Representation of Systematic Literature Review as Heatmaps Based on Sentiment Analysis

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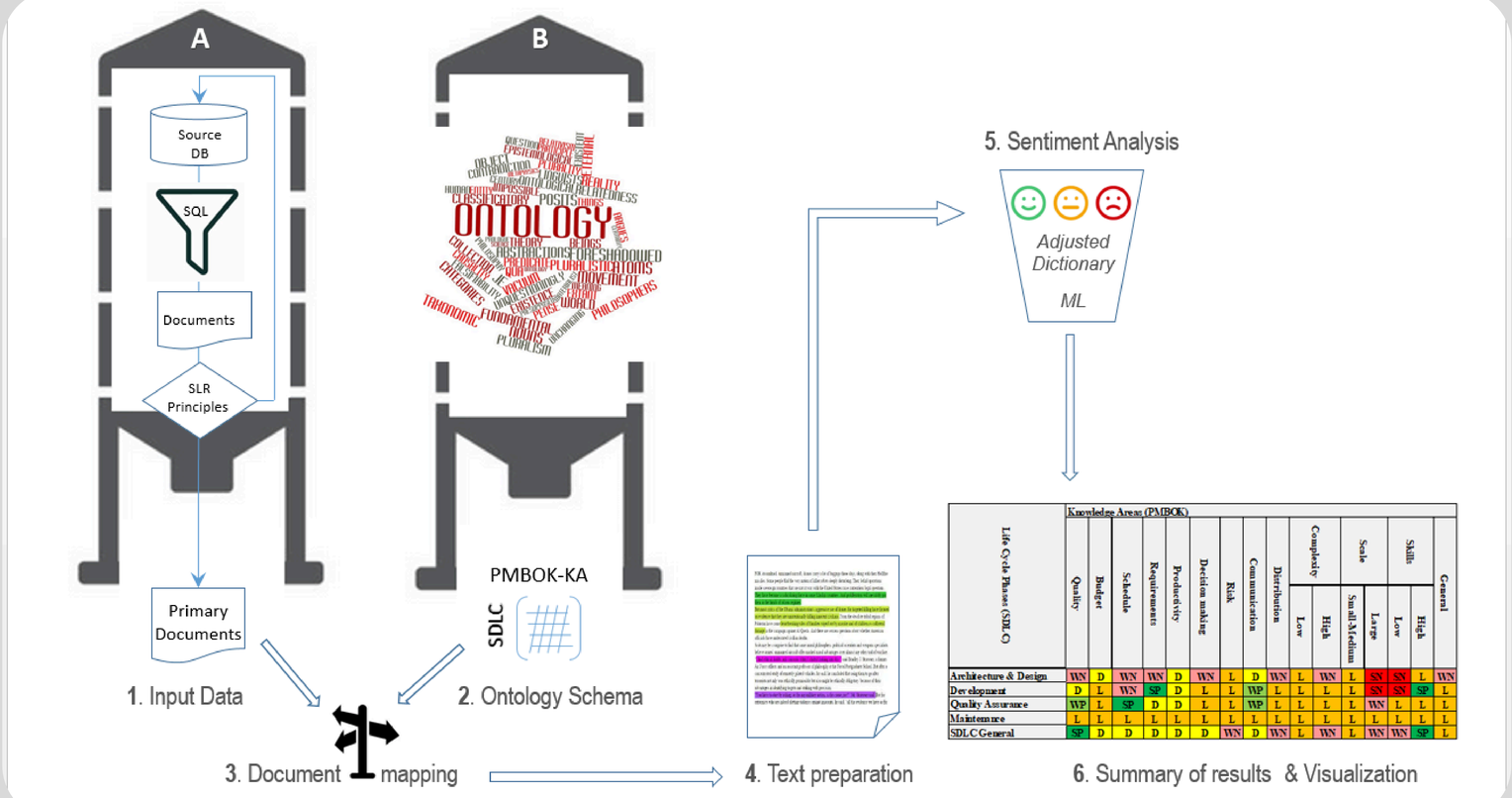
Introduction

