

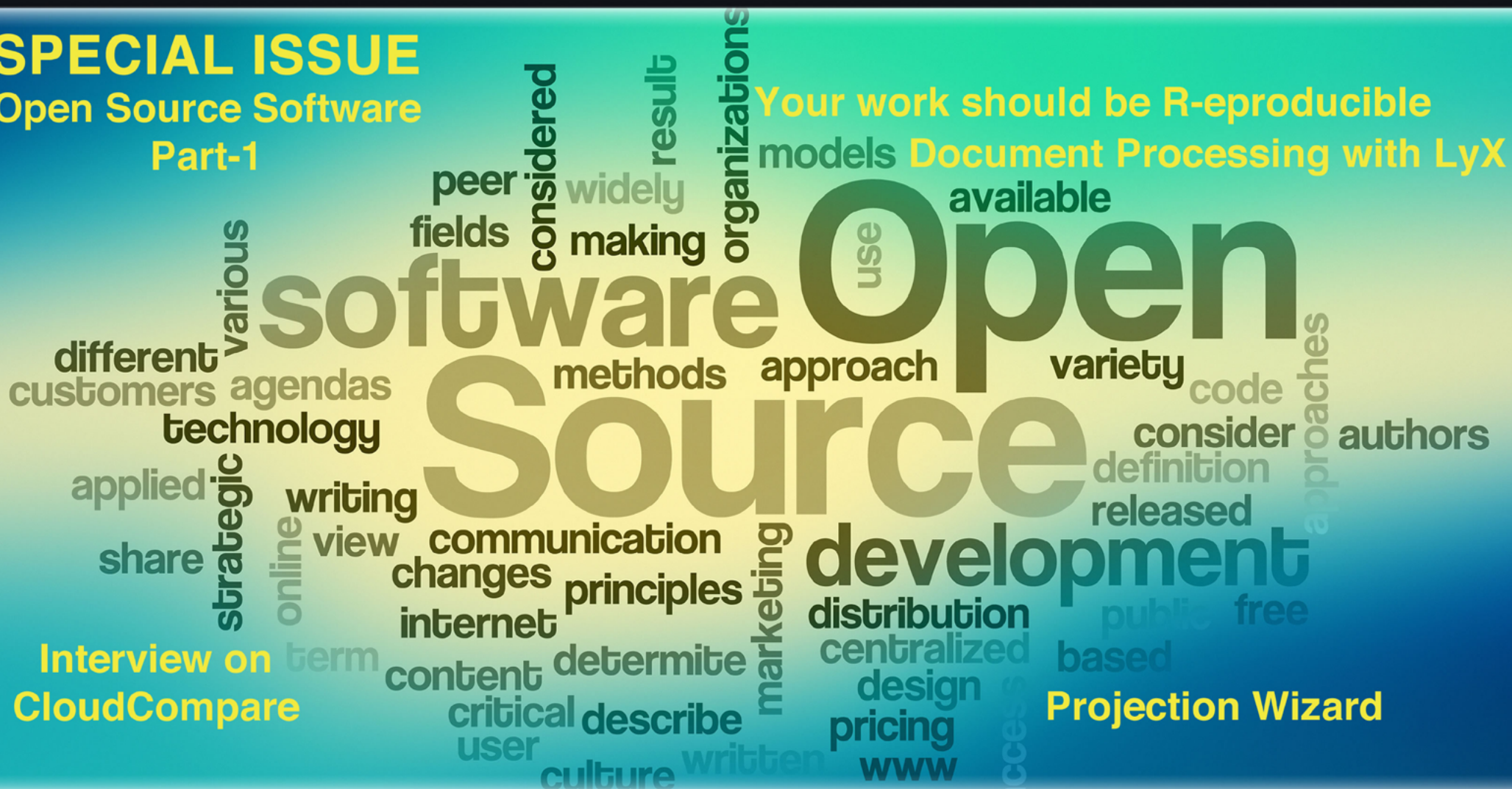
NewsLetter

Issue No.4, Vol. 9 – April 2016

SPECIAL ISSUE

Open Source Software

Part-1



ISPRS SC NewsLetter



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Frontpage designed by Ayda Aktaş



Would you like to join SC Newsletter team? Do you want to make a difference? Want to learn new skills?

