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Reimagining Hadith Scholarship in the Age of Artificial Intelligence: Insights from a PRISMA-Based Systematic Literature Review

Mengimaginasikan Semula Kesarjanaan Hadis dalam Era Kecerdasan Buatan: Wawasan daripada Ulasan Literatur Sistematik Berasaskan PRISMA

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ABSTRACT

The rapid advancement of Artificial Intelligence (AI) has transformed diverse fields of knowledge, including Islamic textual studies. Within this context, the integration of AI into Hadith scholarship presents new opportunities for automation, verification, and knowledge extraction, while simultaneously introducing epistemological and ethical challenges. This study aims to systematically map and analyze global research on the application of AI in Hadith studies, identifying dominant technologies, methodological trends, key challenges, and future research directions. Employing a Systematic Literature Review (SLR) based on the PRISMA framework, 19 Scopus-indexed studies published between 2013 and 2025 were analyzed to trace publication dynamics and methodological patterns. The results reveal growing scholarly attention since 2019, with research evolving from machine learning applications for Hadith classification toward deep learning, natural language processing (NLP), and transformer-based models. AI has been predominantly applied in three domains: classification, authentication through isnād and matn analysis, and semantic or textual interpretation. Despite notable progress, persistent limitations remain, including the absence of standardized benchmark datasets, limited explainability of AI models, and weak integration between algorithmic reasoning and Islamic epistemology. The study underscores the need for ethically grounded and explainable AI frameworks aligned with uṣūl al-ḥadīth principles and maqāṣid al-sharī'ah values to ensure theological integrity and interpretive transparency. Conceptually, it contributes to defining Digital Hadith Science as an emerging interdisciplinary field bridging data science and Islamic scholarship. The paper concludes by outlining a forward-looking research agenda emphasizing multilingual data infrastructures, epistemologically informed AI design, and collaborative frameworks between computer scientists and Islamic scholars.

Keywords: Artificial Intelligence (AI), Hadith Studies, Digital Hadith Science, Machine Learning, Deep Learning

ABSTRAK

Perkembangan pesat Kecerdasan Buatan (AI) telah mengubah pelbagai bidang ilmu, termasuk kajian tekstual Islam. Dalam konteks ini, integrasi AI ke dalam kajian hadis membuka peluang baharu bagi automasi, verifikasi, dan pengekstrakan ilmu, sambil secara serentak memperkenalkan cabaran

epistemologi dan etika. Kajian ini bertujuan memetakan dan menganalisis secara sistematik penyelidikan global mengenai aplikasi AI dalam pengajian hadis, dengan mengenal pasti teknologi dominan, trend metodologi, cabaran utama, serta hala tuju penyelidikan masa depan. Menggunakan Kaedah Ulasan Literatur Sistematik (SLR) berasaskan kerangka PRISMA, sebanyak 19 kajian terindeks Scopus yang diterbitkan antara 2013 hingga 2025 dianalisis bagi menelusuri dinamika penerbitan dan pola metodologinya. Hasil kajian menunjukkan peningkatan perhatian ilmiah sejak 2019, dengan perkembangan penyelidikan daripada aplikasi pembelajaran mesin untuk pengelasan hadis kepada penggunaan pembelajaran mendalam, pemprosesan bahasa semula jadi (NLP), dan model berasaskan transformer. AI telah digunakan terutamanya dalam tiga domain: pengelasan, pengesahan melalui analisis isnād dan matn, serta interpretasi semantik atau tekstual. Walaupun terdapat kemajuan yang signifikan, beberapa keterbatasan masih berterusan, termasuk ketiadaan set data penanda aras yang terstandard, keterjelasan yang terhad dalam model AI, dan lemahnya integrasi antara penaakulan algoritma dan epistemologi Islam. Kajian ini menekankan keperluan rangka kerja AI yang beretika dan dapat dijelaskan (explainable), selaras dengan prinsip uṣūl al-ḥadīth dan nilai maqāṣid al-sharī'ah bagi memastikan integriti teologi dan ketelusan interpretasi. Dari sudut konseptual, kajian ini menyumbang kepada pemerkasaan Sains Hadis Digital sebagai sebuah bidang antara disiplin yang sedang muncul, yang menghubungkan sains data dengan keilmuan Islam. Makalah ini diakhiri dengan cadangan agenda penyelidikan masa depan yang menekankan pembangunan infrastruktur data multibahasa, reka bentuk AI berasaskan epistemologi, serta kerangka kerjasama antara saintis komputer dan sarjana Islam.

