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An SLR-Tool: Search Process in Practice

A tool to conduct and manage Systematic Literature Review (SLR)

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ABSTRACT

Systematic Literature Reviews (SLRs) have established themselves as a method in the field of software engineering. The aim of an SLR is to systematically analyze existing literature in order to answer a research question. In this paper, we present a tool to support an SLR process. The main focus of the SLR tool (<https://www.slr-tool.com/>) is to create and manage an SLR project, to import search results from search engines, and to manage search results by including or excluding each paper. A demo video of our SLR tool is available at <https://youtu.be/Jan8JbwiE4k>.

KEYWORDS

SLR, systematic literature review, tool

1 Introduction

A systematic literature review (SLR) [9] is a scientific method for evaluating and interpreting all available research results that are relevant to a certain research question or a certain subject area. As a result, all available research results are collected, summarized, and evaluated. The basis of an SLR is the scientific literature already published [9].

According to the guidelines of Kitchenham and Charters [9], the systematic review process can be divided into three main phases: planning, conducting, and reporting. Figure 1 shows the individual phases in more detail.

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The first phase (Figure 1 - Planning the review) determines why an SLR should be carried out. Once this question has been clarified, the research questions can be determined accordingly. The format and content of the review protocol are then determined.

In the second phase (Figure 1 - Conducting the review), the search terms are defined. These search terms are then executed in the previously defined search engines and the results are collected. The results are then analysed according to the previously defined quality criteria.

In the last phase (Figure 1 - Reporting the review), the results are summarized in a report. In addition, it is determined where and how the report is to be published.

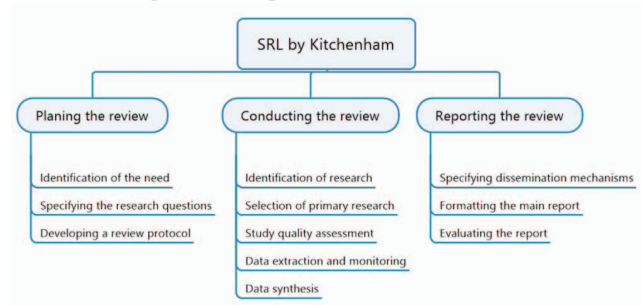


Figure 1 SLR by Kitchenham [9]

A tool for carrying out an SLR could provide useful support for the SLR process, as each phase must be carried out accurately, transparently, and comprehensibly [9].

Phases 2 and 3 are particularly suitable for this purpose. A tool should reduce the effort involved in carrying out an SLR as it represents one of the biggest barriers [2]. In particular, a tool should support different data sources with different quality. In practice, it has been shown that the quality of search results varies significantly from search engine to search engine (see Section 3.2).

In this article, we present our SLR tool to support an SLR process and an extended search. In Chapter 2, we will introduce the related works and the background of the existing SLR tools. Our SLR tool will be introduced in Chapter 3. In chapter 4, we present our strategy for validating the SLR tool. This article concludes with a summary and future work.

2 Related work and background

The literature contains various tools to support the implementation of an SLR [3,4,6]. An overview of SLR tools was created by Marshall and Brereton [10]. The SLR tools were examined on their maturity level and functions. Marshall and Brereton [10] came to the conclusion that most tools are in an early stage of development and use and that they have not been further developed. The vast majority of these tools represent parts or all of Phases 2 and 3 of an SLR. However, it also turned out that newer tools increasingly depict text-mining functions, which can evaluate the results of research or paper.

Al-Zubidy et al. [2] did not analyse the existing tools but the requirements for potential SLR tools. By analysing the existing studies and conducting several workshops with the target group of SLR tools, a prioritized list of requirements has been drawn up. The first five most important requirements are: integrated search (search and selection), collaboration support (overall protocol), traceability (overall protocol), support inclusion and exclusion (search and selection), and data maintenance (overall protocol). The list of requirements also coincides with another study by Hassler et al. [7].