SC Newsletter is at a stage where getting broader and better demands more people to be involved in the process of it's formation. That's why SC Newsletter team is looking for the following volunteers:

- More **people who would be willing to prepare articles** for existing or new rubrics,
- Designers of Newsletter

If you can help us with any of the above, please let us know!

info@isprs-studentconsortium.org

And also...

If you **would like to publish your research work** in the SC Newsletter send us your abstract on email written above. We will soon contact you for further information.

Dear ISPRS SC Newsletter readers,



There is a rapid growth in the popularity of geoinformatics in conjunction with advances in computing technology, hardware and software. As the amount of geographical data available from different sources (remote sensing platforms, surveying methods etc.) gets bigger, the need for low-cost software to describe, analyze and diagnose

this data is becoming more important, especially for educational research and decision making in geoinformatics.

Nearly every student or young scientist comes to a point where open source software is a way to solve this problem. Our special issue, dedicated to open source software in geoinformatics, will give you a glimpse of this world, with different point of views from users to developers within various projects. As the newsletter team, we believe that the articles you'll read will give you many insights and maybe help you with your research.

The XXIII ISPRS Congress, when the new board members will be elected, is getting closer. We are encouraging our readers to send in their application forms if they want to have a front-row seat at ISPRS-SC.

Ayda Aktaş
ISPRS SC Publication Responsible

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Let's Come Together
to Make The World
Smaller and Smaller,
While Enlarging
and
Powering Our
Student Consortium
Network!!

JOIN US!!!

Interview

by Jeremy Steward and Ivan Detchev



Questions on CloudCompare with Dr. Daniel Girardeau-Montaut

How did the CloudCompare project begin?

CloudCompare was initiated in 2004 during my PhD studies. The aim was to perform fast change detection directly on dense point clouds acquired with a laser scanner. Our idea was to be able to compare the point clouds directly without being obliged to convert them to more evolved geometric representations (such as triangular meshes). Another goal was to be able to use the software on a standard laptop (in order to be able to do all the comparisons just after the clouds were acquired and on the move). This resulted in a set of efficient algorithms and tools to compute robust distances between point clouds and extract meaningful information.

Currently, what are the most commonly used features of CloudCompare? For whom is CloudCompare most suitable?

In addition to the comparison algorithms, CloudCompare seems to be widely used for its standard point cloud edition tools: interactive transformation and segmentation, subsampling, noise cleaning and registration. More advanced users appreciate the fact that CloudCompare can handle any kind of scalar fields (e.g. distances, intensity, density, roughness, confidence) and the various ways in which they can be generated, processed, mixed and displayed. We also have plugins that extend CloudCompare's capabilities in very different ways (e.g. to reconstruct 3D meshes, to classify point clouds, to generate animation videos, to detect geological fracture planes or standard primitives).

The users are mostly academics in the fields of remote sensing, geology and archaeology. But we also have a wide audience in the private sector where people are interested in the "Swiss army knife" side of CloudCompare and its various format conversion capabilities.

How does CloudCompare differ from commercial point cloud packages (e.g., Cyclone)? What about other open source and/or free packages (e.g., MeshLab)?

The biggest differences with commercial packages is that CloudCompare is free (just kidding). More seriously it evolves much faster than most commercial tools. And requests from users are more likely to be integrated, especially since users can actually participate in the development. We can also use the huge base of open source algorithms and libraries

without infringing on their licenses. And of course we don't limit / prioritize features based on their potential revenues...

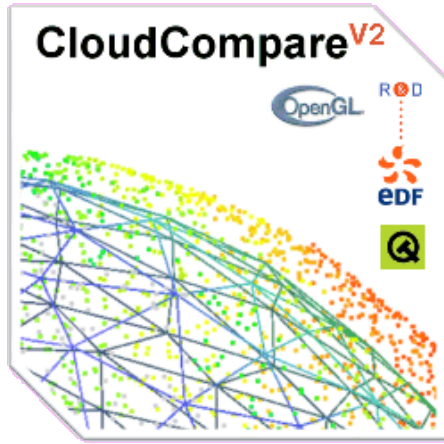
Regarding the other open-source packages, as far as I know there are not a lot of alternatives when dealing with terrestrial LIDAR or photogrammetry point clouds. Meshlab is definitely the best open-source solution when dealing with... meshes! While CloudCompare is focused on point clouds (maybe we should have named it "CloudLab" to make things clearer), Paraview has maybe more features in common with CloudCompare, especially regarding the visualization and management of scalar fields. But the input data and the targeted users are very different.