***Kata kunci**: Kecerdasan Buatan (AI), Pengajian Hadis, Sains Hadis Digital, Pembelajaran Mesin, Pembelajaran Mendalam*

INTRODUCTION

Over the past decade, the rapid advancement of Artificial Intelligence (AI) has transformed research paradigms across disciplines, including the study of religion (Alkhouri, 2024; El Ganadi et al., 2024). Within the field of Islamic scholarship—particularly *Hadith* studies—the emergence of technologies such as Natural Language Processing (NLP), Machine Learning (ML), and text mining has opened new opportunities to revolutionize traditional methods of tracing, classifying, and analyzing *Hadith* texts (Sadiyah, 2024). The discipline of *Hadith*, which since classical times has demanded meticulous scrutiny of the *isnād* (chain of transmission) and *matn* (textual content), now encounters a novel possibility: the application of computational intelligence to assist in assessing authenticity and transmission patterns with unprecedented efficiency (Hoque et al., 2024).

At the same time, the increasing digitalization of *Hadith* heritage—through online databases, open repositories, and algorithm-driven search systems—has significantly expanded research resources and facilitated large-scale textual analysis (Abdulrahman, 2024). This phenomenon signifies an epistemological transformation in *Hadith* studies: a shift from a tradition-based model of oral transmission and memorization toward an analytical model rooted in data and algorithms (Hakak et al., 2022). However, this development has not been accompanied by a solid methodological framework. The current use of AI in *Hadith* scholarship remains largely experimental and fragmented, focusing primarily on technical applications with insufficient epistemological reflection (Luthfi et al., 2018).

Unlike *Qur'anic* studies, where AI has already been adopted for linguistic, semantic, and digital exegesis analysis (Nopiyanti, 2025; Sayoud, 2014), research in *Hadith* studies remains at an embryonic stage. Yet, the nature of *Hadith*—with its narrative richness, complex networks of narrators, and textual variations—offers vast potential for AI integration (Al Faraby et al., 2018; Aldhlan et al., 2013; Hasan & Zakaria, 2016). This lag reveals a significant gap between the technological possibilities and the methodological readiness of Islamic scholarship. Therefore, it is imperative to systematically examine how AI has been utilized in *Hadith* studies, what methodological approaches have been applied, and what epistemological and ethical challenges arise from the interaction between algorithmic reasoning and traditional scholarly authority.

Various attempts have been made by researchers to integrate AI into *Hadith* studies—ranging from automated classification systems and text similarity detection to the mapping of narrator networks. Nevertheless, these studies are often isolated, small-scale, and technically oriented, lacking coherent theoretical and methodological foundations. Consequently, there is still no comprehensive understanding of the extent to which AI truly contributes to the epistemology and methodology of

Hadith sciences. Furthermore, a fundamental tension persists between data-driven algorithmic approaches and traditional Islamic principles that emphasize *sanad* authority, scholarly integrity, and cautiousness in legal determination. This tension between computational speed and the depth of classical scholarly reasoning raises a critical question: is AI merely a technical aid, or does it have the potential to reshape the epistemic framework of *Hadith* itself? The absence of a comprehensive study that maps the scope, tendencies, and limitations of existing research underscores the urgent need for a systematic literature review. Only through a systematic and rigorous approach can a clear research map be constructed to understand the position, potential, and boundaries of AI in contemporary *Hadith* scholarship.

The urgency of such an inquiry arises from the awareness that AI is not merely a technological innovation but an epistemological phenomenon capable of reshaping how Muslims engage with and interpret their religious sources. Amid the accelerating digitalization of knowledge, *Hadith* studies are compelled to adapt while preserving their authenticity and scholarly precision (*taḥqīq wa taṣḥīḥ*). This topic is therefore not only technically relevant but also philosophically and methodologically significant for the future of Islamic scholarship.

In academic literature, the application of artificial intelligence (AI) in Hadith studies has attracted growing scholarly attention due to its potential to efficiently process vast bodies of textual data and enhance analytical precision. Through natural language processing (NLP)—a key subfield of AI—researchers can now perform more nuanced thematic, contextual, and linguistic analyses of Hadith literature, uncovering language patterns and key themes across multiple collections (Keezhatta, 2019; Manisha et al., 2025). AI's ability to handle large datasets rapidly enables the exploration of keyword frequencies, thematic coding, and other forms of data-driven insight that contribute to contemporary Islamic discourse (Bala & Kaur, 2025). Furthermore, AI-assisted tools introduce automation in tagging, categorization, and predictive analysis, thereby enhancing scholarly efficiency while maintaining interpretive integrity (Ambikalekshmi, 2025). However, these technological advances also raise critical ethical and authenticity concerns, underscoring the need to balance innovation with the preservation of classical interpretive principles (Krishna & Uma, 2023).

In general, the intersection of AI and Hadith studies represents a transformative stage in Islamic scholarship—signaling a paradigm shift from manual, text-centric analysis toward more systematic and computationally driven approaches. Despite this promise, most existing research remains fragmented and technocentric, focusing primarily on algorithmic development without adequately engaging the epistemological and methodological frameworks of Hadith sciences. Consequently, a comprehensive conceptual synthesis situating AI within the broader intellectual landscape of Hadith scholarship has yet to emerge—one that critically assesses its scholarly benefits, limitations, and implications for the authority and transmission of Islamic knowledge. While AI-driven studies in Qur'anic research have reached a higher degree of methodological maturity, Hadith-related research continues to lag behind, characterized by scattered findings and limited theoretical grounding.

