Systematic Review Toolbox: A Catalogue of Tools to Support Systematic Reviews

Christopher Marshall & Pearl Brereton
School of Computing and
Mathematics
Keele University
Staffordshire UK
c.marshall@keele.ac.uk / o.p.brereton@keele.ac.uk

ABSTRACT
Systematic review is a widely used research method in software engineering, and in other disciplines, for identifying and analysing empirical evidence. The method is data intensive and time consuming, and hence is usually supported by a wide range of software-based tools. However, systematic reviewers have found that finding and selecting tools can be quite challenging.

In this paper, we present the Systematic Review Toolbox; a web-based catalogue of tools, to help reviewers find appropriate tools based on their particular needs.

Categories and Subject Descriptors
D.2.m [**Software Engineering**]: Miscellaneous

General Terms
Documentation

Keywords
Systematic review, automated tool, toolbox

1. INTRODUCTION
Systematic review (SR) is an established research method for rigorously locating and analysing empirical evidence on a particular topic of interest [1]. Undertaking a SR involves the systematic storage, management, validation and analysis of large quantities of data; activities, which can be error prone and time consuming. Automated tools, therefore, are used to support many aspects of the SR process. In software engineering these include basic productivity tools, such as word processors and spreadsheets, reference managers, statistics packages and purpose built tools targeting either particular stages of the review or the review process as a whole.

A number of studies have identified and investigated tools to support systematic reviewers. In healthcare, a survey of current systems that provide support for SRs identified a variety of tools [2]. A cross-domain mapping study of visual data mining (VDM) techniques identified a number of VDM tools to support data extraction and data synthesis [3]. Within software engineering, a broader mapping study of SR tools was performed, which identified a predominance of visualisation and text mining tools used to support study selection, data extraction and data synthesis [4]. Whilst these studies are useful, it remains a challenge for reviewers to easily discover what tools are currently available to support the conduct of their SRs. Some effort has been made to provide systematic reviewers with this information in other domains. For example, in healthcare, the Cochrane Collaboration provides a webpage on 'Other Software Resources[1]', which presents a list of available tools. However, the list is short and is missing many, potentially, helpful tools.

In this paper, we present the ***Systematic Review Toolbox***; a catalogue of tools to support SRs, which aims to help reviewers find appropriate tools based on their needs.

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2. SR Toolbox
Systematic Review (SR) Toolbox[2] (see Figure 1) is a searchable online catalogue of, primarily, automated tools that support the SR process across multiple domains. It uses a simple, yet flexible classification system (see Figure 2) to classify tools based on how they provide support for the SR process. It has been developed using PHP and MySQL. In this section, the three key functions of ***SR Toolbox*** are described; namely, executing a *'Quick Search'* (Section 2.1), performing an *'Advanced Search'* (Section 2.2) and submitting a new tool to the catalogue (Section 2.3).

2.1 Quick Search
Users can perform a simple '*Quick Search',* which queries the 'tool_name' and 'tool_description' fields in the tool table (see Figure 2) and returns any matching results. As shown in the example presented in Figure 3, a search for the term *"Framework"* has returned three automated tools; namely, *DBPedia* (a resource description framework), *Pimiento* (a framework for text mining) and *ReVis* (A visual text mining tool). If a user wishes to find out more about a returned tool, clicking the tool's name re-directs them to a dynamically generated profile page (see Figure 4). This area provides more information about the tool and includes some useful links.

2.2 Advanced Search
Performing an *Advanced Search* lets users specify what kind of tool they require based on their needs. As shown in Figure 1, users can select a particular underlying approach associated with the tool. The underlying approaches available are *Visualisation, text mining, visual text mining, whole process* (i.e. a tool which aims to support all or at least many stages in the process),

[1] https://tech.cochrane.org/revman/other-resources
[2] http://systematicreviewtools.com