What so far has been the biggest hurdle in developing CloudCompare?

The main hurdle has always been the lack of skillful developers to help us. Most of our users are rarely trained in the art of development (as they are geologists, archaeologists, surveyors, etc.). There are dozens of very interesting algorithms and features that could be added to CloudCompare but we lack the time and energy to implement all of them.

The GPL can be problematic, especially regarding code modules built on top of GPL software. Do you think the licensing has or will cause problems for the project, or is it largely a non-issue given that few users directly modify the CloudCompare sources?

As I said the GPL license of CloudCompare is a blessing for us as we can build our own tools upon a huge base of freely available open source code. And for users who'd like to integrate CloudCompare into their own process or solution it shouldn't be too much of an issue. First, the core algorithms (distance computation, octree computation, registration, etc.) are all included in a single LGPL library. Then, you are free to use GPL code with closed-source code as long as you don't distribute the result (which is the case for most academic prototypes). And, last but not least, we have a very liberal policy regarding plugins. With the GPL license, plugins are already in a kind of grey zone. And we decided right from the start of the project to allow any kind of plugins to be released and not limit their developers in any way (i.e. CloudCompare plugins can remain closed source and / or be sold).



Is it possible to get more detailed statistics and error reporting when performing a cloud-to-cloud ICP registration? For example, the log provides an overall RMSE, but it would be nice to have a residual for every observation.

In fact, as CloudCompare is meant to compute distances between entities, one can always compute the distances / residuals once a registration or a fitting algorithm has finished. And this way, it is also possible to visualize the residuals so as to get a clear view of the areas that match the best.

Often it is necessary to perform several manual translations and/or rotations to approximately orient two point clouds before they can be registered using ICP. These intermediate transformations, however, are not factored into the 4x4 transformation matrix provided by the CloudCompare logger. Are there any plans, or is there any way that these transformation parameters can be accumulated into a single transformation matrix (sans doing it manually)?

Look at the transformation history of any cloud or mesh entity (at the bottom of their properties). This is exactly what it's meant for (it factorizes all the transformation applied since loading time).

CloudCompare supports extensions through its plugin interface. However, its features cannot be used programmatically. Are there any plans for releasing an extension interface for a high-level language such as Python or Scheme? For example, it would be great to be able to pull in point clouds, transform them into a common coordinate frame, merge them, and then output the results across many datasets, preferably only having to call some specific functions that would be exposed by an API.

Indeed, several users have already asked for a Python interface. This would definitely be a great addition. However we don't have sufficient time or skills in the existing developer team to realize such a challenging task. This is why we really need more contributors.

CloudCompare and ccViewer now support NVidia 3D Vision glasses. Will virtual reality headsets like the Oculus Rift be supported? Likewise, will there be support or interest in low cost options such as Google Cardboard? Any discussion in this space would be appreciated.

The Oculus support is already in development. A working prototype should be ready for the 2.7 version (that will be released in a few weeks). Google Cardboard wouldn't be too hard to support once this is done... however making CC or at least ccViewer work on an Android device is another story!

Do you have any other CloudCompare related thoughts or insights for the young scientists in the ISPRS Student Consortium?

I was very lucky to start my PhD in association with a company (EDF - the main French power utility) that was a pioneer in the field of laser scanning. But I have also always been very concerned with making things that would be useful to people. I spend a lot of time talking with potential users and trying to understand their needs in order to provide them with actually usable tools. I have always tried to avoid developing cryptic pieces of code with dozens of parameters that only work on a single data set. I know it's not very appealing to spend more time on the usability and the graphical interface than on the algorithm itself, especially during a PhD. But if you don't do that, then you can be pretty sure that everything you've done will end up in a (virtual) trashcan at the end of your PhD (or even before that). And making the code open-source is another key - this is the best way for others to actually test and evaluate your work. In the best case, your work might even be improved in the process. At least it might help another PhD student and save him/her a lot of time (have you already wondered how much time an average PhD student loses while trying to re-implement falsely magical algorithms or with some key information missing in the article?).

