TRABAJO DE FIN DE MÁSTER

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Máster Universitario en Tecnologías de la Información Geográfica para la Ordenación del Territorio: Sistemas de Información Geográfica y Teledetección

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Agradecimientos

And I would like to acknowledge ...

Prólogo

El presente Trabajo Fin de Máster en Tecnologías de la Información Geográfica para la Ordenación del Territorio: SIG y Teledetección, expone todas las tareas que se han realizado durante la colaboración en el Proyecto SIOSE-INNOVA: Innovaciones técnicas y metodológicas en el Sistema de Información sobre Ocupación del Suelo de España (SIOSE) y su aplicación en estudios geográficos. El investigador principal de este proyecto es Alfredo Ramón Morte, que cuenta además con la participación de los miembros del Laboratorio de Geomática y otros profesionales, en colaboración con el equipo de investigación responsable de la base de datos del SIOSE.

Resumen

En este trabajo...

Abstract

Una prueba de acencuación

Índice de contenidos

Índice de figuras

Índice de tablas

1. INTRODUCCIÓN

1.1. What is loren ipsum? Title with math σ

Lorem Ipsum is simply dummy text of the printing and typesetting industry (see Section **??**). Lorem Ipsum [3] has been the industry's standard dummy text ever since the 1500s, when an unknown printer took a galley of type and scrambled it to make a type specimen book. It has survived not only five centuries, but also the leap into electronic typesetting, remaining essentially unchanged. It was popularised in the 1960s with the release of Letraset sheets containing Lorem Ipsum passages, and more recently with desktop publishing software like Aldus PageMaker including versions of Lorem Ipsum [1, 4, 5].

The most famous equation in the world: $E^2 = (m_0 c^2)^2 + (pc)^2$, which is known as the **energy-mass-momentum** relation as an in-line equation.

A *LATEX class file* is a file, which holds style information for a particular LATEX.

$$CIF: \quad F_0^j(a) = \frac{1}{2\pi\iota} \oint_\gamma \frac{F_0^j(z)}{z-a} dz \tag{1}$$

1.2. Why do we use loren ipsum?

It is a long established fact that a reader will be distracted by the readable content of a page when looking at its layout. The point of using Lorem Ipsum is that it has a more-or-less normal distribution of letters, as opposed to using 'Content here, content here', making it look like readable English. Many desktop publishing packages and web page editors now use Lorem Ipsum as their default model text, and a search for 'lorem ipsum' will uncover many web sites still in their infancy. Various versions have evolved over the years, sometimes by accident, sometimes on purpose (injected humour and the like).

1.3. Where does it come from?

Contrary to popular belief, Lorem Ipsum is not simply random text. It has roots in a piece of classical Latin literature from 45 BC, making it over 2000 years old. Richard McClintock, a Latin professor at Hampden-Sydney College in Virginia, looked up one of the more obscure Latin words, consectetur, from a Lorem Ipsum passage, and going through the cites of the word in classical literature, discovered the undoubtable source. Lorem Ipsum comes from sections 1.10.32 and 1.10.33 of "de Finibus Bonorum et Malorum" (The Extremes of Good

and Evil) by Cicero, written in 45 BC. This book is a treatise on the theory of ethics, very popular during the Renaissance. The first line of Lorem Ipsum, "Lorem ipsum dolor sit amet..", comes from a line in section 1.10.32.

The standard chunk of Lorem Ipsum used since the 1500s is reproduced below for those interested. Sections 1.10.32 and 1.10.33 from "de Finibus Bonorum et Malorum" by Cicero are also reproduced in their exact original form, accompanied by English versions from the 1914 translation by H. Rackham

"Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum." zz Section 1.10.32 of "de Finibus Bonorum et Malorum", written by Cicero in 45 BC: "Sed ut perspiciatis unde omnis iste natus error sit voluptatem accusantium doloremque laudantium, totam rem aperiam, eaque ipsa quae ab illo inventore veritatis et quasi architecto beatae vitae dicta sunt explicabo. Nemo enim ipsam voluptatem quia voluptas sit aspernatur aut odit aut fugit, sed quia consequuntur magni dolores eos qui ratione voluptatem sequi nesciunt. Neque porro quisquam est, qui dolorem ipsum quia dolor sit amet, consectetur, adipisci velit, sed quia non numquam eius modi tempora incidunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim ad minima veniam, quis nostrum exercitationem ullam corporis suscipit laboriosam, nisi ut aliquid ex ea commodi consequatur? Quis autem vel eum iure reprehenderit qui in ea voluptate velit esse quam nihil molestiae consequatur, vel illum qui dolorem eum fugiat quo voluptas nulla pariatur?"

