Conducting Systematic Literature Reviews and Systematic Mapping Studies

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ABSTRACT

Context*:* An essential part of conducting software engineering (SE) research is the ability to identify extant research on tools, technologies, concepts and methods in order to evaluate and make rational and scientific decisions. The domain from which such knowledge is extracted is typically existing research literature found in journals, conference proceedings, books and gray literature. Empirical approaches that include various systematic review (SR) methodologies such as systematic literature review (SLR) and systematic mapping study (SMS) are found to be effective in this context. They adopt rigorous planning, follow repeatable and well-defined processes, and produce unbiased and evidence-based outcomes. Despite these significant benefits, the general trend on using these systematic review (SR) methodologies is not encouraging in SE research. The primary reasons emerging are twofold - a) SR methodologies are largely cited as time-consuming activities and b) lack of guidance to conduct systematic reviews. This tutorial discusses these concerns and describes an effective way of using SR methodologies for SE research.

Objectives*:* Attendees will be introduced to the key concepts, methods and processes for conducting systematic literature reviews (SLR) and systematic mapping studies (SMS). The benefits, limitations, guidelines for using SR methodologies in an effective manner will discussed in the session. Attendees will be guided on the appropriate formulation of a research question and sub questions; the development of a review protocol such as inclusion criteria, exclusion criteria, quality criteria and classification structures; and execution of review protocol using digital libraries and syntheses of review data. A web based software tool[1], for supporting the systematic literature review process will be demonstrated and attendees will get the opportunity to use the tool to conduct the review to help in identification of relevant research and extraction and synthesis of data.

Method*:* We will use a blend of information presentation, interactive hands-on session and knowledge sharing session. The presentation will introduce the key concepts, benefits, limitations and how to overcome the limitations; hands on session will illustrate a review process with a case study, and finally the knowledge sharing session will discuss the experiences, best practices and the lesson learnt.

[1]http://ta.mdx.ac.uk/slr/

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Keywords

Literature Review; Systematic Literature Review; Systematic Mapping Study; Meta Modeling; Model Based Literature Review

1. SYSTEMATIC REVIEW

A thorough literature review on a topic establishes a firm foundation for advancing knowledge. It identifies existing research and the areas where research is needed. Systematic Review (SR) methodologies in the form of Systematic Literature Review (SLR) [6] and Systematic Mapping Study (SMS) [7] methodology are two popular choices for many disciplines such as medicine, genetics, psychology and social science.

In principal, the SLR and SMS methodologies are a three-phase review method that includes *planning*, *execution* and *synthesis*. They essentially differ in terms of: how a research questions is formed, how the publication corpus is explored, what is the reviewing style, and what is the principal objective of review outcome. For example, the SR that adopts SMS methodology focuses on a broad research question, reviews large number of publications, adopts a style which is not as thorough as SLR, and aims for publication classification leading to a high-level understanding. In contrast, the SR with SLR methodology focuses on precise research questions leading to precise outcomes by conducting a thorough review of relatively small number of publications.

Both the methodologies introduce significant benefits over traditional literature review methods. The mostly cited benefits are: improved precision; fairness; trustworthiness and auditability of review method and review outcomes. The process for conducting SR is also observed as rigorous and repeatable in contrast to traditional literature review process. However, SMS and SLR methodologies are consistently reported as a time, effort and knowledge intensive activity in SE literature. It is also reported that excessive knowledge intensiveness limits the adoption of SLR and SMS in SE.

1.1 Our Motivation

We observed an increasing trend in the numbers of publications on SR in all major digital libraries such as Scopus,

ScienceDirect, IEEE Xplore, ACM Digital Library and Web of Science. Most of these publications concluded with positive feedback on SR methodology and high-quality review artefacts. We have also undertaken a number of systematic reviews using SLR and SMS to understand various aspects of SE such as trends in software engineering[3], trends in enterprise modeling [1], and the capabilities of enterprise modelling techniques[1]. Our experiences are congruent with the literature. However, we observed that the research contributions on SR is not uniformly distributed across the research communities. For instance, the 227 publications out of 837 contributions in Scopus digital library (i.e., 27%) are from 10 affiliations/institutions. Similarly 170 publications (20% of total publication) in Scopus digital library are from Brazil. Spain and Sweden are the next in the table with 83 and 76 publications respectively. So there is a clear indication that the use of SR is not widely accepted across research groups around the globe. Our primary objective is to create awareness to the larger research community and help them to use SR effectively in SE research.

2. TUTORIAL OVERVIEW

Learning outcomes*:* On completion of the tutorial, attendees will be able to:

- Understand key concepts, processes and use technologies for conducting systematic literature reviews and mapping studies.
- Plan and conduct reviews with respect to specifying research questions, developing the review protocols, selecting studies, assessing study quality, extracting required data and synthesizing results.
- Critically evaluate review literature using a systematic approach in order to realize benefits for their own research.
- Evaluate appropriate review methodology for a research question.

Target audience and expected background*:* Delegates attending this tutorial will be postgraduate research students (Masters and PhD); early career researchers, industrial researchers seeking to refresh their research skills and senior academics who wish to implement such practice in their own organization.

Reading materials*:* Relevant reading materials are as follows:

- Overview of Evidence based software engineering [6]
- Overview of Systematic Literature Review (SLR) [5]
- Overview of Systematic Mapping Study (SMS) [7]
- Guidelines for performing systematic literature reviews in software engineering [4]
- Overview of Slrtool [2]
- A case study of SMS [3]

3. REFERENCES

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