From time to time I meet people telling me that they have come up with much more efficient / smarter / nicer solutions than what is implemented in CloudCompare or other open-source packages. I'm sure they have. But then I ask them: have you made it publicly available? Can I get the code? Or have you already integrated this into a tool that can be used by (almost) anyone and without having to read a (badly written) PhD manuscript? I'll let you guess the answers I (almost) always get.

End...

Your work should be R-reproducible

by Urša Kanjir



This article will briefly introduce the statistical software R to the image processing community. We encourage readers to test it, play around with simple tasks and start using R for basic data work to get an insight into this very powerful and user-friendly programming language. Many tutorials, for beginners without any programming experience and veteran programmers alike, can be easily found online.

R programming language has become one of the most important tools for computational statistics, visualization and data science in both academia and industry in the last decade. Nearly 1 in 100 scholarly articles indexed in Elsevier's Scopus database cites R or one of its packages — and in agricultural and environmental sciences, the share is even higher.

R is similar to other programming languages, like C, Java and Perl, in that it helps people perform a wide variety of computing tasks by giving them access to various commands. Because R is open source, there is an extensive community of users and developers to support the creation of R-based algorithms and packages, and the number of international scientists that are participating in the development of R is constantly growing. Worldwide, thousands of new tools and libraries have been developed and shared amongst communities. As one of its co-creators Ross Ihaka said, "R is a real demonstration of the power of collaboration." The number of packages has grown exponentially and today nearly 7,000 packages exist for all kinds of specialized purposes.

The strong R online user support is for me personally one of the major things that got me hooked on this programming language. On the forums, you can find the answers to most of the problems you encounter during its use, or you can share your problem and you will get qualitative advices or clues that will help you understand your code in a short time. You can also reproduce and reuse techniques that have already been discovered. The Comprehensive R Archive Network (CRAN) is one group where new codes and techniques are shared.

It is important to mention here that R has a powerful and productive user interface called RStudio (one of R's GUIs), which is also free and open source, and it works on all the platforms. Although you don't need RStudio to get started, it makes working with R much easier. It has useful features you would expect from a coding platform, such as syntax highlighting and tab for suggested code auto-completion. It also has a four-pane workspace, which makes it easier to manage multiple R windows for typing commands, storing scripts, viewing command histories, viewing visualiza-

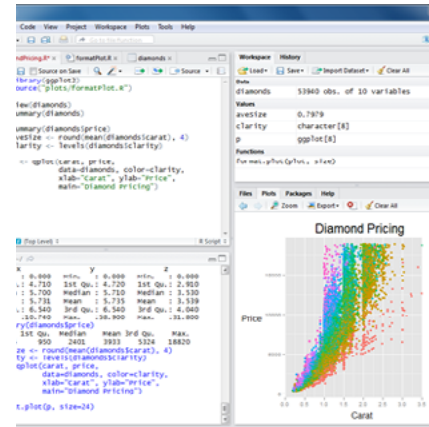


Image 1: The editor, workspace, console and plots windows in RStudio.

tions and more (see Image1). Although it was developed as a statistical tool, R is becoming one of the major platforms on which to perform spatial analysis. It works well when dealing with huge image datasets such as satellite data and it also includes interesting statistical and graphical tools, which are important and necessary for image processing techniques. R provides a collection of many common statistical methods (tests, classification) and visualization tools out of the box — thus it allows for quick production of statistics and well-designed plots by beginners yet it gives full control to experienced users. A number of built-in packages (libraries) with a spatial or geostatistical emphasis are included for relatively easy coding. These packages allow geo-informatics scientists to manipulate geographic (spatial) data in raster format (raster); estimate the time and number of abrupt changes within time series (bfast); calculate classification and regression trees (tree); read and handle spatial objects (maptools); visualize the results in polished graphics (ggplot2); and many more, in just a few lines of code. The ability to use R as a toolbox makes it easy to integrate its functionality into other software such as Grass and QGIS. This kind of "software combination" adds functionality to the user's workbench.

Of course, like any other skill, learning R cannot be done overnight. To develop research-specific skills in R definitely requires a commitment. But your research will surely be very grateful for that. And don't forget to follow the mantra that is common among R enthusiasts: "Make sure your work is reproducible!"

