Automating Systematic Reviews – Screening Tools

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1. Wallace BC, et al. Semi-automated screening of biomedical citations for systematic reviews. BMC Bioinformatic 2010, 11:55.
2. Olofsson H, et al. Can abstract screening workload be reduced using text mining? User experiences of the tool Rayyan. Res Syn Meth 2017;8:275-280.

Steps of a Systematic Review

- Identify the research question
- Develop a protocol
- Search for studies
- Abstract review
- Full-text review
- Data extraction
- Quality assessment
- Synthesis
- Write results

Screening Tools (http://systematicreviewtools.com/)

- Abstrackr
- CADIMA
- CREBP
- Colandr
- Covidence
- DistillerSR
- EPPI-Reviewer
- EROS
- GAP Screener
- JBI-SUMARI
- Lingo3G
- MeSHSIM
- Pimiento
- Rayyan
- RevMan
- Revtools
- SRDB.PRO
- SWIFT-Review

Comparison of Features

- Abstrackr
  - Website: http://abstrackr.cebm.brown.edu/account/login
  - Cost: Free
  - Developer: Brown University
  - Supports:
    - Citation screening
- Rayyan
  - Website: https://rayyan-prod.qcri.org/welcome
  - Cost: Free
  - Developer: Qatar Computing Research Institute
  - Launched in 2014
  - Supports:
    - Citation screening

Comparison of Features

- Abstrackr
  - Label references
  - Label terms and indicate if relevant or irrelevant
  - Tag citations
  - Add notes
  - Pilot round – where everyone reviews the same abstracts
- Rayyan
  - Allows 2+ users to screen independently or simultaneously
  - Label references
  - Keyword highlighting
  - Keyboard shortcuts
  - Mobile app

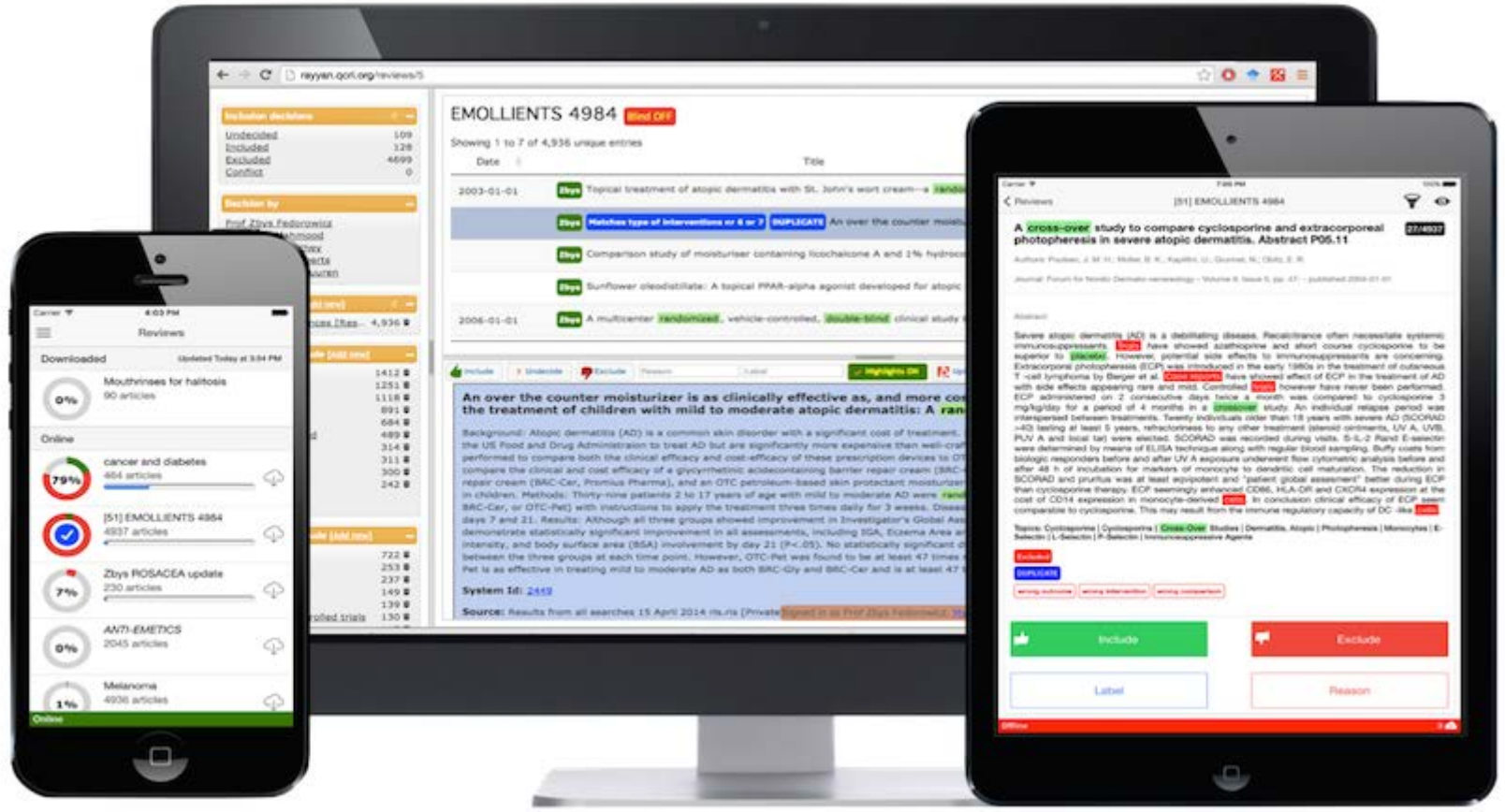
How the program sorts abstracts by relevance