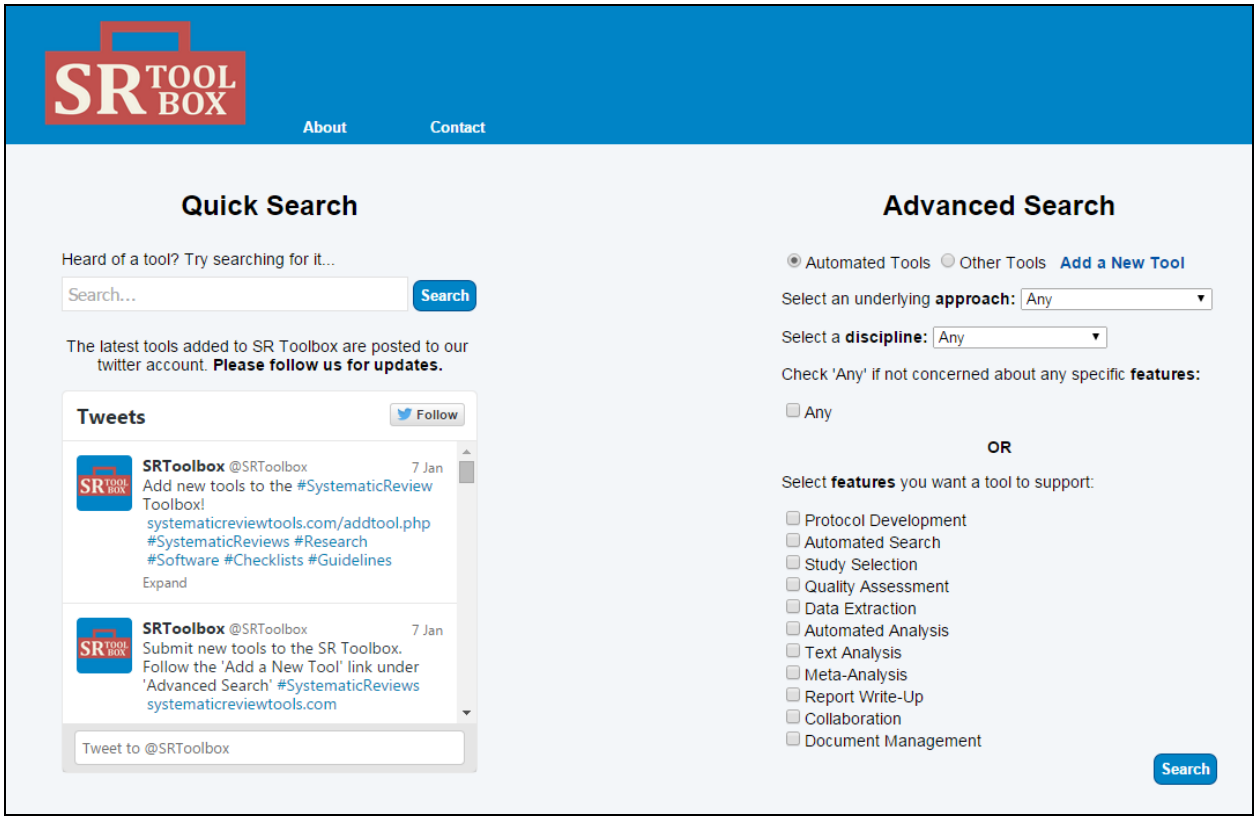

Figure 1. SR Toolbox Homepage

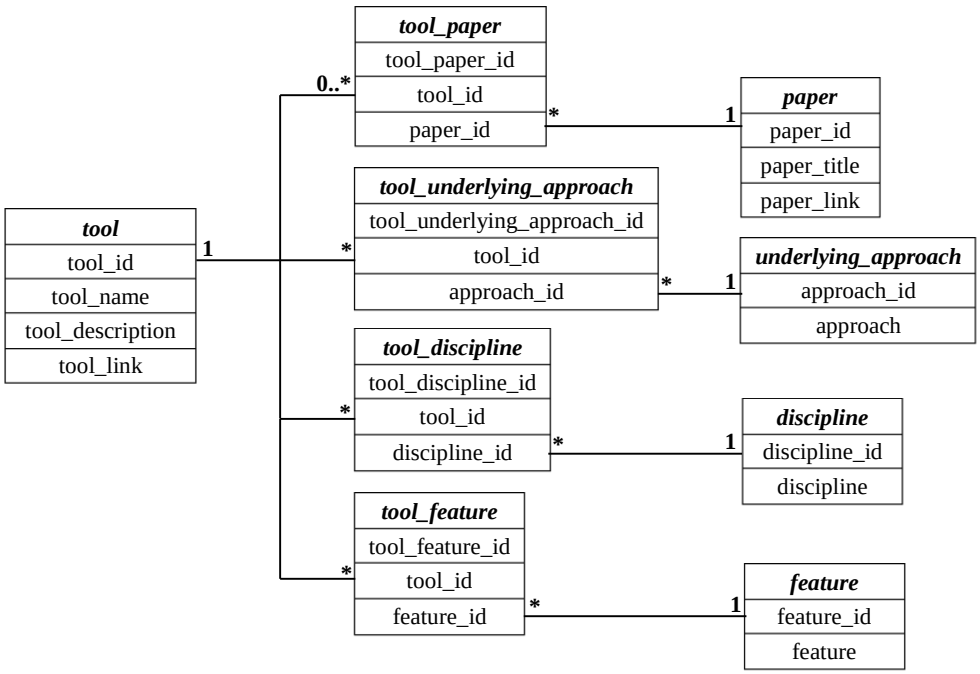

Figure 2. Class Diagram

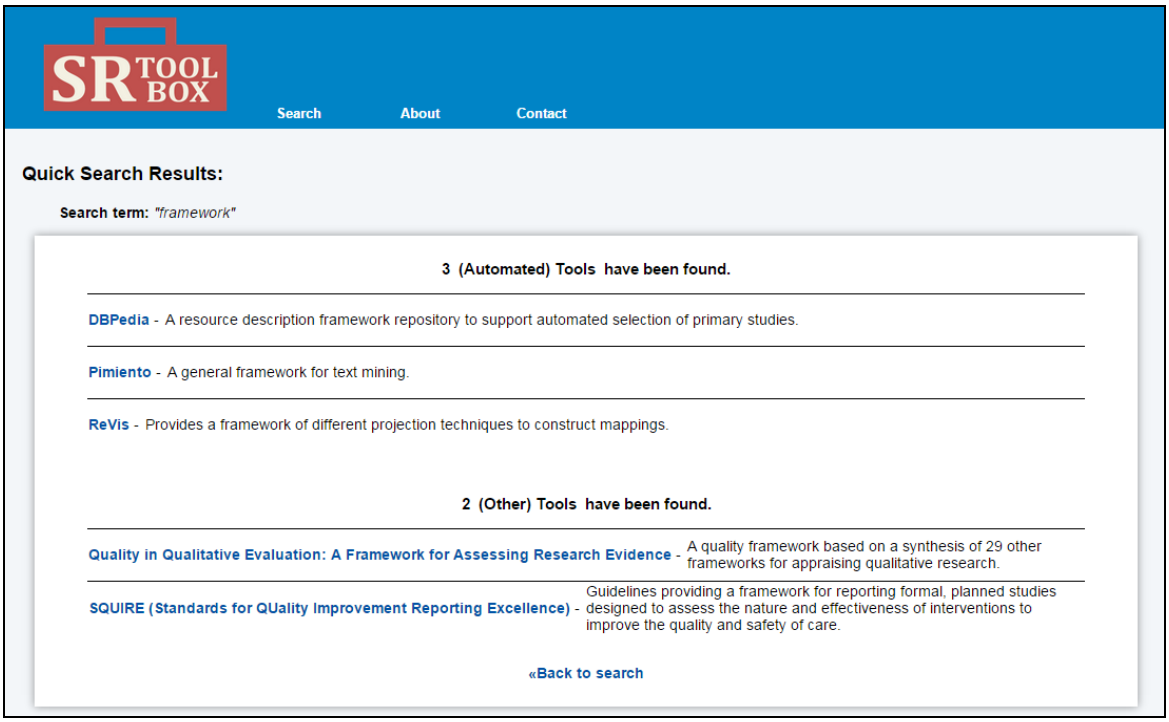

Figure 3. Quick Search Results

ontology, *search*, *machine learning*, *data mining*, *visual data mining*, *reference management* and *other*. Next, users can specify the target domain in which they require support. Currently, ***SR Toolbox*** includes tools that support SRs in *Healthcare*, areas of *Social Science* and *Software Engineering*. Recent research suggests that problems relating to SRs faced in certain disciplines are similar to those faced by researchers in other domains [5]. As a result, some tools considered domain specific may also be helpful to researchers in other fields too. Where we believe this to be the case, some tools have been classified appropriately as providing *multidiscipline* support. Where users are not concerned about a particular domain, they can select the '*any*' option.