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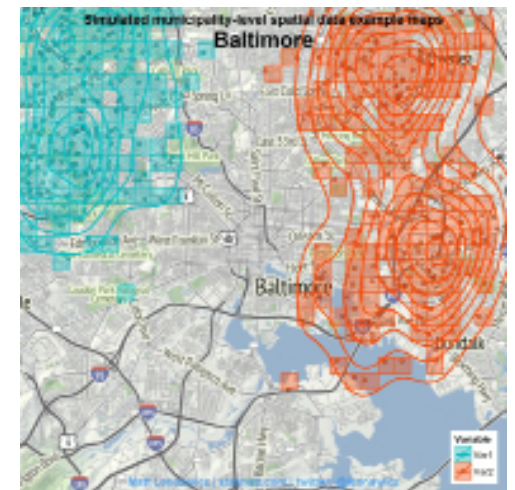


Image 2: An example of a map made in R with a package called ggplot.

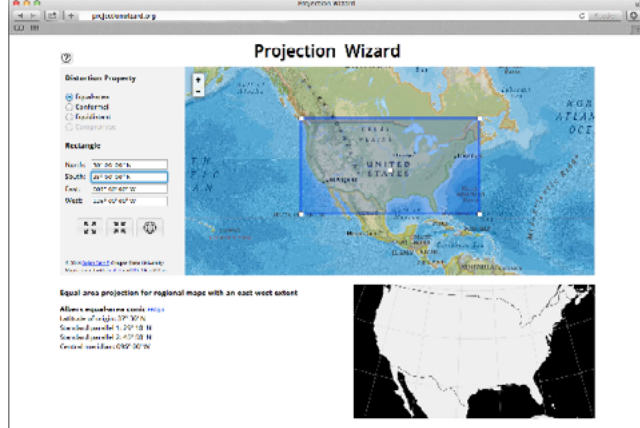
Projection Wizard: A Free Web Application for Selecting a Map Projection

by Bojan Šavrič

One of the more difficult tasks in visualizing geospatial data and designing a map is selecting an appropriate map projection. The map projection transforms a spherical or ellipsoidal surface into a planar surface, which always results in some distortion caused by shearing, compression, and tearing [1]. Cartographers have developed several hundred map projections, each with its own distortion properties and application domains. Despite some available selection guidelines [2, 3], the selection of map projections is a mystery to many. Map projections ought to be selected based on the map's geographic extent and the appropriate distortion properties, with the goal of minimizing the overall distortion of the mapped area.

Projection Wizard is a free web application (available at projectionwizard.org) that helps cartographers and GIS users select an appropriate projection for their map.

The user only has to specify the desired distortion property and bounding box of



the area to be mapped. There are four distortion properties to select from: equal-area, equidistant, conformal, and compromise. Not all distortion properties are available to the user for all map extents. Compromise projections are only available for world maps, and conformal projections are available for large-scale maps.

The web map in the upper area of the interface contains an interactive rectangle that allows the user to select the area to map by moving the corner handlers. Alternatively, the user can enter the geographic coordinates of the north, south, east, and west borders of the rectangle in the text fields on the left side of the web map. The rectangle can also be repositioned to another area on the map. To select a polar area, the user drags the rectangle towards the north or south end of the web map, and Projection Wizard returns a map projection that is appropriate for polar regions.

Projection Wizard proposes map projections based on the selected distortion property and three parameters derived from the selected geographic area. The derived parameters are the size of the area, its central latitude and longitude, and its height-to-width ratio. The tool lists proposed projections and their parameters for the mapped area in the lower left corner, below the web map. If available, PROJ.4 projection codes are provided next to each proposed projection. Projection Wizard also displays a map preview with the suggested projection on the right from the list. Any changes to the rectangle or distortion property update the list of proposed map projections and the map preview. Thirty-three map projections are currently included and proposed by the web application.

Leaflet, an open-source JavaScript library for web mapping (leafletjs.com), was used to build the Projection Wizard. Web map tiles are from Esri's National Geographic World Map (http://services.arcgisonline.com/ArcGIS/rest/services/Nat-Geo_World_Map/MapServer) and the preview map is rendered with D3.js [4], a free and open source JavaScript library for producing data visualizations in web browsers (d3js.org).