- Abstrackr
  - Reviewers mark citations as relevant or irrelevant
  - Analyzes title text, abstract text, MeSH terms, UMLS terms
  - Generates a probability that the citation will be included
- Rayyan
  - Reviewers mark citations as relevant or irrelevant
  - Analyzes title and abstract text and MeSH terms
  - Generates a 1-5 star rating

Greater cost to the review when a citation is wrongly excluded than when citation is wrongly included.
For both software tools, reviewers need to correctly identify articles as relevant or not.

Abstrackr Screenshot

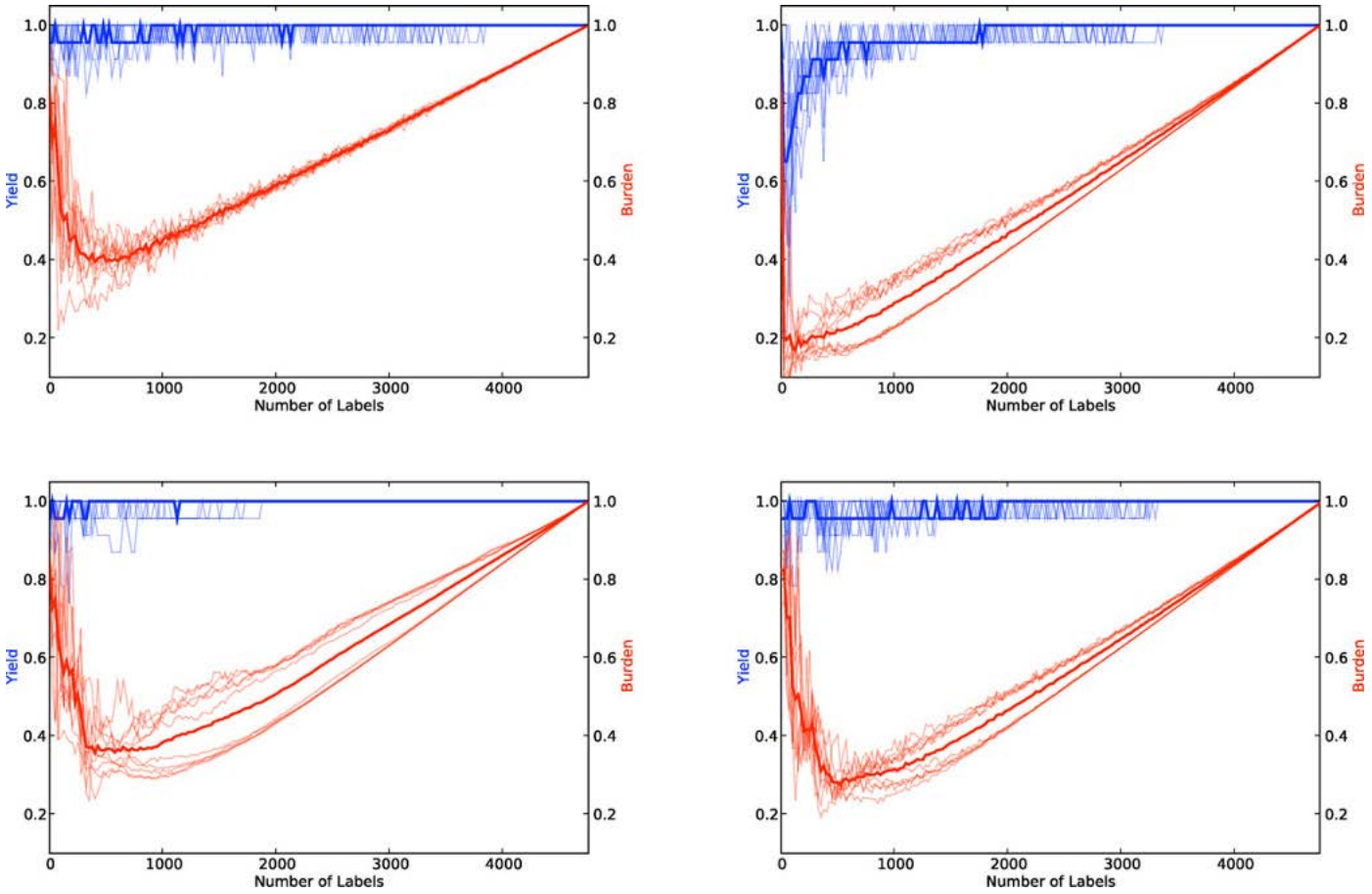
Rayyan Screenshot



Methods - Abstrackr

- Tested against 3 systematic reviews