1914 translation by H. Rackham: "But I must explain to you how all this mistaken idea of denouncing pleasure and praising pain was born and I will give you a complete account of the system, and expound the actual teachings of the great explorer of the truth, the master-builder of human happiness. No one rejects, dislikes, or avoids pleasure itself, because it is pleasure, but because those who do not know how to pursue pleasure rationally encounter consequences that are extremely painful. Nor again is there anyone who loves or pursues or desires to obtain pain of itself, because it is pain, but because occasionally circumstances occur in which toil and pain can procure him some great pleasure. To take a trivial example, which of us ever undertakes laborious physical exercise, except to obtain some advantage from it? But who has any right to find fault with a man who chooses to enjoy a pleasure that has no annoying consequences, or one who avoids a pain that produces no resultant pleasure?"

Section 1.10.33 of "de Finibus Bonorum et Malorum", written by Cicero in 45 BC: "At vero eos et accusamus et iusto odio dignissimos ducimus qui blanditiis praesentium voluptatum deleniti atque corrupti quos dolores et quas molestias excepturi sint occaecati cupiditate non provident, similique sunt in culpa qui officia deserunt mollitia animi, id est laborum et dolorum fuga. Et harum quidem rerum facilis est et expedita distinctio. Nam libero tempore, cum soluta nobis est eligendi optio cumque nihil impedit quo minus id quod maxime placeat facere possimus, omnis voluptas assumenda est, omnis dolor repellendus. Temporibus autem quibusdam et aut officiis debitis aut rerum necessitatibus saepe eveniet ut et voluptates repudiandae sint et molestiae non recusandae. Itaque earum rerum hic tenetur a sapiente delectus, ut aut reiciendis voluptatibus maiores alias consequatur aut perferendis doloribus asperiores repellat."

1914 translation by H. Rackham: "On the other hand, we denounce with righteous indignation and dislike men who are so beguiled and demoralized by the charms of pleasure of the moment, so blinded by desire, that they cannot foresee the pain and trouble that are bound to ensue; and equal blame belongs to those who fail in their duty through weakness of will, which is the same as saying through shrinking from toil and pain. These cases are perfectly simple and easy to distinguish. In a free hour, when our power of choice is untrammelled and when nothing prevents our being able to do what we like best, every pleasure is to be welcomed and every pain avoided. But in certain circumstances and owing to the claims of duty or the obligations of business it will frequently occur that pleasures have to be repudiated and annoyances accepted. The wise man therefore always holds in these matters to this principle of selection: he rejects pleasures to secure other greater pleasures, or else he endures pains to avoid worse pains."

1. METODOLOGÍA

El desarrollo del software requiere de una metodología de trabajo colaborativo basado en una serie de herramientas de contenerización y orquestación de manera eficiente, extensible y reproducible.

2.1. Software y plataformas

2.2. Conjunto de datos

Antes de seleccionar las métricas de paisaje que han sido utilizadas para complementar el nuevo software, ha sido necesario elaborar y procesar conjuntos de datos que posteriormente se han utilizado para realizar comprobaciones del funcionamiento de las métricas. Así pues, por una parte se ha creado un paisaje ficticio y por otra, se han utilizado los datos del SIOSE de dos zonas de estudio como casos de estudio reales.

Para el paisaje ficticio, se ha digitalizado desde cero todos los polígonos que comprenden esta zona de estudio a partir de herramientas de geoprocesamiento, geometría, vectorial y edición, utilizando QGIS. En la tabla de atributos del shapefile, cada polígono tiene identificador único, geometría, clasificación según el tipo de cobertura del suelo y color según el tipo de categoría al que pertenece.

Tabla 1.1 . Atributos del primer conjunto de datos.

Nombre	Tipo de campo	Descripción
gid	integer	Identificador único de cada polígono
geom	geometry	Geometría del polígono
category	character varying (text)	Clasificación de la cobertura del suelo
svg_color	character varying (text)	Color según tipo de categoría

2.3. Selección de métricas

2.4. Implementación/desarrollo de funciones en PostgreSQL

2.5. Documentación de la extensión

A lo largo del trabajo, se aplican una serie de lenguajes de marcado para la documentación de la extensión. Pero antes se obtienen conocimientos previos sobre ellos y su funcionamiento para utilizarlos durante el proyecto. Los lenguajes utilizados son:

- **Markdown**[1] es un lenguaje ligero capaz de convertir texto plano a lenguaje HTML. Permite una escritura sencilla y conserva un diseño fácil de lectura. Es compatible con muchas plataformas. Este tipo de lenguaje es utilizado para documentar la extensión en la plataforma de GitHub y la descripción de cada una de las métricas de paisaje.