A systematic literature review (SLR) is a means of identifying, evaluating, and interpreting all available research relevant to a particular research question, topic area, or phenomenon of interest. Currently, the processes for conducting SLR are primarily manual. Therefore, SLR processes require significant time and resources, are limited in scope, and are exposed to errors and bias. the number of publications and publication rates increase each year, which consequently leads to a greater volume of publications that researchers need to examine during a SLR. The current research represents a first attempt at automating the process of SLR through the integration of tools from the field of machine learning. This is through a structured methodology that facilitates the identification of relevant literature, extraction of sentences expressing a position (i.e., a sentiment), and their evaluation in the context of various components included within our domain ontology. Furthermore, this research offers a unique approach to presenting the ontology of the researched field as a matrix of components, which enables a holistic and integrated representation of the sentiments attitude through a heat map. The proposed methodology also contributes to aligning the field of SLR with the principles of open science, facilitating reproducibility by peers, an aspect that is critical for ensuring the objectivity of scientific research.



Objective

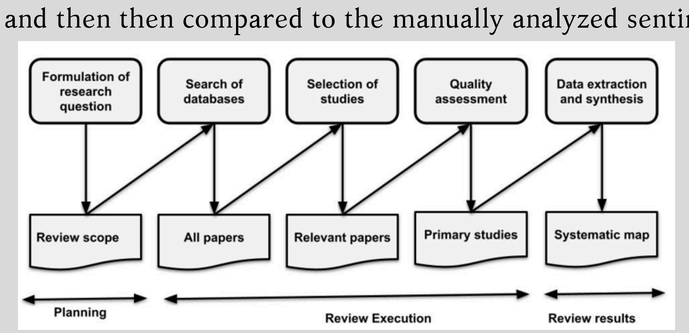
- Delineate an approach that employs automated sentiment analysis and a structured aggregation method, especially in the data synthesis step of the SLR process.
- Examined evidence from software development projects using agile methodology to assess the compatibility of this methodology with the various characteristics of a software project.

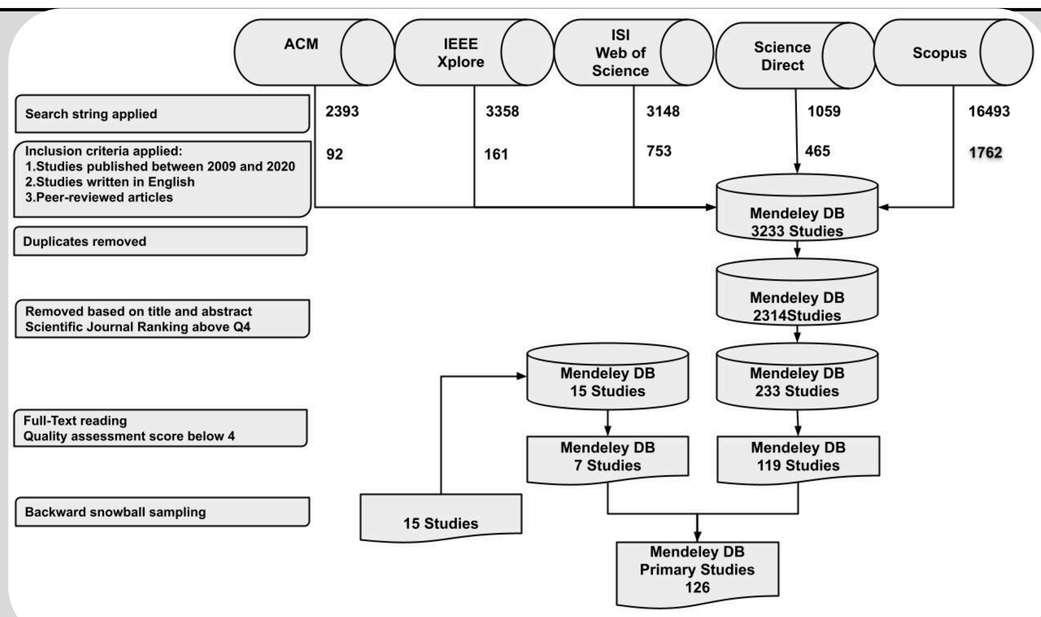
Methodology

The research unfolds in three pivotal stages:

1. Sentiment analysis is manually performed through a Systematic Literature Review process within the agile software development domain. This process creates a labeled dataset, laying the groundwork for the subsequent phase - an experiment.

2. Sentiment analysis is automated through machine learning techniques, with dictionaries and algorithms tailored to the context of agile software development. The accuracy of the machine-generated sentiment evaluated by conventional metrics and then then compared to the manually analyzed sentiments to validate its reliability.





