

A case study demonstrating VPH-NoE guideline compliance: Exercising the toolkit guidelines for a simple graphical tool

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Introduction

The VPH Toolkit is a technology resource for the biomedical research community, with patrons uploading/downloading models, tools and data for interoperable components and solutions to biomedical research problems. Uploaded content is of variable quality, and the VPH NoE has compiled a collection of Guidelines[1] to help contributors improve the quality of their submitted content, particularly in respect of usability, discoverability, and interoperability. Compliance with the guidelines will purportedly aid software uptake and dispersion. The guidelines consist of eight documents, individually addressing tools/ model/data characterisation, licensing, ethico-legal matters, usability, interoperability and metadata annotation (ontologies).

This paper describes a simple tool (*VIEW- Versatile Image Evaluation Window*) destined for the ToolKit, which has been significantly revised and adapted for guidelines compliance, as described below. The tool is a simple utility for measuring images, and is designed to quantify a range of simple parameters relevant to a region of interest (ROI), such as line length, angle between lines, ROI perimeter length, area enclosed within the ROI. Although many examples of such a tool already exist [2,3,4], *VIEW* exploits a novel design feature that enables it to operate in tandem with, but independent of, any application exposed on the Operating System desktop.

Materials and Methods

As originally written, the software was considered suitable for upload to the VPH Toolkit. However, subsequent reading of the VPH NoE Guidelines invited numerous changes, and the influences of the guidelines on the design of the tool are described below...

- **Licensing:** Licensing is a feature that can easily be overlooked and reference to the Licensing Guidelines resulted in attribution of a simplified BSD license. This information is now exposed in the software through the Help->About software menu.
- **Validation:** User testing of tool accuracy is considered important within the Guidelines framework and software testing has been more rigorous as a result of guidelines application. The guidelines stress the importance of software reliability and accuracy of output. For this purpose, calibration test images have been included with the tool. This helps to inspire confidence by enabling the user to explore the tool's functionality and assess its limitations against a benchmark data set.
- **Disclaimer:** The ethico-legal guidelines raise concerns about legal aspects of VPH data/model/tool exposure for 3rd party use (eg. privacy of personal data, suitability of purpose etc.), with particular emphasis on the need to act in accordance with constraints relating to patient data (ethical issues of informed patient consent apply here). None of the above raises specific concerns for *VIEW* except to ensure that the test images supplied for user familiarisation and tool validation do not contain patient sensitive data. However, the guidelines do promote the use of a

disclaimer, so as to clarify the software's domain of application (ie. to avoid it being used for purposes for which it was never intended). An appropriate disclaimer has been attached and is evident in the Help-> About menu.

- **Data Format:** The tool was originally coded to save measurement data in a native binary format. Application of the Interoperability Guidelines precipitated development of a modified file format, employing a validated XML schema that is both human and machine readable.
- **Usability:** This refers to the ease with which a user can effectively engage with the tool and produce meaningful results. No universal metric is offered by the guidelines for assessment of usability, but it does highlight the importance of user testing, availability of training resources, and well written documentation. Other elements are also presented but effort was only directed at addressing the above three items.
- **Characterisation:** The VPH NoE Guidelines have a strong emphasis on characterisation, which involves characterising the software and its output according to a range of specific categories. Model characterisation was not applicable to our case and data characterisation was uncomplicated for the simple measurements provided by *VIEW*. Tool characterisation employs example templates illustrated by the Guidelines, and these made the characterisation exercise relatively straightforward.
- **Interoperability:** *VIEW* operates independently of, but in concert with other applications. Arguably, it can be considered highly interoperable, because it naturally interoperates with a wide range of software. The saving of measurement data in a structured XML format promotes interoperability further, as do other design choices (eg. coding in C# to exploit the .NET framework). The latter however, limits cross-platform interoperability (for example it excludes a Linux/Unix variant of *VIEW*). The cost of porting the tool to these other operating systems was prohibitive and could not be met within our delivery schedule. Consequently, *VIEW* suffers from limited interoperability.
- **Annotation:** The simplicity of the tool helps with issues of metadata annotation, because the data file incorporates only a limited range of simple concepts. A calibration feature permits conversion of pixel measurement to real world units, and this is supported by an ontology structure within the XML data file. The unique id of the measurement unit is declared in accordance with the 'units ontology' of the NCBO Bioportal (<http://bioportal.bioontology.org>).

Results and Discussion

The VPH NoE Guidelines were found to be fairly comprehensive, but several elements were of little relevance to *VIEW* (eg. model characterisation). It is worth noting that the effort required to adapt *VIEW* for compliance with the VPH NoE Guidelines was moderate overall, although the result produced a significantly improved piece of software. Several recommendations were easily implemented (data format, licensing, disclaimer), whereas full cross-platform compatibility was ignored because it was too demanding for our delivery schedule. Of those recommendations requiring moderate effort, perhaps usability was the most valuable. The greatest benefit of configuring the software for guidelines compliance was that it committed the authors to considering the software from a broader and more interoperable perspective; a process that was eased by the supportive framework of the guidelines.

The following table summarises the outcomes of the application of the Guidelines to *VIEW*.

Guideline Topic	Influence of Guideline Recommendations on the Software Tool (<i>VIEW</i>)	Outcome	Level of effort required for guidelines compliance
Data Characterisation	Measurement data saved in XML format	Improved interoperability	Easy
Usability and Training	Inclusion of test exercises for user familiarisation and validation of the software	Improved user confidence	Moderate
Licensing	Simplified BSD license attached to the software	Clarification of the software's potential for further use	Easy
Legal, Ethics and Provenance	Appropriate disclaimer attached to the software	Clarification of the domain of application of the software tool	Easy
Interoperability	Consideration of cross-platform interoperability, but unable to comply (eg. a Unix/Linux compatible version of <i>VIEW</i> is not available).	A section of the user community is excluded.	Difficult – unable to comply with recommendation
Ontological Annotation	Metadata annotation of the data file	Improved discoverability and interoperability	Moderate
Tool Characterisation	Description of <i>VIEW</i> categorised according to the Tool Characterisation guideline template	Improved discoverability and interoperability	Moderate
Model Characterisation	Not applicable (N/A)	N/A	N/A

Table 1: The influences of the VPH NoE guideline documents are summarised, with comments relating to the effort required and the outcomes of adapting the software.

Conclusion

The original software tool (*VIEW*) was developed with simplicity and interoperability in mind. This it achieved with some success, but with application of the VPH NoE Guidelines, *VIEW* has become a more polished and professional application, with the prospect of much wider uptake within the user community.

References

1. The VPH-NoE toolkit guidelines [Internet] 2011 [cited 2012 Mar 13], Available from: <http://toolkit.vph-noe.eu/toolkit-guidelines>
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