- **TeX**[2] es el lenguaje que se utiliza en el sistema de textos LaTeX y que crea documentos con una alta calidad tipográfica. Se utiliza para escribir artículos o libros científicos, y desde hace tiempo este lenguaje se emplea por un gran número de usuarios. Este tipo de lenguaje es utilizado para redactar este trabajo. Para trabajar con este lenguaje, se utiliza la aplicación Texmaker que se ejecuta desde un contenedor Docker.

- **Scalable Vector Graphics (SVG)** es un lenguaje capaz de crear gráficos basados en vectores escalables a partir de archivos vectoriales en 2D y en formato XML. En esta década muchos de los navegadores web utilizan este tipo de lenguaje para sus gráficos. Gracias a este lenguaje, los gráficos no pierden calidad, pueden ser escalables y ocupan menos espacio en la memoria. Este tipo de lenguaje es utilizado para crear las figuras del trabajo.

  Por ello, se desarolla una función SQL, como primera propuesta, que dibuja y colorea los gráficos vectoriales que acompañan en el trabajo y en la documentación de la extensión en la plataforma GitHub. Para que las figuras tengan el color correspondiente al tipo de cobertura al que pertenecen, se aplica el código SVG que acompaña a cada polígono en la tabla de atributos del primer conjuntos de datos. La función SVG puede consultarse en el Anexo II.

- **Mermaid**[3] es un lenguaje de secuencia, que utiliza etiquetas similares a las que son empleadas en el lenguaje de marcado, capaz de generar gráficos a partir de texto por

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[1]https://github.com/adam-p/markdown-here/wiki/Markdown-Cheatsheet
[2]https://www.latex-project.org/
[3]https://mermaidjs.github.io/

medio de JavaScript. Este tipo de lenguaje se ha utilizado para crear los diagramas de secuencia y el diagrama de Gantt.

2. MY THIRD CHAPTER

2.1   First section of the third chapter

And now I begin my third chapter here . . .

And now to cite some more people Read [6], Ancey et al. [2]

2.1.1   First subsection in the first section

. . . and some more

2.1.2   Second subsection in the first section

. . . and some more . . .

First subsub section in the second subsection

. . . and some more in the first subsub section otherwise it all looks the same doesn't it? well we can add some text to it . . .

2.1.3   Third subsection in the first section

. . . and some more . . .

First subsub section in the third subsection

. . . and some more in the first subsub section otherwise it all looks the same doesn't it? well we can add some text to it and some more and some more and some more and some more and some more and some more and some more . . .

Second subsub section in the third subsection

. . . and some more in the first subsub section otherwise it all looks the same doesn't it? well we can add some text to it . . .

2.2   Second section of the third chapter

and here I write more . . .

2.3   The layout of formal tables

This section has been modified from "Publication quality tables in LaTeX*" by Simon Fear.

The layout of a table has been established over centuries of experience and should only be altered in extraordinary circumstances.

When formatting a table, remember two simple guidelines at all times:

1. Never, ever use vertical rules (lines).

2. Never use double rules.

These guidelines may seem extreme but I have never found a good argument in favour of breaking them. For example, if you feel that the information in the left half of a table is so different from that on the right that it needs to be separated by a vertical line, then you should use two tables instead. Not everyone follows the second guideline:

There are three further guidelines worth mentioning here as they are generally not known outside the circle of professional typesetters and subeditors:

3. Put the units in the column heading (not in the body of the table).

4. Always precede a decimal point by a digit; thus 0.1 *not* just .1.

5. Do not use 'ditto' signs or any other such convention to repeat a previous value. In many circumstances a blank will serve just as well. If it won't, then repeat the value.

A frequently seen mistake is to use '\begin{center}' . . . '\end{center}' inside a figure or table environment. This center environment can cause additional vertical space. If you want to avoid that just use '\centering'

Tabla 2.1 A badly formatted table

	Species I		Species II	
Dental measurement	mean	SD	mean	SD
I1MD	6.23	0.91	5.2	0.7
I1LL	7.48	0.56	8.7	0.71
I2MD	3.99	0.63	4.22	0.54
I2LL	6.81	0.02	6.66	0.01
CMD	13.47	0.09	10.55	0.05
CBL	11.88	0.05	13.11	0.04

Tabla 2.2 A nice looking table

	Species I		Species II	
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Tabla 2.3 Even better looking table using booktabs

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References

[1] Abramovich, Y. A., Aliprantis, C. D., and Burkinshaw, O. (1995). Another characterization of the invariant subspace problem. *Operator Theory in Function Spaces and Banach Lattices.* The A.C. Zaanen Anniversary Volume*, Operator Theory: Advances and Applications*, 75:15–31. Birkhäuser Verlag.

