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You have completed the reproducible paper template and are ready to configure and implement it for your own research. This template contains almost all the elements that you will need in a research project containing the downloading of raw data and necessary software, building the software, and processing the data with the software in a highly-controlled environment. It then allows including the results in plots and producing the final report, including this abstract, figures and bibliography. If you design your project with this template's infra-structure in your work, don't forget to add a notice and clearly let the readers know that your work is reproducible. If this template proves useful in your research, please cite Akhlaghi and Ichikawa (2015).

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1. CONGRATULATIONS!

Congratulations on running the raw template project! You can now follow the checklist in the `README.md` file to customize this template to your exciting research project.

Just don't forget to *never* use numbers or fixed strings (for example database urls like https://fits.gsfc.nasa.gov/samples) directly within your LaTeX source. Read them directly from your configuration files, or processing outputs, and import them into LaTeX as macros through the `tex/build/macros/project.tex` file (created after running the project). See the several existing examples within the template for a demonstration. For some recent real-world examples, the reproducible project sources for Sections 4 and 7.3 of Bacon et al. (2017) are available at zenodo.1164774[1], or zenodo.1163746[2]. Working in this way, will let you focus clearly on your science and not have to worry about fixing this or that number/name in the text.

Figure 1 shows a simple plot as a demonstration of creating plots within LaTeX (using the PGFPlots package). The minimum value in this distribution is 1.000, and 2500.000 is the maximum. Take a look into the LaTeX source and you'll see these numbers are actually macros that were calculated from the same dataset (they will change if the dataset, or function that produced it, changes).

The individual PDF file of Figure 1 is available under the `tex/tikz/` directory of your build directory. You can use this PDF file in other contexts (for example in slides showing your progress or after publishing the work). If you want to directly use the PDF file in the figure without having to let TiKZ decide if it should be remade or not, you can also comment the `makepdf` macro at the top of this LaTeX source file.
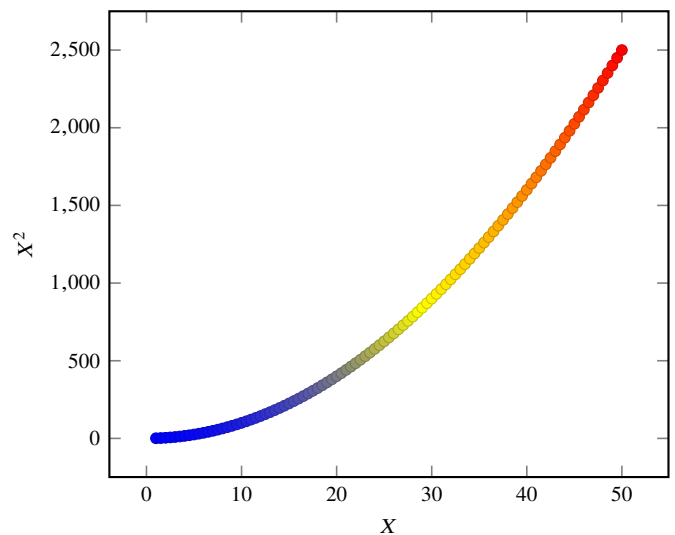
Figure 1: A very basic X^2 plot for demonstration.

Figure 2 is another demonstration of showing images (datasets) using PGFPlots. It shows a small crop of an image from the Wide-Field Planetary Camera 2, on board the Hubble Space Telescope from 1993 to 2009. This cropped image is one of the sample FITS files from the FITS file standard webpage[3]. Just as another basic reporting of measurements on this dataset within the paper without using numbers in the LaTeX source, the mean is 5.12 and the median is 0.86. The skewness in the histogram of Figure 2(b) explains this difference between the mean and median. The dataset was prepared for demonstration here with Gnuastro's ConvertType program and the histogram and basic statstics were generated with Gnuastro's Statistics program.
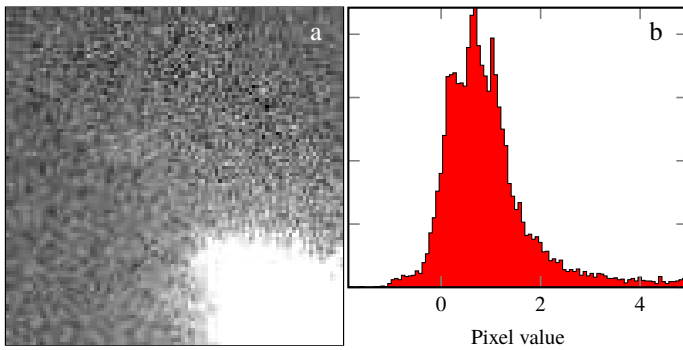
PGFPlots[4] is a great tool to build the plots within LaTeX and

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[1] https://gitlab.com/makhlaghi/muse-udf-origin-only-hst-magnitudes
[2] https://gitlab.com/makhlaghi/muse-udf-photometry-astrometry
[3] https://fits.gsfc.nasa.gov/fits_samples.html
[4] https://ctan.org/pkg/pgfplots

Figure 2: (a) An example image of the Wide-Field Planetary Camera 2, on board the Hubble Space Telescope from 1993 to 2009. This is one of the sample images from the FITS standard webpage, kept as examples for this file format. (b) Histogram of pixel values in (a).

removes the necessity to add further dependencies (to create the plots) to your project. There are high-level language libraries like Matplotlib which also generate plots. However, the problem is that they require many dependencies (Python, Numpy and etc). Installing these dependencies from source, is not easy and will harm the reproducibility of your paper. Note that after several years, the binary files of these high-level libraries, that you easily install today, will no longer be available in common repositories. Therefore building the libraries from source is the only option to reproduce your results.

