Title

Tool-less Human–AI Co-Execution Framework for Scientific Research

Abstract

This study investigates a human–AI co-execution framework designed for scientific research environments without reliance on specialized tools or custom systems. The framework ensures that decision-making authority remains with the human researcher, while AI supports structuring, organization, and validation across research stages. The study demonstrates that such collaboration can improve clarity, reproducibility, and transparency in research processes while maintaining ethical accountability.

Introduction

The increasing use of AI in scientific research has raised concerns regarding unclear decision authority and accountability. Many AI-assisted approaches emphasize automation, which may obscure human responsibility. This study proposes a human-centered co-execution framework in which AI operates strictly as a supportive agent, assisting with structuring and verification while all critical judgments remain with the researcher.

Methods

The research was conducted through a sequential process consisting of topic selection, literature review, research objective definition, methodology design, data collection, data analysis, manuscript structuring, and self-review. At each stage, AI was utilized to organize information, identify structural relationships, and support consistency checks. Final decisions regarding research direction, interpretation, and conclusions were made exclusively by the researcher.

Results

Application of the framework resulted in improved organization of research materials, clearer articulation of research objectives, and enhanced traceability of AI contributions. The structured collaboration reduced cognitive load while preserving transparency in the research workflow.

Discussion

The findings suggest that a tool-less human–AI co-execution framework can effectively support scientific research without compromising human authority or ethical responsibility. This approach offers a practical model for AI-assisted research that prioritizes accountability, reproducibility, and responsible AI use.