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Document processing with LyX

by Ivan Detchev, University of Calgary, Canada

Beyond Word

Have you ever looked for an alternative to Microsoft Word? Maybe you couldn't afford the cost of buying Microsoft Office, or you were used to the good old drop-down menus in the pre-2007 Word versions, and now you cannot easily find specific formatting setting within the ribbon. Or maybe, no matter how diligent you have been about consistency and how many work-around tricks you have picked up over the years, you always end up having some non-uniform formatting creep into your document. It's also possible that you have had a large document such as a thesis break down on you – you lost cross-referencing and in-text citations, or the equation/figure/table numbering was incorrect after uniting multiple documents. My biggest pet peeve with MS Word has always been the need to manually rearrange the placement of figures, tables and equations within the text so as to avoid orphaning captions or having large empty spaces at the bottom of pages.

TeXnical writing

In the long run you just want software where you can concentrate on the content you are writing, and not get distracted by formatting issues, i.e., how your content will appear on the screen or paper. So, especially if you are from the sciences or engineering, you should look into LaTeX (<https://www.latex-project.org/>). LaTeX is an extension of the markup language/typesetting system TeX (<https://tug.org/>). It offers a lot of advantages compared to “what you see is what you get” (WYSIWYG) word processing software such as MS Word:

- It enforces the use of styles, so your document ends up with a definite structure as opposed to a collection of sporadically formatted fragments;
- It allows for figure/table/equation floats, which are automatically placed within the text according to a hierarchy of rules;
- Cross-referencing, numbering, and generating lists such as a bibliography or a table of contents is readily available without any work-arounds;
- Given its support for ligatures, kerning, and hyphenation, it creates documents with superior aesthetics;
- All content is saved in text files, so a version control system can be used.

TEX LATEX

There are some disadvantages with LaTeX too. Since it is an actual programming language, there is a steep learning curve in figuring out which packages to use for a specific task. The strict separation of content and formatting makes it hard for some people to visualize the output unless the document is actually compiled and converted to a .pdf. This is especially the case when typesetting equations and tables.

The typesetting painkiller

For those who would prefer a graphical user interface, where they can see approximately how their content is laid out, there is LyX (<http://www.lyx.org/>) which has a basic set of packages already built in. LyX is a “what you see is what you mean” WYSIWYM document processor – you get to have all the benefits of LaTeX without having to code much.

No hairy styling

Figure 1 shows an example of a resume within the LyX GUI. The cursor is placed on the line with “William Shakespeare” written on it, and in the drop-down menu in the top left corner you will notice that the style used for this line is Title. Another obvious style is Section (see “Work Experience”, “Education” and “Publications”). Other not-so-obvious styles are Left Header (see the street address), Right Header (see the phone and e-mail), Topic (see items under “Work Experience” and “Education”), and Bibliography (see items under “Publications”).

Depending on the class of the document (e.g., article, book, report, letter, CV) you can choose from many other pre-set styles (e.g., Chapter, Subsection, Quotation, Itemize, Enumerate). Generally, you start a new line in the Standard or default style, and then you switch the style type to the appropriate one you would like. While you can still simply highlight some text and change its font, face or paragraph settings, this should be avoided as much as possible so as to preserve the formatting consistency.