Furthermore, since PGFPlots is built by LATEX it respects all the properties of your text (for example line width and fonts and etc). Therefore the final plot blends in your paper much more nicely. It also has a wonderful manual[5].

This template also defines two LATEX macros that allow you to mark text within your document as *new* and *notes*. For example, this text has been marked as new. [While this one is marked as tonote.] If you comment the line (by adding a '%' at the start of the line or simply deleting the line) that defines highlightchanges, then the one that was marked new will become black (totally blend in with the rest of the text) and the one marked tonote will not be in the final PDF. You can thus use highlightchanges to easily make copies of your research for existing coauthors (who are just interested in the new parts or notes) and new co-authors (who don't want to be distracted by these issues in their first time reading).

2. NOTICE AND CITATIONS

To encourage other scientists to publish similarly reproducible papers, please add a notice close to the start of your paper or in the end of the abstract clearly mentioning that your work is fully reproducible.

For the time being, we haven't written a specific paper only for this template. Until then, we would be grateful if you could cite the first paper that used the early versions of this template: Akhlaghi and Ichikawa (2015).

After publication, don't forget to upload all the necessary data, software source code and the project's source to a long-lasting host like Zenodo (https://zenodo.org).

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[5] http://mirrors.ctan.org/graphics/pgf/contrib/pgfplots/doc/pgfplots.pdf

3. ACKNOWLEDGEMENTS

Please include the following two paragraphs in the Acknowledgement section of your paper. This reproducible paper template was developed in parallel with Gnuastro, so it benefited from the same grants. If you don't use Gnuastro in your final/customized project, please remove it from the paragraph below, only mentioning the reproducible paper template.

References

Akhlaghi, M. and T. Ichikawa (2015). *ApJS*, 220, 1.
Astropy Collaboration et al. (2013). *A&A*, 558, A33.
Astropy Collaboration et al. (2018). *AJ*, 156, 123.
Bacon, R. et al. (2017). *A&A*, 608, A1.
Behnel, S. et al. (2011). *CiSE*, 13, 31.
Dalcin, L. D. et al. (2011). *Advances in Water Resources*, 34, 1124.
Foreman-Mackey, D. (2016). *The Journal of Open Source Software*, 1, 24.
Hunter, J. D. (2007). *CiSE*, 9, 90.
Millman, K. J. and M. Aivazis (2011). *CiSE*, 13, 9.
Oliphant, T. E. (2007). *CiSE*, 9, 10.
van der Walt, S. et al. (2011). *CiSE*, 13, 22.

A. SOFTWARE ACKNOWLEDGEMENT

1.1.1a, PatchELF 0.10, Perl 5.30.0, Pixman 0.38.0, pkg-config 0.29.2, Python 3.7.4, R 3.6.2, Unzip 6.0, WCSLIB 6.4, XZ Utils 5.2.4, Zip 3.0 and Zlib 1.2.11. Within Python, the following modules were used: ASTEVAL 0.9.16, Astropy 4.0 (Astropy Collaboration et al. 2013; Astropy Collaboration et al. 2018), Corner 2.0.1 (Foreman-Mackey 2016), Cycler 0.10.0, Cython 0.29.6 (Behnel et al. 2011), emcee 3.0.1, h5py 2.9.0, Kiwisolver 1.0.1, LMFIT 0.9.14, Matplotlib 3.1.1 (Hunter 2007), mpi4py 3.0.2 (Dalcin et al. 2011), Numpy 1.17.2 (van der Walt et al. 2011), Pexpect 4.7.0, pkgconfig 1.5.1, PyParsing 2.3.1, python-dateutil 2.8.0, Scipy 1.3.1 (Oliphant 2007; Millman and Aivazis 2011), Setuptools 41.6.0, Setuptools-scm 3.3.3, Six 1.12.0 and uncertainties 3.1.2. The LaTeX source of the paper was compiled to make the PDF using the following packages: biber 2.14, biblatex 3.14, bitset 1.3, caption 53318 (revision), courier 35058 (revision), csquotes 5.2j, datetime 2.60, ec 1.0, etoolbox 2.5h, fancyhdr 3.10, fmtcount 3.05, fontaxes 1.0d, footmisc 5.5b, fp 2.1d, kastrup 15878 (revision), letltxmacro 1.6, logreq 1.0, newtx 1.623, pdfescape 1.15, pdftexcmds 0.31, pgf 3.1.5b, pgfplots 1.16, preprint 2011, setspace 6.7a, tex 3.14159265, texgyre 2.501, times 35058 (revision), titlesec 2.13, trimspaces 1.1, txfonts 15878 (revision), ulem 53365 (revision), xcolor 2.12 and xkeyval 2.7a. We are very grateful to all their creators for freely providing this necessary infrastructure. This research (and many others) would not be possible without them.