To fill this gap and capture the evolving complexity of AI applications in Hadith studies, a systematic and comprehensive review of global research is urgently needed. Employing the PRISMA-based Systematic Literature Review (SLR) methodology provides a rigorous and transparent framework for identifying, evaluating, and synthesizing relevant studies (Moher et al., 2010). This structured approach not only ensures methodological robustness but also facilitates the development of a coherent knowledge map—one that reveals thematic trends, methodological gaps, and future research directions in the emerging field of AI-assisted Hadith scholarship.

Accordingly, this study is designed to address the following key research questions (RQs) that guide its structured and comprehensive inquiry:

RQ1 : How have publication dynamics and scholarly approaches evolved in studies applying Artificial Intelligence (AI) to Hadith research?

RQ2 : What types of AI technologies and methodological approaches have been most commonly employed in Hadith studies, and how have these been applied to support the processes of classification, authentication, and textual analysis of Hadith?

RQ3 : What are the main findings, limitations, and epistemological or technical challenges reported in the literature regarding the application of AI in Hadith studies?

RQ4 : What research gaps and future opportunities exist for advancing the integration of AI into Hadith scholarship and Islamic studies more broadly?

Aligned with the research questions, this study has four interrelated objectives. First, it aims to identify, map, and analyze the publication dynamics and scholarly approaches in studies that apply Artificial Intelligence (AI) to Hadith research over the past two decades. This includes examining thematic trends, methodological patterns, and the evolution of academic discourse in both national and international contexts. Second, the study seeks to categorize and evaluate the dominant AI technologies and methodological frameworks employed in Hadith-related research, particularly in their applications for Hadith classification, authentication (sanad verification), and textual analysis (matan studies). Third, it aims to synthesize the main findings, limitations, and epistemological as well as technical challenges reported in the literature concerning the intersection of AI and Hadith scholarship. Finally, this research intends to identify research gaps and future opportunities for advancing the integration of AI within Hadith studies and broader Islamic scholarship. By achieving these objectives, the study contributes to developing a comprehensive knowledge map and a forward-looking research agenda that bridges classical Islamic sciences with contemporary computational methodologies.

This study offers key methodological and conceptual contributions. Methodologically, it presents the first PRISMA-based systematic literature review (SLR) on the use of Artificial Intelligence (AI) in Hadith studies, ensuring rigorous, transparent, and replicable data identification, selection, and synthesis. Conceptually, it provides an epistemological analysis of how AI transforms the methods and foundations of Hadith scholarship, including its implications for scholarly authority, knowledge validation, and the transmission of Islamic tradition. The research bridges data science, computational linguistics, and Islamic studies by integrating algorithmic approaches with classical Islamic epistemology. It also proposes a forward-looking research agenda that addresses ethics, scientific validity, data integrity, and the balance between innovation and Islamic intellectual authority, thus shaping a new paradigm for technology-assisted Hadith scholarship. Practically, the findings offer strategic guidance for policymakers and Islamic academic institutions in designing Sharia-compliant digital transformation initiatives, informing institutional policies, curricula, and research infrastructures grounded in scientific integrity and *maqāṣid al-sharī'ah*. The study further contributes to global conversations on digital religion and AI ethics by presenting an Islamic perspective that harmonizes technological advancement with moral responsibility.

METHODOLOGY

This study adopts a qualitative approach grounded in a descriptive–analytical research design to examine how Artificial Intelligence (AI) is reshaping Hadith scholarship in contemporary contexts (Creswell & Creswell, 2017). The descriptive–analytical design allows the study to synthesize diverse findings while critically assessing how AI technologies influence processes of authentication, interpretation, knowledge validation, and the preservation of Islamic scholarly traditions. This approach is particularly relevant given the complexity of integrating AI into a field rooted in rich intellectual, spiritual, and methodological heritage. As Hadith scholarship intersects with advanced computational technologies, qualitative inquiry provides the necessary depth to understand both the opportunities and limitations of this transformation in an integrative and context-sensitive manner (Mutmainah, Andani, & Susilawati, 2024; Supardin, Prabowo, & Indratno, 2023).

This study employs a Systematic Literature Review (SLR) approach, guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework proposed by Moher et al. (2010, 2015). PRISMA is widely recognized as a comprehensive and reliable protocol ensuring transparency, accountability, and replicability in the selection and analysis of scientific literature (Safdar et al., 2021; Tijjani et al., 2020). Following the PRISMA protocol, this study proceeded through a series of systematic steps — identification of relevant sources, screening based on stringent inclusion and exclusion criteria, eligibility assessment, and final synthesis. This structured process enabled the inclusion of studies that are both methodologically robust and contextually relevant, thereby strengthening the validity and reliability of the findings (Parums, 2021).