[2] Ancey, C., Coussot, P., and Evesque, P. (1996). Examination of the possibility of a fluid-mechanics treatment of dense granular flows. *Mechanics of Cohesive-frictional Materials*, 1(4):385–403.

[3] Aupetit, B. (1991). *A Primer on Spectral Theory.* Springer-Verlag, New York.

[4] Conway, J. B. (1990). *A Course in Functional Analysis.* Springer-Verlag, New York, second edition.

[5] Ljubič, J. I. and Macaev, V. I. (1965). On operators with a separable spectrum. *Amer. Math. Soc. Transl. (2)*, 47:89–129.

[6] Read, C. J. (1985). A solution to the invariant subspace problem on the space l_1. *Bull. London Math. Soc.*, 17:305–317.

A. HOW TO INSTALL LaTeX

Windows OS

TeXLive package - full version

1. Download the TeXLive ISO (2.2GB) from
   https://www.tug.org/texlive/

2. Download WinCDEmu (if you don't have a virtual drive) from
   http://wincdemu.sysprogs.org/download/

3. To install Windows CD Emulator follow the instructions at
   http://wincdemu.sysprogs.org/tutorials/install/

4. Right click the iso and mount it using the WinCDEmu as shown in
   http://wincdemu.sysprogs.org/tutorials/mount/

5. Open your virtual drive and run setup.pl

   or

Basic MikTeX - TeX distribution

1. Download Basic-MiKTeX(32bit or 64bit) from
   http://miktex.org/download

2. Run the installer

3. To add a new package go to Start » All Programs » MikTex » Maintenance (Admin)
   and choose Package Manager

4. Select or search for packages to install

TexStudio - TeX editor

1. Download TexStudio from
   http://texstudio.sourceforge.net/#downloads

2. Run the installer

Mac OS X

MacTeX - TeX distribution

1. Download the file from
   https://www.tug.org/mactex/

2. Extract and double click to run the installer. It does the entire configuration, sit back and relax.

TexStudio - TeX editor

1. Download TexStudio from
   http://texstudio.sourceforge.net/#downloads

2. Extract and Start

Unix/Linux

TeXLive - TeX distribution

Getting the distribution:

1. TexLive can be downloaded from
   http://www.tug.org/texlive/acquire-netinstall.html.

2. TexLive is provided by most operating system you can use (rpm,apt-get or yum) to get TexLive distributions

Installation

1. Mount the ISO file in the mnt directory

   ```
   mount -t iso9660 -o ro,loop,noauto /your/texlive####.iso /mnt
   ```

2. Install wget on your OS (use rpm, apt-get or yum install)

3. Run the installer script install-tl.

   ```
   cd /your/download/directory
   ./install-tl
   ```

4. Enter command 'i' for installation

5. Post-Installation configuration:
   http://www.tug.org/texlive/doc/texlive-en/texlive-en.html#x1-320003.4.1

6. Set the path for the directory of TexLive binaries in your .bashrc file

For 32bit OS

For Bourne-compatible shells such as bash, and using Intel x86 GNU/Linux and a default directory setup as an example, the file to edit might be

```
edit $~/.bashrc file and add following lines
PATH=/usr/local/texlive/2011/bin/i386-linux:$PATH;
export PATH
MANPATH=/usr/local/texlive/2011/texmf/doc/man:$MANPATH;
export MANPATH
INFOPATH=/usr/local/texlive/2011/texmf/doc/info:$INFOPATH;
export INFOPATH
```

For 64bit OS

```
edit $~/.bashrc file and add following lines
PATH=/usr/local/texlive/2011/bin/x86_64-linux:$PATH;
export PATH
MANPATH=/usr/local/texlive/2011/texmf/doc/man:$MANPATH;
export MANPATH
INFOPATH=/usr/local/texlive/2011/texmf/doc/info:$INFOPATH;
export INFOPATH
```

Fedora/RedHat/CentOS:

```
sudo yum install texlive
sudo yum install psutils
```

SUSE:

```
sudo zypper install texlive
```

Debian/Ubuntu:

```
sudo apt-get install texlive texlive-latex-extra
sudo apt-get install psutils
```