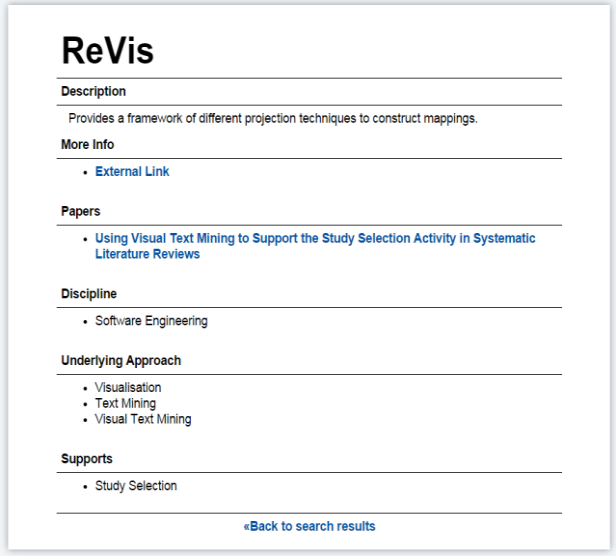

Figure 4. Tool Profile Page

A user can also specify what aspects of the SR process they want supported by a tool. The features supported by tools included in ***SR Toolbox*** are shown in Figure 1. When selecting multiple features, it is important to note that selections stack. For example, if a user selects '*Protocol Development*', '*Study Selection*' and '*Quality Assessment*', only tools which include support for ***all*** of these features will be returned. In the case of this example, four automated tools were found that fulfilled the search criteria, as shown in Figure 5.

2.2.1 Other Tools

Although the focus of ***SR Toolbox*** is on identifying automated tools (i.e. software) to support SRs, other tools or support mechanisms (i.e. checklists, guidelines and reporting standards) can also be found. On selecting the 'Other Tools' radio button, a new form appears that allows users to search for non-automated tools (see Figure 6). Currently, ***SR Toolbox*** includes *Guidelines*, *Quality Checklists*, *Reporting Standards* and paper-based *Search Tools* that support SRs across multiple disciplines.

Users can also use the 'Quick Search' feature to search for these types of tools. Using the same example reported in Section 2.1, two 'Other' tools; namely, *Quality in Qualitative Evaluation: A Framework for Assessing Research Evidence* and *SQUIRE (Standards for Quality Improvement Reporting Excellence)* were found (see Figure 2).

2.3 Add a New Tool

Since the launch of ***SR Toolbox*** in May 2014, several users have been in contact with suggestions for new features. One of the more frequently requested updates was the ability for users to add their own tools. Under the Advanced Search heading (see Figure 1) there is a link to 'Add a New Tool.' This presents the user with a form to complete. The form asks for the name of the tool, a short description of how it provides support (including any relevant