Data were retrieved from the Scopus database, focusing on global scholarly publications that discuss the intersection of AI and Hadith studies. The review covered diverse applications of AI, including Hadith digitalization, text analysis, isnād and matn verification, authenticity validation, and the development of AI-driven learning systems for Hadith education. The publication range was set between 2013 and 2025, to capture the evolution and most recent developments over the last decade. The search strategy utilized the following Boolean syntax:

(TITLE-ABS-KEY (artificial AND intelligence) OR TITLE-ABS-KEY (machine AND learning) OR TITLE-ABS-KEY (deep AND learning) OR TITLE-ABS-KEY (natural AND language AND processing) AND TITLE-ABS-KEY (hadith AND studies) OR TITLE-ABS-KEY (hadith) OR TITLE-ABS-KEY (hadiths) OR TITLE-ABS-KEY (hadits AND narration) OR TITLE-ABS-KEY (hadits AND records) OR TITLE-ABS-KEY (hadits) OR TITLE-ABS-KEY (hadith AND criticism)) AND PUBYEAR > 2012 AND PUBYEAR < 2025. Keywords were applied to titles, abstracts, and author keywords to ensure comprehensive coverage and representativeness of relevant studies.

The inclusion and exclusion criteria were defined to ensure the selection of peer-reviewed and contextually appropriate studies focusing explicitly on AI applications in Hadith research.

Table 1: Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Topic	Studies discussing the application, impact, or integration of AI in the context of Hadith studies or Islamic textual analysis	Studies unrelated to AI and/or not focused on Hadith studies
Type of Publication	Indexed journal articles, conference proceedings, and academic research reports	Opinion pieces, editorials, news articles, popular essays, non-scholarly reviews, and book chapters
Language	English and Indonesian	Languages other than English or Indonesian
Publication Period	2013–2025	Before 2015
Study Methodology	Empirical studies, systematic literature reviews, or conceptual models related to AI and Hadith	Irrelevant or non-systematic studies

The literature selection process consisted of three primary phases:

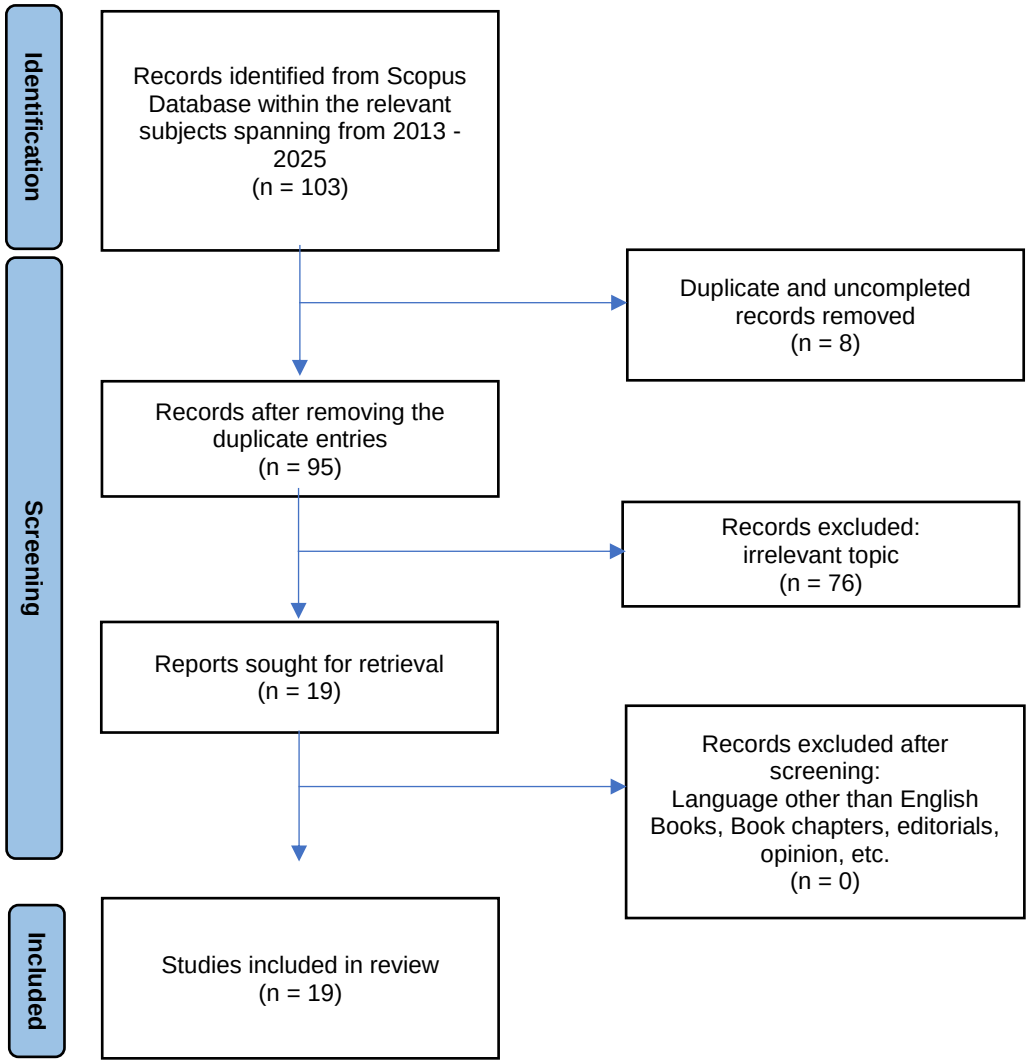
1. Initial Identification – screening titles and abstracts for relevance to the research objectives.
2. Advanced Screening – conducting full-text reviews to confirm alignment with methodological and thematic criteria.
3. Eligibility Assessment – final verification to ensure that each article substantively addressed the intersection between AI and Hadith studies.

