<Study types: Literature studies>

Introduction into systematic literature reviews and mapping studies
<Mohammad Reza Basirati>

Institut für Informatik
Software & Systems Engineering

Why Do We Need Literature Review?

"Indeed, one of my major complaints about the computer field is that whereas Newton could say, "**If I have seen a little further than others, it is because I have stood on the shoulders of giants**," I am forced to say, "**Today we stand on each other's feet.**"".

Richard Hamming 1968 Turing Award Lecture

Why Do We Need Literature Review?

- To *summarize the existing evidence* concerning a treatment or technology
- To *identify any gaps* in current research in order to suggest areas for further investigation.
- To *provide a framework/background* in order to appropriately position new research activities.

What Is Literature Review?

- A **systematic literature review** is a means of evaluating and interpreting all available research relevant to a particular research question, topic area, or phenomenon of interest.

How Do We Perform a Literature Review?

- Guideline derived from existing guidelines used by medical, social sciences and disciplines involved in evidence-based practice.
- Three main phases:

Planning The Review

Conducting The Review

Reporting The Review

How Do We Perform a Literature Review?

Planning The Review

Identification of the need for a review

Commissioning a review

Specifying the research question

Developing a review protocol

Evaluating the review protocol

An Example: Planning the Review

- Need:
  - In spite of the fact that most software cost estimation research concentrates on formal cost estimation models, most industrial cost estimation is based on expert judgment.

- Questions:
  - Should we expect more accurate effort estimates when applying expert judgment or models?
  - When should software development effort estimates be based on expert judgment, when on models, and when on a combination of expert judgment and models?

How Do We Perform a Literature Review?

Conducting The Review

Identification of research

Selection of primary studies

Study quality assessment

Data extraction and monitoring

Data synthesis

An Example: Conducting the Review

- Searching all volumes of over 100 journals for papers on software cost estimation. The journals were identified by reading reference lists of cost estimation papers, searching the Internet, and the researchers own experience.

- Searching papers identified by the INSPEC database using the following search string:
    - 'effort estimation' OR 'cost estimation' AND 'software development'

An Example: Conducting the Review

- Including papers that compare judgment-based and model-based software development effort estimation.

- Extracting design factors and primary study results
  - Design factors included:

    - Estimation method selection process
    - Estimation models
    - Expert judgment process
    - Etc.

An Example: Conducting the Review

- Tabulating the studies according to best, worst , and average accuracy of experts vs. models.

- Conclusion:
  - Expert opinion is likely to be useful if models are not calibrated to the company using them and/or experts have access to important contextual information that they are able to exploit.
  - Models may be useful when there are situational biases towards over optimism, experts do not have access to large amounts of contextual information, and/or models are calibrated to the environment.

How Do We Perform a Literature Review?

Reporting The Review

Specifying dissemination mechanism

Formatting the main report

Evaluating the report

Advantages of Systematic Literature Review

- Less likely to be biased

- Providing information about some phenomenon across a wide range of settings and methods

- Enables using meta-analytic techniques

Challenges in Literature Reviews

- Time/effort consuming: Requires considerably high effort

- Searching for literatures

- Lack of criteria for evidence quality assessment

Systematic Mapping Studies

- Systematic Mapping Studies provide a wide overview of a research area, to establish if research evidence exists on a topic and provide an indication of the quantity of the evidence.

- Example of systematic mapping study question:
  - What are the most investigated object oriented design topics?

Systematic Mapping vs. Systematic Review

- Mapping studies have broader research questions than SLRs.
- Mapping studies are less focused and return a very large number of studies than SLRs.
- There is no assessment of studies in systematic mappings; so there is the problem of validation.
- Dissemination of the results may be more limited.
- Mapping study is good as a starting point.

<p style="text-align:center">They should be used complementarily</p>

Tertiary study

- A systematic review of systematic reviews

- To answer wider research questions
  - Which individuals and organizations are most active in SLR-based research?

Summary

- Today (in computer science) we stand on each other's feet
- Mapping study is a good starting point
- Using systematic literature review for investigation of research questions
- Important stages for performing a SLR:
  - Specifying the research question
  - Developing a review protocol
  - Selection of primary studies
  - Study quality assessment
  - Data synthesis
  - Reporting The Review

Thank You for Your Attention