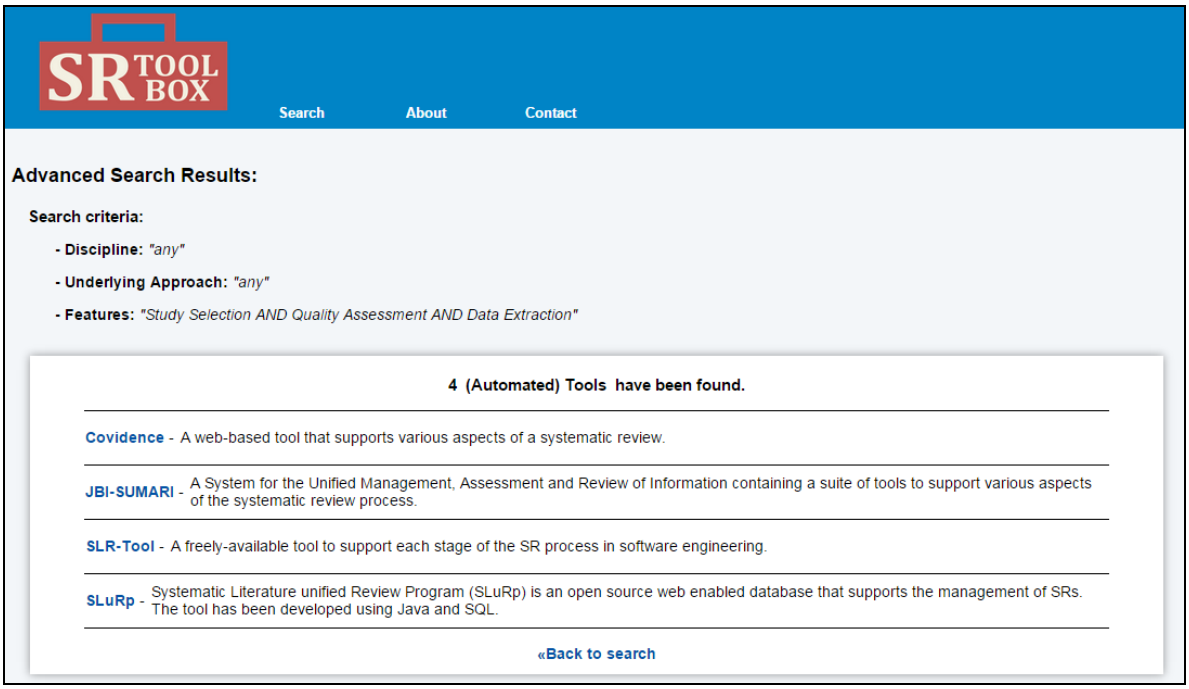

Figure 5. Advanced Search Results

links), the target domain (i.e. healthcare, social science, software engineering or multidiscipline), any underlying approaches associated with the tool and the aspects of the SR process (i.e. features) which it supports. Optionally, the user can provide their contact details and any final comments.

On submission, users are presented with a confirmation message informing them that the tool information has been received. Currently, this information is not added to the site instantly. Instead, the data is emailed to the site author for review and, if suitable, then added to the database. Once a new tool is added, the ***SR Toolbox*** twitter account ('@SRToolbox') is updated. Users are encouraged to 'follow' the account for notifications on new tools. An embedded twitter feed can be found on the site's homepage (see Figure 1).

3. CONCLUSIONS & FUTURE WORK

This paper has presented ***SR Toolbox***; a resource for reviewers to identify tools to support their SRs. Currently, the database holds 71 automated tools (i.e. software support) and 23 other tools (i.e. guidelines, checklists and reporting standards). Since going live in May 2014, the resource has been well received (particularly in healthcare [6]) and currently averages between 200 to 300 visits a month. As future work, we will continue to populate the database with new tools, improve existing functionality and implement new features.

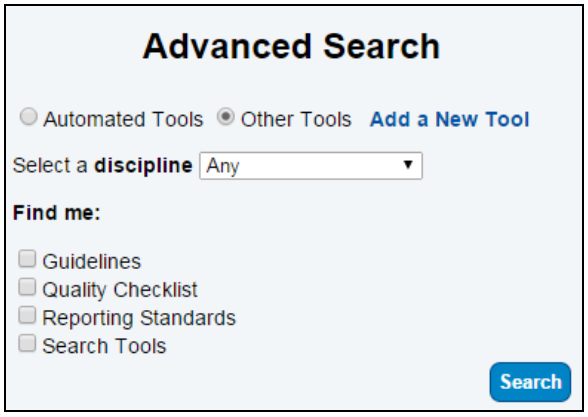

Figure 6. Advanced Search (*Other Tools*)

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