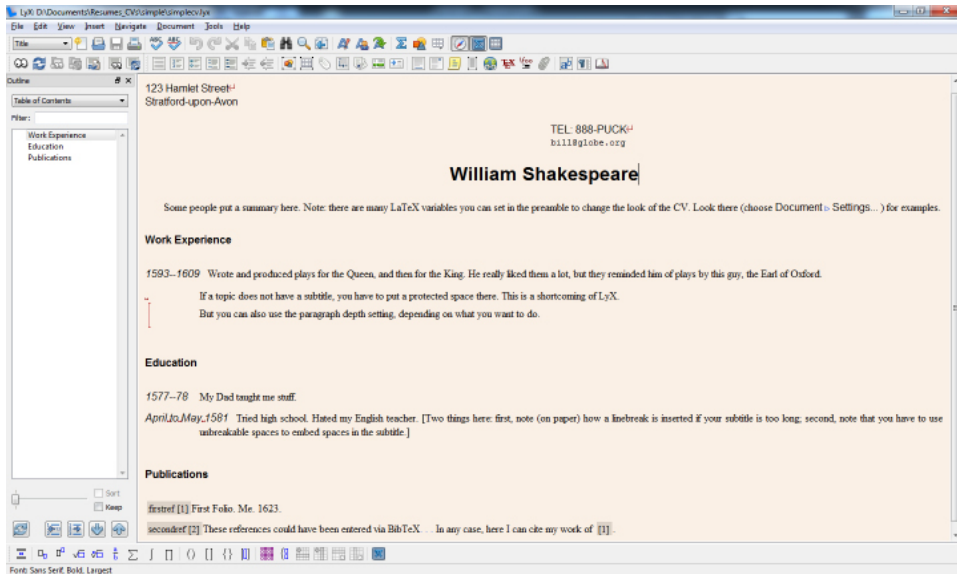


Figure 1. LyX GUI and sample input

Output with class

In Figure 2a you can see the .pdf output of the given .lyx file, which falls under the curriculum vitae document note class and more specifically the Simple CV template/layout.

While the formatting is fairly rigid, LyX does allow you to tweak some parameters within the GUI. For example, under the Document\Settings... menu you can:

- switch the document class,
- set the font properties,
- control the line spacing,
- pick the paper format,
- specify the page margins,
- turn on hyperlinks,
- choose the float placement rules, and
- insert a custom LaTeX preamble.

The LaTeX preamble is there for you to type new or overwrite certain already existing commands within the LyX layout or the LaTeX class definitions without having to modify the original source code. For example, if you want to change the relative font size of the title from “large” to “huge” you can type in `\titlefont{\Huge}`. Note that this also resets the font series from “bold” to the default “medium” and the font family from “sans serif” to the default “roman”. Another example would be

to change the width of the left column of the Topic style from the default 20% to 30% by typing in: `\renewcommand{\topicmargin}{0.3\columnwidth}`. The effects of both changes can be seen in Figure 2b.

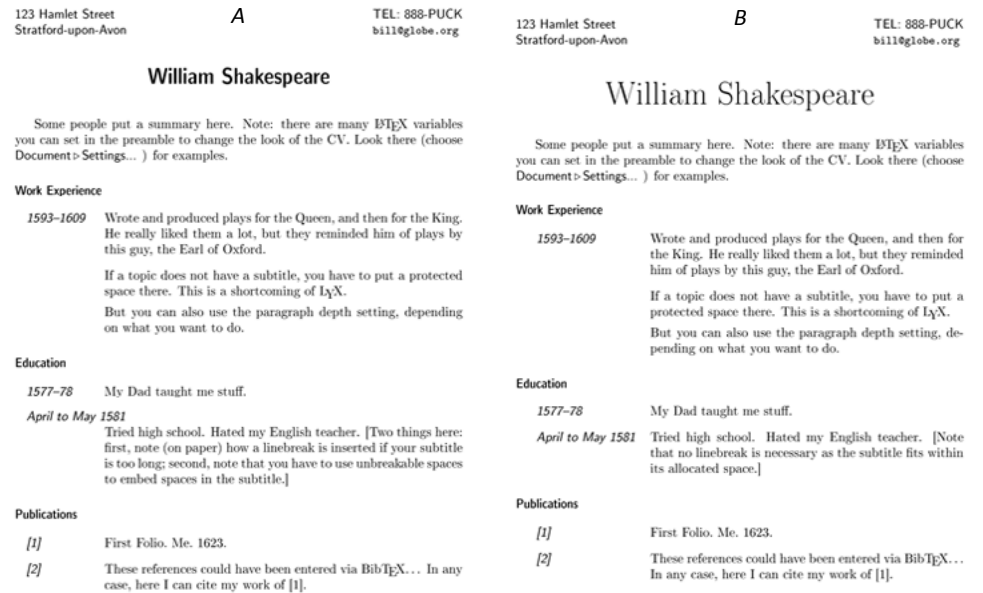


Figure 2. Output .pdf per the LyX “simplecv” example

Overflowing stacks

Answers to most questions on LaTeX commands can be found on internet forums. There also exist .pdf tutorials on LyX (<ftp://cs.uregina.ca/pub/class/305/lab1/lyxtutorial.pdf>), LaTeX (<http://www.docs.is.ed.ac.uk/skills/documents/3722/3722-2014.pdf>), and even TeX (<http://texdoc.net/texmf-dist/doc/plain/gentle/gentle.pdf>), which vary from several-page “cheat” sheets, to quick starter guides, to practically entire books. You can also explore this topic via videos on YouTube.

