

A Living Interactive Evidence Synthesis Framework and Applications for Creating and Maintaining Living Systematic Reviews and Meta-Analysis

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Background. Systematic Reviews (SRs) and meta-analyses (MAs) are tools to synthesize evidence and provide precise estimates of effects for benefits and harms outcomes with associated certainty of evidence. However, when the research field rapidly evolves, it requires frequent labor-intensive updates to keep pace with new evidence to keep the systematic reviews and meta-analyses “living” (SRMAs). For truly living SRMAs, several laborious steps still must be done by researchers manually, such as data collection, study screening, and information extraction. Thus, a system that facilitates the steps in SRMA is urgently needed to reduce the time and effort spent on repetitive tasks. To address this need, we propose a living interactive evidence synthesis (LIVe) framework that integrates open-source web techniques and MA libraries to maintain living SRMA and provide an interactive exploration of the SRMA results.

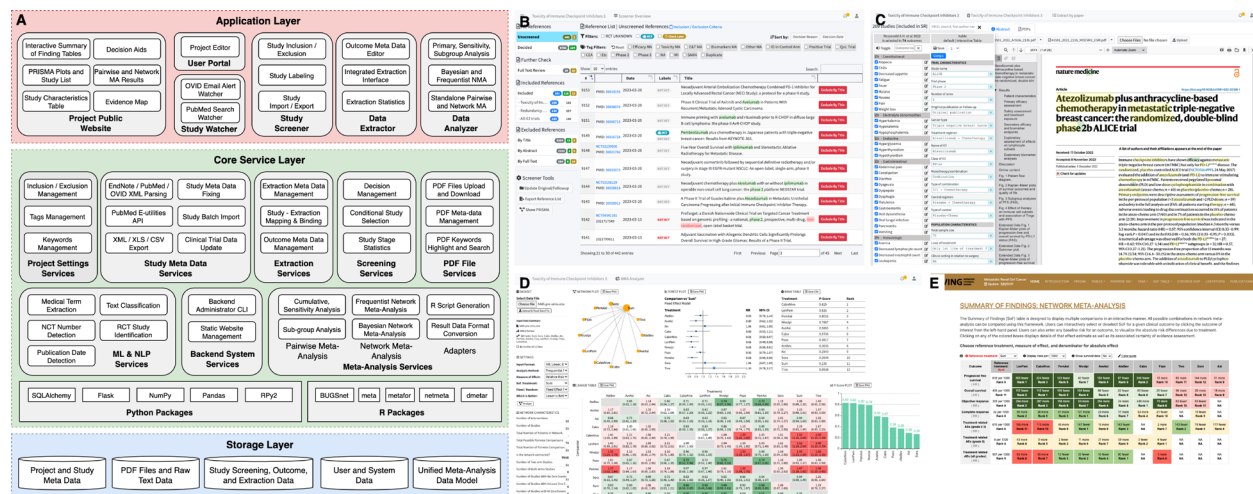


Figure 1. (A) The architecture of the LIVe framework. The screenshots of our prototype system based on LIVe framework, including (B) study screener, (C) data extractor, (D) MA analyzer, and (E) a project public website.

System Design and Development. As shown in Figure 1A, we designed a multi-layer architecture to implement the functions needed by the living SRMA, including 1) *the application layer*, which provides the user interface for researchers to screen studies, extract information from selected studies, and conduct MAs to understand the benefits and harms of treatments. 2) *the core service layer*, which implements the functionalities needed for conducting the tasks of SRMA, such as project data management, screening decision management, extraction management, and meta-analyses. 3) *the storage layer*, which saves all the data generated in the living SRMA process.

To validate the effectiveness and usefulness of the LIVe framework, we developed a prototype system based on open-source Python packages (e.g., Flask, Pandas, and RPy2) and R packages (e.g., meta, netmeta, and BUGSnet) to support the SRMA tasks, including the study screener (Figure 1B) that helps researchers to screening studies based on inclusion/exclusion criteria, data extractor (Figure 1C) that facilitates the information extraction from full-text PDF files, and MA analyzer (Figure 1D) that supports both pairwise and network MAs. The final MA results are exported as plots and summary of finding tables in the project public website for public access (Figure 1E).

Future Work. We have published several living SRMA projects at living-evidence.com based on LIVe framework (the source code is available at <https://github.com/OHNLP/LivingSRMA>). In the future, we plan to integrate natural language processing and deep learning methods to facilitate study screening, data extraction, pairwise and network MA, and certainty of evidence (CoE) assessments for more living SRMA projects.

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