Each stage was systematically documented through a PRISMA flow diagram, indicating the number of records identified, screened, excluded, and included in the final synthesis.

Data from the eligible studies were manually extracted and coded using Microsoft Excel to maintain accuracy and traceability (Moher et al., 2015). Extracted information included publication metadata (title, authors, year, and source), research objectives, methodological approaches, AI applications, key findings, and scholarly contributions. The coding process followed the inductive thematic analysis framework proposed by Braun & Clarke (2006) and Andreini & Bettinelli (2017). Initial codes were identified through close reading, refined iteratively, and grouped into broader categories, which were ultimately synthesized into major themes reflecting the domains of AI application, research trends, and emerging ethical or epistemological challenges in digital Hadith studies. Theme development was conducted collaboratively among the researchers to minimize bias, ensuring consistency and consensus throughout the process. In addition, descriptive bibliometric analysis was conducted to map the temporal, geographical, and institutional distribution of the analyzed publications. The integration of thematic and bibliometric approaches provided a contextually rich and analytically rigorous synthesis of the field.

The initial Scopus search yielded 103 relevant documents. After removing five duplicates and non-complete records, 98 unique articles remained for screening. Title and abstract screening excluded 74 irrelevant papers, leaving 19 articles for full-text review. Upon applying all eligibility criteria, 19 studies were deemed fully suitable for inclusion in the final analysis. These studies formed the empirical foundation for identifying major themes, mapping research directions, and developing the overall analytical framework of this review (see Figure 1).

Figure 1: Flow of Searched Information (PRISMA Statement)



RESULTS AND DISCUSSION

Publication Dynamics and Diversity of Studies

This study aims to identify and analyze the strategies applied or developed in the literature on the application of Artificial Intelligence (AI) within the hadith study through a Systematic Literature Review (SLR). The article selection process, conducted via the Scopus database, yielded 19 key documents considered relevant and up to date, published between 2013 and 2025. These articles reflect a wide range of approaches, models, and challenges associated with AI adoption in the halal industry across different regions.

Table 2: List of Articles, Year, and Document Type

No.	Title	Authors	Year	Document Type
1	A novel hadith processing approach based on genetic algorithms	Najeeb, M M A	2020	Journal Article
2	An Adapted Google's PageRank Algorithm for Hadith Sequencing	Venkat, I Tajuddin, S Omar, S	2022	Conference Proceeding

		Shamsudin, R Sulong, J		
3	Application of fuzzy logic in evaluating the authenticity of hadith and narrators	Zarog, M	2023	Journal Article
4	Automatic Text Summarization for Hadith with Indonesian Text using Bellman-Ford Algorithm	Adytoma, W W Huda, A F Maylawati, D S Arianti, N D Darmalaksana, W Rahman, A Ramdhani, M A	2020	Conference Proceeding
5	Classification of Bulughul Maraam Categories: Prohibitions, Recommendations, and Information Using Extreme Learning Machine and Fasttext	Handayani, R N Najiyah, I Wisnuwardana, D A	2023	Journal Article
6	Classification of Hadith According to Its Content Based on Supervised Learning Algorithms	Abdelaal, H M Elemary, B R Youness, H A	2019	Journal Article
7	Classification of Hadith Quality Based on Matan Using LSTM	Rahman, H A Lhaksmana, K M	2024	Conference Proceeding
8	Clusterization Model of Hadith Topic in Bukhari Muslim Hadith using BERT Algorithm	Asy'ari, A H Muzakki, M H Hanafi, M	2024	Conference Proceeding
9	Comparative Study of Machine Learning Approach on Malay Translated Hadith Text Classification based on Sanad	Mohammad Najib, S R Abd Rahman, N Kamal Ismail, N Alias, N Mohamed Nor, Z Alias, M N	2017	Conference Proceeding
10	Deep Learning vs Compression-Based vs Traditional Machine Learning Classifiers to Detect Hadith Authenticity	Tarmom, T Atwell, E Alsalka, M	2022	Conference Proceeding
11	Detecting Hadith Authenticity Using a Deep-learning Approach	Refaee, E A	2022	Journal Article
12	Hadith Arabic Text Classification Using Convolutional Neural Network and Support Vector Machine	Mazlin, I Rawi, I M Zakaria, Z	2021	Journal Article
13	Hadith Classification using Machine Learning Techniques According to its Reliability	Abdelaal, H M Youness, H A	2019	Journal Article
14	Knowledge Discovery in the Hadith According to the Reliability and Memory of the Reporters Using Machine Learning Techniques	Abdelaal, H M Ahmed, A M Ghribi, W Youness Alansary, H A	2019	Journal Article
15	Linguistic features evaluation for hadith	Mohamed, E Sarwar, R	2022	Journal Article