As a conclusion, the problem lies in the fact that some tools are no longer available and therefore, cannot be used. Furthermore, to the best of our knowledge there is no SLR tool that evaluate the quality of the results from search engines (Science Direct, Springer Link, IEEEExplore, Scopus, ACM etc.). However, this is essential as it is the basis for an SLR.

3 SLR tool

Concerning the list of requirements from different studies [1,2,7,11] the focus of our SLR tool lies on the quality of search results from search engines, usability and user experience and management of the SLR process.

Our basic assumption is that a paper is relevant if it contains the search term within the title, abstract, or keywords [5]. Using information extraction, the relevance of a paper is calculated by counting the frequency of the keywords occurring in the search string.

With our SLR tool, we map the following main processes or functions:

- Create and manage an SLR project. Invite users to existing project.
- Import search results from search engines and evaluate the quality of the search results. Adding missing information from other data sources.

- Manage search results by including or excluding each paper.

The following subsections describe the individual processes and functions in more detail.

3.1 Create and manage an SLR project

The start of an SLR project begins with the creation of a project. This project can then be shared or edited with other users. Figure 2 shows an example of the project overview. Each user can create several projects or be invited to projects as an editor.

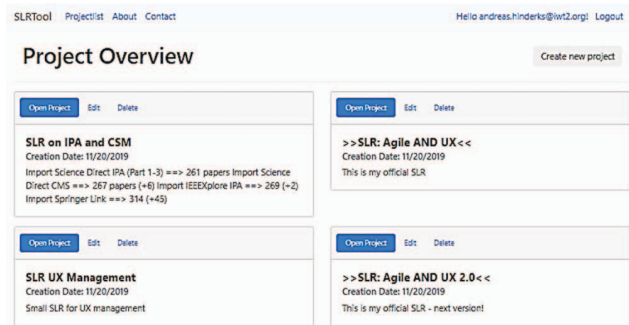


Figure 2 SLR tool - Project Overview (example)

In each project, all found research results or papers are administered. Figure 3 shows the overview of an open project. In each project, the paper can be imported from different sources and then managed.

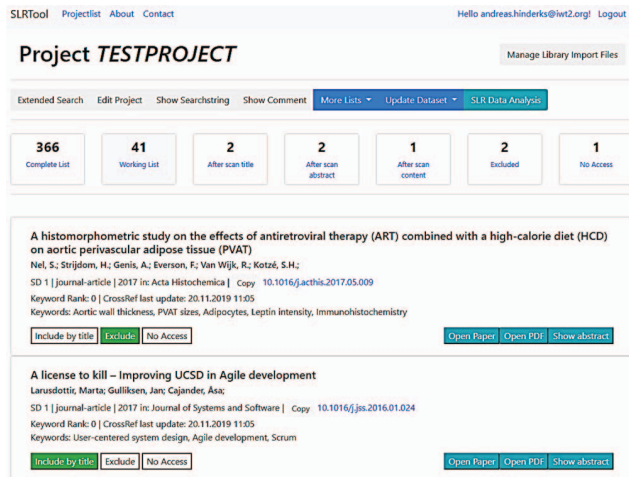


Figure 3 SLR tool – Project (example)

The import of the paper is described in Section 3.2 and the administration of the paper in Section 3.3.

3.2 Import and manage search results

When using various search engines (Science Direct, Springer Link, IEEEExplore, Scopus, ACM etc.), we noticed that not all

search engines can search only by title, abstract, and keywords. Rather, some search engines produced false and incomprehensible search results. So, we used only the full text function of the search engines and made further restrictions in the SLR tool.

For this, the SLR tool offers an import of different formats of search engines, mainly BibTex. Each import file can be carried out as an independent import. When importing, already existing entries are considered according to the DOI or the title and are not imported. This means that the function can continued to be used even if the search results are updated later.

In the next step, the imported papers are updated via the CrossRef API¹. If the abstract does not exist, it is updated. In addition, the formatting of the authors is updated, since these are carried out differently from different sources.

Finally, the 'extended Search' function can be used to restrict the previously imported search results, as shown in Figure 4.