Results

Decision-Making Framework derived from manual sentiment analysis

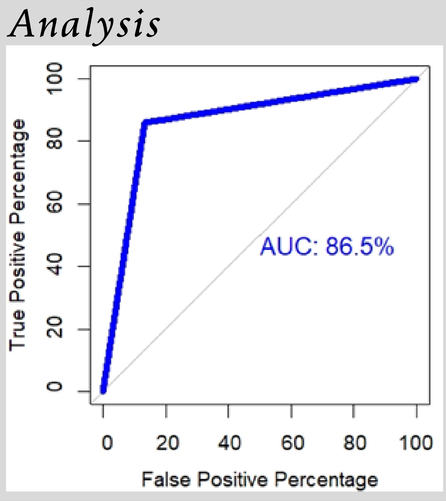
Life Cycle Phases (SDLC)	Knowledge Areas (PMBOK)															
	Quality	Budget	Schedule	Requirements	Productivity	Decision making	Risk	Communication	Distribution	Complexity		Scale		Skills		General
										Low	High	Small-Medium	Large	Low	High	
Architecture & Design	WN	D	WN	WN	WN	WN	L	D	SN	L	SN	L	SN	SN	L	SN
Development	WP	L	SN	SP	D	L	L	WP	L	L	L	L	SN	SN	SP	L
Quality Assurance	WP	L	SN	D	D	L	L	WP	L	L	L	L	WN	L	L	L
Maintenance	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SDLC General	SP	D	D	D	WP	WN	WN	WP	WN	L	WN	L	SN	SN	SP	L

SP Strong Positive consensus
WP Weak Positive consensus
SN Strong Negative consensus
WN Weak Negative consensus
D Disagreement
L Lack of evidence

Decision-Making Framework Derived from Sentiment Analysis through Machine Learning Techniques

Life Cycle Phases (SDLC)	Knowledge Areas (PMBOK)															
	Quality	Budget	Schedule	Requirements	Productivity	Decision making	Risk	Communication	Distribution	Complexity		Scale		Skills		General
										Low	High	Small-Medium	Large	Low	High	
Architecture & Design	WN	D	WN	WN	D	WN	L	D	WN	L	WN	L	SN	SN	L	WN
Development	D	L	WN	SP	D	L	L	WP	L	L	L	L	SN	SN	SP	L
Quality Assurance	WP	L	SP	D	D	L	L	WP	L	L	L	L	WN	L	L	L
Maintenance	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SDLC General	SP	D	D	D	D	D	WN	D	WN	L	WN	L	WN	WN	SP	L

Analysis



Confusion matrix of sentiment classification

		Predicted			
		Positive	Negative	Total	Recall
Actual	Positive	457	58	515	88.74%
	Negative	69	357	426	83.80%
	Total	526	415	941	86.50%
	Precision	86.88%	86.02%	86.50%	-

Life Cycle Phases (SDLC)	Knowledge Areas (PMBOK)															
	Quality	Budget	Schedule	Requirements	Productivity	Decision making	Risk	Communication	Distribution	Complexity		Scale		Skills		General
										Low	High	Small-Medium	Large	Low	High	
Architecture & Design	0	0	0	0.06	0.25	0	L	0.15	0.25	L	0.3	L	0.07	0.1	L	0.4
Development	0.31	L	0.2	0	0	L	L	0.26	L	L	L	L	0	0.29	0.38	L
Quality Assurance	0.06	L	1.60	0.29	0.06	L	L	0	L	L	L	L	0	L	L	L
Maintenance	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SDLC General	0	0.17	0.05	0	0	0.25	0.29	0.04	0.12	L	0	L	0.2	0.07	0.19	L

Impact on findings: None, Low, Medium, Lack of evidence, High, Very High

Conclusions

Project management

- The decision-making framework proposed in this study comprehensively overviews the agile methodology. It shows how the agile methodology performs at each phase of the SDLC and across the PMBOK knowledge areas. It also uncovers the existence or absence of a solid consensus (positive or negative) about the compatibility of the agile methodology with the different SDLC phases.

Systematic Literature review

- Integrating ML techniques, including text mining and sentiment analysis, into SLR methodology is quite feasible. ML techniques have proven a viable substitute for the previous manual sentiment classification procedure.
- Utilizing ML techniques for automated sentiment analysis in secondary studies also facilitates navigating a complex domain ontology, such as the particular domain of agile software development.