- Yield = fraction of citations that are finally eligible for the systematic review that are identified by a citation screening approach
- Burden = fraction of the total number of citations that a human has to review manually with a given screening approach
- Started with one known relevant and one known irrelevant citation
- Calculated yield and burden after every 25 citations until all citations were reviewed
- Repeated the process 10 times

Results - Abstrackr



Yield and burden curves for four learning strategies over the proton beam dataset as a function of the training set

Results – Abstrackr

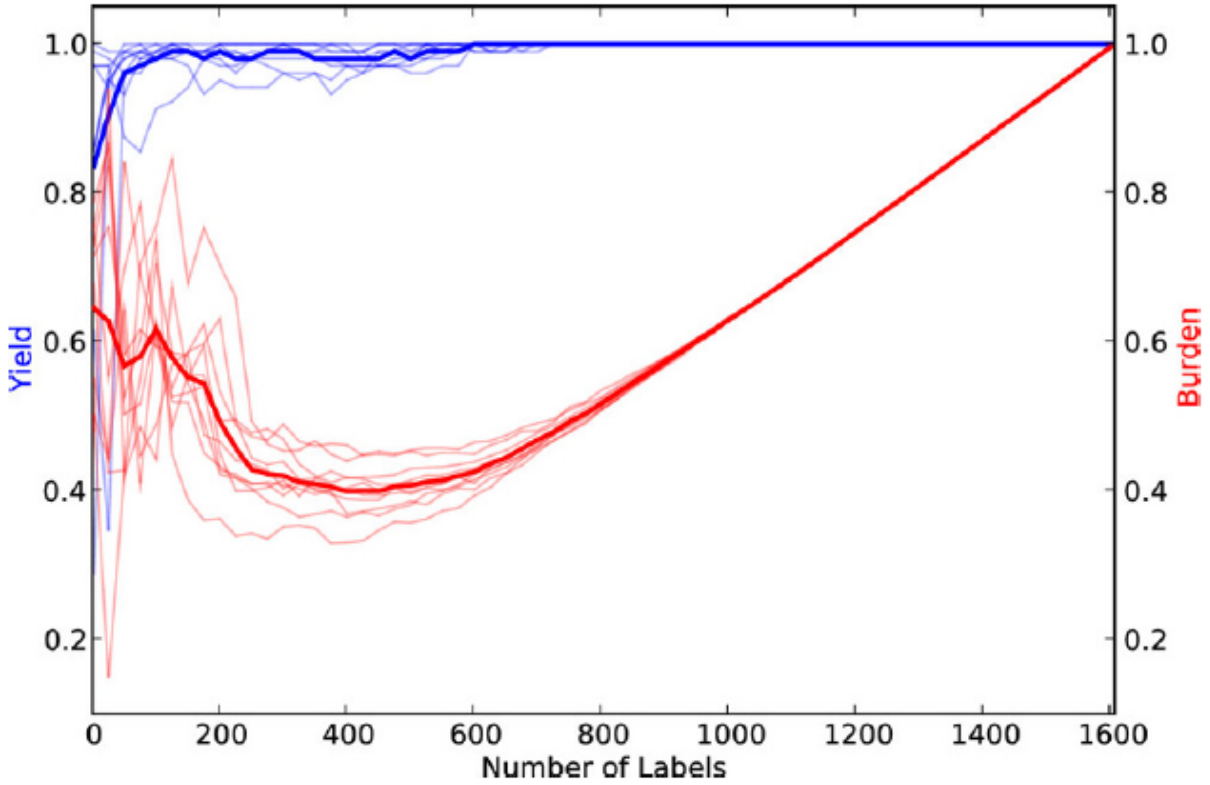


Figure 5 Results over the COPD dataset.