Give LyX a chance

To get you started, I suggest downloading LyX, and first using it for a course report where you won’t have to worry about specific formatting or page limits. This way you will get to practice the use of styles and figure/table/equation floats. I guarantee that you will end up with a well-structured and professional looking document without breaking the bank. And who knows, maybe you will end up writing your thesis in LaTeX or LyX.

EORSA 2016

Guangzhou, China, 04-06 July 2016

For more info visit: <http://www.eorsa2016.org/>

GI_Forum 2016 – open:spatial:interfaces

Salzburg, Austria, 05-08 July 2016

For more info visit: <http://www.gi-forum.org/>

XXIIIrd ISPRS Congress

Prague, Czech Republic, 12-19 July 2016

For more info visit: <http://www.isprs2016-prague.com>

Summer school Natural Resource Management: From data processing to web publishing

Telč, Czech Republic, 05-11 July 2016

For more info visit: <http://www.isprs2016-prague.com/youth-activities/summer-school>

Summer School Alpbach 2016

Alpbach/Tyrol, Austria, 12-21 July 2016

For more info visit: <http://www.summerschoolalpbach.at/>

41st Scientific Assembly of the Committee on Space Research (COSPAR)

Istanbul, Turkey, 30 July - 07 August 2016

For more info visit: <https://www.cospar-assembly.org/>

3rd Potsdam Summer School

Potsdam, Germany, 05-14 September 2016

For more info visit: <http://potsdam-summer-school.org/>

1st International Conference on Smart Data and Smart Cities, 30th UDMS

Split, Croatia, 07-09 September 2016

For more info visit: <http://www.udms.net/>

2nd International Symposium on Cellular Automata Modeling for Urban and Spatial Systems

Québec, Canada, 21-23 September 2016

For more info visit: <http://www.camuss2016.ulaval.ca/>

Dear ISPRS Student Consortium members,

I am writing to ask you if you wish to become a future ISPRS Student Consortium (SC) board member for the period of July 2016 to 2018 or preferably 2020 (see the term duration for each position in the application template).

If you are interested in becoming an active SC member, as a SC board member, please send an application (in .pdf) by June 1, 2016 to: Tee-Ann Teo, tateo@mail.nctu.edu.tw

In preparing the application, the use of the [provided template](#) is required. The application should contain the following information:

- Name, year of birth, city and country of residence, e-mail address(es), current place of employment or educational institution, degree towards you are studying (if applicable).
- Curriculum Vitae (one page).
- Participation during the period 2012-2016 in SC activities or other regional and national student activities (0.5 page).
- What are your professional and/or study plans for the period from July, 2016 till 2020?
- Which specific ISPRS SC board position you are applying for (see application template), and how long can you be active after July 2016?
- Motivation to become a SC board member (0.5 page).
- How do you plan on contributing to the ISPRS SC if elected as a board member? (0.5 page)
- Will you attend the ISPRS congress in Prague?

Before submitting an application, please also consult the SC statutes at:

http://www.isprs-sc.org/material/ISPRS_SC_Statutes.pdf

Please note:

- Submission of all required information above is a prerequisite for acceptance of an application by the nomination committee.
- Active participation in SC activities in the period 2012-2016, at a global, regional or national level or any other student related organisation is considered an asset but not a requirement (with the only exception being the SC chair position).
- If a candidate is enrolled as a student and/or is working towards a degree at an educational institution, there is no set age limit. However, in any other circumstances, the age cut off for candidates is 35.
- The minimum time commitment expected is 2 years for the positions with duration of 2+2 years, and 4 years for positions with duration of 4 years; the preferred time commitment in all cases is 4 years (i.e., the full mandate between the next two ISPRS congresses).

A nomination committee will process the filled out application forms by June 20. Successful applicants will be announced on the Student Consortium website at <http://www.isprs-sc.org/>. The results will be also publicly presented during the SC General Assembly. An in-person yes-or-no-vote election will take place in order to approve the selected candidate by the general SC members. This procedure will be carried out on July 17 during the SC Youth Forum, which will be a part of the XXIII ISPRS congress in Prague, Czech Republic, July 12-19, 2016.

Sincerely yours,

Ursa Kanjir, Chair of the ISPRS Student Consortium



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Please visit our SC web page www.isprs-sc.org where you will find more information about Student Consortium, our previous Newsletter issues, SC activities, photo galleries from previous Summer Schools, interesting links etc.

Our previous Newsletter issues