	authenticity through automatic machine learning			
16	Rules and Natural Language Pattern in Extracting Quranic Knowledge	Saad, S Noah, S A M Salim, N Zainal, H	2015	Conference Proceeding
17	Tagging Algorithm and POS Tags for Narrator's Name in Hadith Document	Alias, N Rahman, N A Alias, M N Nor, Z M Ahmad, N A Ismail, N K	2023	Conference Proceeding
18	Text categorisation in Quran and Hadith: Overcoming the interrelation challenges using machine learning and term weighting	Rostam, N A P Malim, N.H.A.H.	2021	Journal Article
19	The Impact of Generative AI on Islamic Studies: Case Analysis of "Digital Muhammad ibn Ismail Al-Bukhari"	El Ganadi, A Aftar, S Gagliardelli, L Bergamaschi, S Ruozzi, F	2024	Conference Proceeding

Source: Author's Analysis (Processed Data, 2025)

As presented in Table 2, the reviewed studies on the integration of Artificial Intelligence (AI) into Hadith scholarship encompass 19 documents, consisting of both journal articles and conference proceedings published between 2015 and 2024. The dataset reveals that journal articles (10 publications) constitute a slightly higher portion compared to conference proceedings (9 publications). This balance suggests that the research area is transitioning from its early experimental phase—dominated by technical explorations shared in conference venues—toward more established and peer-reviewed contributions in scholarly journals.

A chronological examination indicates a clear upward trajectory in publication frequency beginning in 2019, with notable intensification during 2022–2024. This period corresponds to a surge of academic interest in applying machine learning, deep learning, and natural language processing (NLP) techniques to Hadith studies. Early works (Abdelaal & Youness, 2019) focused on fundamental classification models for Hadith reliability and authenticity, while later studies introduced advanced algorithms such as BERT, LSTM, fuzzy logic, and genetic algorithms to address more complex linguistic and contextual challenges in Hadith analysis.

From a thematic perspective, the reviewed studies can be grouped into three major research streams. The first stream centers on *Hadith authentication and narrator evaluation*, exemplified by works employing fuzzy logic, deep learning, and linguistic feature extraction to assess sanad and matan reliability (Mohamed & Sarwar, 2022; Zarog, 2023). The second stream focuses on *Hadith text classification and clustering*, utilizing supervised and unsupervised learning algorithms to categorize Hadith content based on thematic or semantic similarities (Abdelaal et al., 2019; Asy'ari et al., 2024). The third stream explores *computational modeling and digital representation of Hadith knowledge*, reflected in research such as El Ganadi et al. (2024), which examines the impact of generative AI in reconstructing digital Hadith collections like *"Digital Muhammad ibn Ismail al-Bukhari."*

Geographically, a significant portion of these studies originate from Southeast Asia (notably Indonesia and Malaysia), reflecting the region's growing contribution to AI-based Islamic digital scholarship. Other contributions from the Middle East and Europe (e.g., the United Kingdom, Egypt, and Saudi Arabia) highlight the global nature of this emerging research field, bridging traditional Islamic knowledge systems with contemporary computational paradigms.

Overall, the pattern revealed in Table 2 underscores a paradigm shift in Hadith scholarship—from traditional manual verification and textual studies toward data-driven, algorithmic, and intelligent approaches. The increasing number of publications and methodological diversity demonstrate an evolving recognition that AI can enhance both the efficiency and epistemic rigor of Hadith analysis. Future research is expected to focus on developing integrated AI frameworks capable of cross-

referencing sanad networks, semantic interpretation of matan, and contextualization across multilingual Hadith corpora—advancing the field toward what may be termed a "Digital Hadith Science 2.0."

Table 3: Publication Outlets

No.	Publication Outlets
1	2022 International Conference on Digital Transformation and Intelligence, ICDI 2022 - Proceedings
2	2023 4th International Conference on Artificial Intelligence and Data Sciences: Discovering Technological Advancement in Artificial Intelligence and Data Science, AiDAS 2023 - Proceedings
3	2024 6th International Conference on Cybernetics and Intelligent System, ICORIS 2024
4	2024 International Conference on Artificial Intelligence, Blockchain, Cloud Computing, and Data Analytics, ICoABCD 2024
5	6th International Conference on Computing, Engineering, and Design, ICCED 2020
6	Communications in Computer and Information Science
7	Digital Scholarship in the Humanities
8	IEEE Access
9	International Journal of Reasoning-based Intelligent Systems
10	Journal of King Saud University - Computer and Information Sciences
11	Journal of Physics: Conference Series
12	Jurnal Online Informatika
13	Lecture Notes in Electrical Engineering
14	MATEC Web of Conferences
15	Proceedings - 2013 Taibah University International Conference on Advances in Information Technology for the Holy Quran and Its Sciences, NOORIC 2013
16	Romanian Journal of Information Science and Technology