Results - Abstrackr

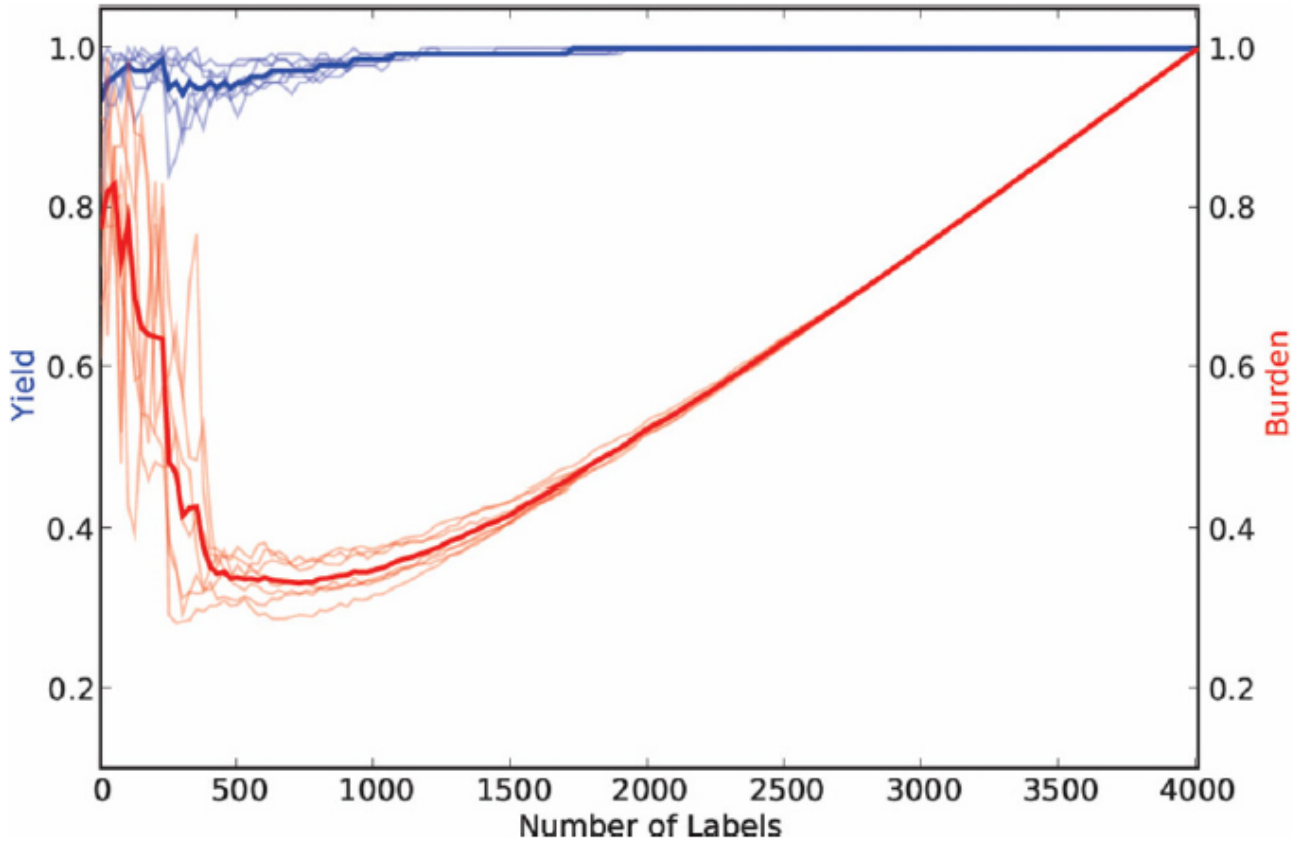


Figure 6 Results over the micro-nutrients dataset.