Figure 4 SLR tool - extended search (example)

The extended search examines the existing paper using the given keywords. All the papers where the corresponding keywords are present in the title, abstract, or keyword list are moved to the 'Working List' (Figure 6) category. In addition, when using the extended search, the number of keywords found is determined (Figure 5).

Number of founded Keywords		
0 Manage UX	0 Manage User Experience	0 Manage Usability
2 User Experience Management	11 UX Management	0 Usability Management

Figure 5 SLR tool - keyword Ranking (example)

A ranking is calculated on the basis of the number of the keywords found. After this ranking, the user can sort the list of papers so that the paper with the most frequently found keywords

¹ <https://www.crossref.org/>

and thus of a high relevance is displayed at the beginning of the list.

3.3 Manage search results

The aim of an SLR is to evaluate the found papers in a qualified way. This step usually includes or excludes a paper from the working list. The SLR tool supports the following include functions (Figure 6): 'After scan title', 'After scan abstract', and 'After scan content'.



Figure 6 SLR tool - paper status tiles (example)

Under 'exclude', all the papers are assigned which are not used in the SLR project. If the paper cannot be accessed, it is assigned the status 'no Access'. If a paper is to be included in the SLR, it can be enriched with additional information, as shown in Figure 7.

Figure 7 SLR tool - additional information (example)

The attributes for additional information can be defined in the project settings so that they can be created according to the user's wishes.

3.4 Implementation

The SLR tool is a web-application and was developed with ASP.NET Core 2.2. MS SQL Server 2016 was used as the database system management. The database itself was only used as data storage. Data logic and functions for data manipulation were implemented in the business logic of the SLR tool.

Bootstrap v4.1.3 with jQuery v3.3.1 was used for the frontend. The design pattern 'Model View Control', supported by ASP.NET Core, was used, where the model represents the data layer, including the data logic, the views represent one HTML page each, and the controllers serves one view each.

The SLR tool is available at <https://www.slr-tool.com/>, and it is free of charge.

4 Validation

Currently, the SLR tool is used and tested in the research group *IWT*² of the Department of Computer Languages and Systems of the University of Seville and in the *Research Group for Agile Software Development and User Experience* at the University of Applied Sciences Emden/Leer. In both research groups, we are testing the SLR tool in several environments. The tool is being tested in the context of PhD theses (for example Sánchez-Gómez et al. [12]) and scientific research (for example SocietySoft³ project) in the university environment and the context of research projects with companies. A subsequent validation is planned. The validation should examine two essential aspects:

1. Does the SLR tool support the SLR process so that the user can perform the SLR process more efficiently and effectively?
2. Does the calculated relevance of the individual papers make sense and support the user?

The first aspect can be determined by means of a case study and a questionnaire. Standard questionnaires such as the UEQ+ [13] are suitable for this purpose. The results can then be evaluated with the importance-performance analysis [8].

In order to determine whether the calculated relevance of the paper makes sense, we plan to analyze the individual SLRs performed in the case study in greater detail. The aim is to determine up to which sorted relevant papers are found, which are then transferred to the SLR. If, for example, only paper from the first-third of the sorted list has been transferred, this is an indication of a successful relevance calculation. In the opposite case, it is rather not.

5 Conclusion and future work

In this paper we presented our developed SLR tool. The aim of the SLR tool is to support the user in performing an SLR and to focus on relevant papers.

The SLR tool should be validated in a later case study. Also, it should be validated whether the goals have been achieved and whether the user can carry out an SLR project more efficiently and effectively by using the SLR tool. In a further step, the requirements identified in the studies by Al-Zubidy et al. [2] and Hassler et al. [7] can be compared with the implemented functions in the SLR tool. A core function, according to Al-Zubidy et al. [1], is the integration of relevant search engines, which is currently not yet implemented in the SLR tool.

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² <https://www.iwt2.org>

³ https://investigacion.us.es/sisius/sis_proyecto.php?idproy=31806