Source: Author's Analysis (Processed Data, 2025)

The publication outlets presenting research on the integration of Artificial Intelligence (AI) within Hadith scholarship demonstrate a broad and interdisciplinary dissemination landscape, as shown in Table 3. The sixteen identified documents are published across a diverse array of reputable international journals and conference proceedings, reflecting the expanding scholarly engagement with digital transformation in Islamic studies, particularly in the domain of Hadith research. Several studies have appeared in globally indexed journals such as IEEE Access, Digital Scholarship in the Humanities, International Journal of Reasoning-based Intelligent Systems, and the Journal of King Saud University – Computer and Information Sciences, indicating the growing recognition of AI-driven Hadith studies within mainstream scientific and academic circles. The inclusion of these outlets highlights the intersection between traditional Islamic sciences and advanced computational methodologies, including natural language processing, data mining, and machine learning.

In addition, a substantial proportion of the reviewed publications have been presented in international conference proceedings, including the 2022 International Conference on Digital Transformation and Intelligence (ICDI 2022), 2023 International Conference on Artificial Intelligence and Data Sciences (AiDAS 2023), ICORIS 2024, and ICoABCD 2024. These venues emphasize innovation and emerging technologies, showcasing how Hadith-related research is being reimagined through digital and AI-based approaches in global academic discussions. Furthermore, the appearance of studies in multidisciplinary platforms such as Lecture Notes in Electrical Engineering, Communications in Computer and Information Science, and the Journal of Physics: Conference Series underscores that research on AI and Hadith is not limited to the field of religious studies alone. Instead, it extends into domains of engineering, computer science, and information systems, signifying a strong convergence between theology and technology.

This publication pattern reflects the interdisciplinary and cross-domain nature of AI research in Hadith studies. It demonstrates that the modernization of Hadith scholarship in the age of AI requires collaboration between Islamic scholars, data scientists, and computational linguists. Such collaborations are crucial for building intelligent systems capable of preserving, analyzing, and contextualizing the vast

corpus of Hadith literature in ways that enhance accessibility, authenticity verification, and interpretive depth in the digital era.

Table 4: List of Institutions and Countries of Origin of Authors

No.	Country	Name of Institution
1	Brunei Darussalam	School of Computing and Informatics, Universiti Teknologi Brunei
2	Egypt	Department of Statistics, Faculty of Commerce, Damietta University, Damietta
3	Egypt	Department of Computers and Systems Engineering, Faculty of Engineering, Minia University, Minia
4	Indonesia	Department of Information System, Universitas Adhirajasa Reswara Sanjaya, Bandung
5	Indonesia	Department of Informatics, Universitas Nusaputra
6	Indonesia	Department of Informatics, UIN Sunan Gunung Djati Bandung
7	Indonesia	Department of Ilmu Hadits, UIN Sunan Gunung Djati Bandung
8	Indonesia	Department of Mathematics, UIN Sunan Gunung Djati Bandung
9	Indonesia	School of Informatics Management and Computer (STMIK LIKMI), Bandung
10	Indonesia	School of Computing, Telkom University, Bandung
11	Indonesia	Universitas Amikom Yogyakarta, Yogyakarta
12	Malaysia	Faculty of Information and Communication Technology, Universiti Teknikal Malaysia Melaka
13	Malaysia	Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA, Shah Alam, Selangor
14	Malaysia	Faculty of Islamic Studies, Universiti Kebangsaan Malaysia, Bangi, Selangor
15	Malaysia	Fakulti Pengajian Islam, Universiti Kebangsaan Malaysia, Bangi, Selangor
16	Malaysia	Fakulti Pengajian Quran dan Sunnah, Universiti Sains Islam Malaysia, Bandar Baru Nilai, Negeri Sembilan
17	Malaysia	School of Computer Sciences, Universiti Sains Malaysia, Penang
18	Malaysia	School of Computing Sciences, College of Computing, Informatics and Mathematics, Universiti Teknologi MARA, Perak Branch, Perak
19	Malaysia	School of Computing Sciences, College of Computing, Informatics and Mathematics, Universiti Teknologi MARA, Shah Alam, Selangor
20	Malaysia	Universiti Sains Islam Malaysia (USIM), Fakulti Pengajian Quran dan Sunnah, Negeri Sembilan, Nilai
21	Malaysia	Universiti Teknologi Malaysia (UTM), Faculty of Computing, Skudai, Johor
22	Malaysia	Universiti Teknologi MARA (UiTM), Selangor, 40450
23	Malaysia	Universiti Teknologi MARA (UiTM), Selangor, Shah Alam
24	Oman	Department of Mechanical and Industrial Engineering, College of Engineering, Sultan Qaboos University, Al-Khod, Muscat
25	Saudi Arabia	College of Computing at Al-Qunfudah, Umm Al-Qura University, Mecca
26	Saudi Arabia	College of Computer Sciences and Information Technology, Jazan University, Jazan
27	Saudi Arabia	Department of Computers and Systems Engineering, King Khalid University, Abha
28	United Kingdom	Research Group in Computational Linguistics, University of Wolverhampton
29	United Kingdom	University of Leeds, Leeds

