamburger venison ball tip. Brisket pork loin bresaola short loin ground round leberkas pastrami tongue jerky cow turducken beef ribs. Pork ribeye landjaeger prosciutto pig venison tenderloin. Swine beef ribs kielbasa, porchetta tenderloin salami venison pork belly tail. Bacon ipsum dolour sit amet porchetta beef turkey, bacon turducken boudin hamburger venison ball tip. Brisket pork loin bresaola short loin ground round leberkas pastrami tongue jerky cow turducken beef ribs. Pork ribeye landjaeger prosciutto pig venison tenderloin. Swine beef ribs kielbasa, porchetta tenderloin salami venison pork belly tail. Bacon ipsum dolour sit amet porchetta beef turkey, bacon turducken boudin hamburger venison ball tip. Brisket pork loin bresaola short loin ground round leberkas pastrami tongue jerky cow turducken beef ribs. Pork ribeye landjaeger prosciutto pig venison tenderloin. Swine beef ribs kielbasa, porchetta tenderloin salami venison pork belly tail.

Bacon ipsum dolour sit amet porchetta beef turkey, bacon turducken boudin hamburger venison ball tip. Brisket pork loin bresaola short loin ground round leberkas pastrami tongue jerky cow turducken beef ribs. Pork ribeye landjaeger prosciutto pig venison tenderloin. Swine beef ribs kielbasa, porchetta tenderloin salami venison pork belly tail. Bacon ipsum dolour sit amet porchetta beef turkey, bacon turducken boudin hamburger venison ball tip. Brisket pork loin bresaola short loin ground round leberkas pastrami tongue jerky cow turducken beef ribs. Pork ribeye landjaeger prosciutto pig venison tenderloin. Swine beef ribs kielbasa, porchetta tenderloin salami venison pork belly tail.

BIBLIOGRAPHY

- B. N. Delaunay. Sur la sphère vide. *Izvestia Akademia Nauk SSSR, Otdelenie Matematicheskii i Estestvennyka Nauk*, 7:793–800, 1934.
- R. Descartes. *Discours de la méthode*. Jan Maire, Leyde, 1637.
- G. M. Voronoi. Nouvelles applications des paramètres continus à la théorie des formes quadratiques. *Journal für die Reine und Angewandte Mathematik*, 134:198–287, 1908.

A

REFLECTION

At P5 a reflection must be included as a distinct part of the thesis (a separate chapter) or as a separate document. In this reflection the student uses a short substantiated explanation to account for the results of the research in the graduation phase (product, process, planning). Depending on the research, reflection on a number of the following aspects should be included (you may choose in which order). The reflection should be in the form of a text, with diagrams and sketches for purposes of illustration and clarification.

ASPECT 1 The relationship between the methodical line of approach of the Master Geomatics and the method chosen by the student in this framework.

ASPECT 2 The relationship between the conducted research and application of the field geomatics.

ASPECT 3 The relationship between the project and the wider social context.

COLOPHON

This document was typeset using \LaTeX . The document layout was generated using the `arsclassica` package by Lorenzo Pantieri, which is an adaption of the original `classicthesis` package from André Miede.