Methods - Rayyan

- Tested against 3 systematic reviews and 3 literature reviews
  - 2 studies compared Rayyan to Endnote or printed lists
  - 1 study does not have comparative data
  - 3 studies used one Rayyan screener
- Tallied number of included abstracts after reviewing ¼, ½, ¾ and all abstracts
- Determine when in the screening process the final included studies were identified

Results - Rayyan

TABLE 1 Characteristics of the included projects used to assess the text mining function in Rayyan

Project	Screening Program	No. of Reference Hits	Time Period	No. of References Selected for Full Text Screening	Percentage of References Selected for Full Text Screening	Percentage of References Selected for Full Text Screening After		
						25%	50%	75%
SR1 prenatal diagnosis	Rayyan	1,358	January 2015	129	9%	53%	95%	100%
	Word	1,358	January 2015	102	8%	33%	73%	92%
SR2 osteoarthritis	Rayyan	1,486	November 2014	265	18%	72%	98%	99%
	EndNote	1,486	November 2014	209	14%	26%	54%	69%
ES1 cardiovascular disease	Rayyan	1,187	January 2015	56	5%	21%	86%	100%
ES2 anxiety	Rayyan	1,864	September 2015	19	1%	21%	89%	89%
ES3 wound care	Rayyan	819	February 2015	68	8%	88%	99%	99%
SR3 perineal trauma	Rayyan	1,242	August 2015	126	10%	76%	96%	96%

ES, Reviews based on questions posed to SBU's Enquiry Service; No, Number; SR, systematic review.

Results - Rayyan

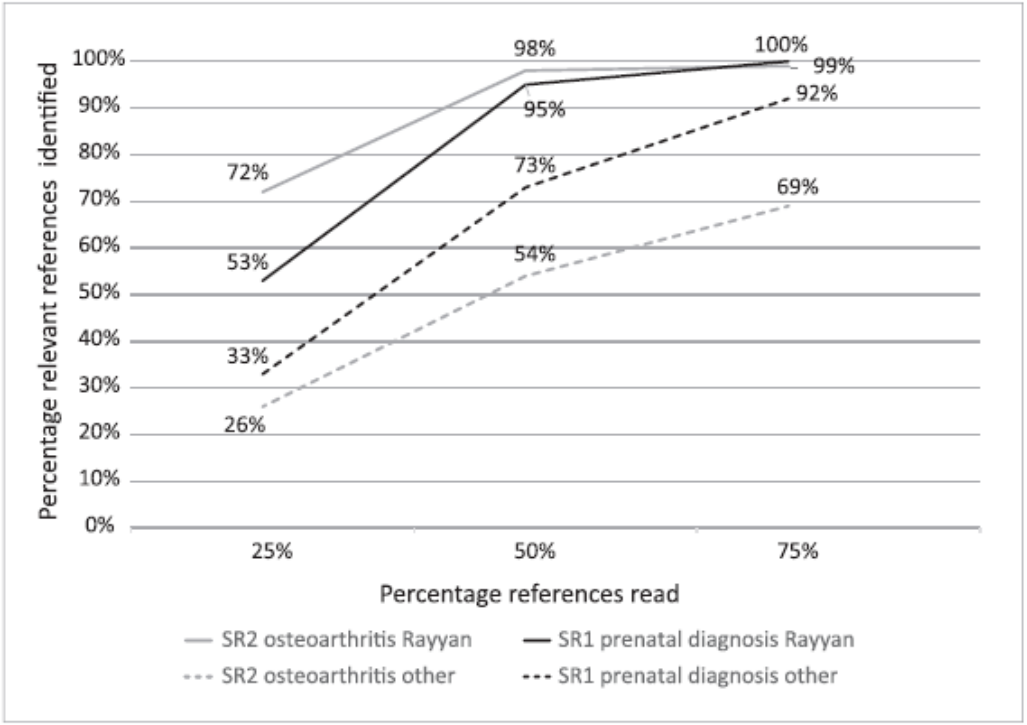


FIGURE 1 Percentage of relevant references identified after 25%, 50% respectively 75% of all references screened

Discussion

- Experiences with software?
  - Pros? Cons?
  - Was the probability feature helpful?
- Have you/would you ever use the tools for:
  - Prioritizing references
  - Second screener
  - Post-review audit
  - Automated screening

Two additional comments

- DistillerSR will be offering automated screening
- Systematic Review Journal is calling for papers to their ‘Automation in systematic reviews’ thematic series https://www.biomedcentral.com/collections/systrevautomation