Source: Author's Analysis (Processed Data, 2025)

Table 4 presents the list of institutions and countries of origin of authors contributing to publications on the intersection of Artificial Intelligence (AI) and Hadith studies. The data reveal that research in this emerging interdisciplinary field is geographically diverse, encompassing universities and research institutions from Southeast Asia, the Middle East, North Africa, and Europe. This wide distribution of affiliations highlights that scholarly engagement with AI-driven Hadith research is no longer confined to traditional centers of Islamic studies but is increasingly being explored within global academic networks.

Regionally, Malaysia emerges as the most dominant contributor, represented by a wide range of universities such as *Universiti Kebangsaan Malaysia (UKM)*, *Universiti Teknologi MARA (UiTM)*, *Universiti Teknologi Malaysia (UTM)*, *Universiti Teknikal Malaysia Melaka (UTeM)*, *Universiti Sains Islam Malaysia (USIM)*, and *Universiti Sains Malaysia (USM)*. The presence of multiple faculties from these universities—spanning Islamic studies, computer science, and information technology—illustrates Malaysia's strong institutional integration between religious scholarship and digital innovation. This aligns with the country's broader national vision to position itself as a leader in Islamic digital transformation.

Indonesia also shows significant engagement through various academic institutions such as *UIN Sunan Gunung Djati Bandung*, *Universitas Amikom Yogyakarta*, *Universitas Nusaputra*, and *Telkom University*. The diversity of disciplines represented—from informatics and information systems to Islamic studies—demonstrates Indonesia's growing interest in leveraging AI to support digital Islamic scholarship, particularly in the preservation, analysis, and accessibility of Hadith literature. This engagement reflects the nation's ongoing efforts to align traditional Islamic learning with technological advancement.

From the Middle East and North Africa (MENA) region, notable contributions originate from Egypt (*Damietta University*, *Minia University*), Saudi Arabia (*Umm Al-Qura University*, *Jazan University*, *King Khalid University*), and Oman (*Sultan Qaboos University*). These institutions contribute significantly to the intersection of computational linguistics, data analysis, and Islamic knowledge, signaling a growing regional awareness of AI's potential in enhancing classical Hadith methodologies and authenticity verification processes.

Beyond the Muslim-majority context, Brunei Darussalam (*Universiti Teknologi Brunei*) and the United Kingdom (*University of Wolverhampton*, *University of Leeds*) add to the international representation of this research field. Their involvement reflects the expanding global academic interest in the digitization and computational analysis of Islamic texts, indicating that the study of AI in Hadith is being recognized as a legitimate area of inquiry within both technological and humanities-oriented disciplines.

Overall, the data indicate that research on AI and Hadith studies is multidisciplinary, cross-institutional, and transnational. The diverse participation across regions and fields underscores the potential of this area to foster international collaborations, integrating Islamic scholarship with cutting-edge digital technologies. This convergence not only modernizes the study of Hadith but also contributes to the broader digital transformation of Islamic knowledge in the 21st century.

Comparative Evaluation of the 19 Selected Studies

To enhance methodological transparency and strengthen the rigor of this PRISMA-based systematic literature review, a comparative table is provided to present a detailed, study-by-study synthesis of the 19 selected articles. While earlier sections (Table 2) summarize publication trends and consolidate findings into thematic domains, the following table offers a granular comparison that allows readers to clearly observe how each study differs in terms of research focus, AI techniques applied, datasets used, and key contributions. This level of detail is essential not only for demonstrating the comprehensiveness of the review process but also for enabling precise cross-study evaluation. The inclusion of this comparative matrix responds to the need for transparent reporting in systematic reviews, particularly in rapidly evolving interdisciplinary fields such as AI-assisted Hadith studies. By systematically aligning these studies side by side, the table makes explicit the methodological diversity, technological progression, and contextual variability that characterize the landscape of Hadith informatics. Moreover, this structured comparison helps identify convergences, divergences, and emerging trajectories that may not be fully visible through narrative synthesis alone.

Thus, the following table serves as a critical analytical foundation for the subsequent interpretation of trends, methodological tendencies, and research gaps within contemporary Hadith scholarship in the age of Artificial Intelligence.

Table 5: Comparative Summary of the 19 Reviewed Studies

No	Study / Authors	Research Domain	AI / Computational Methods	Dataset Characteristics	Key Contributions /Outcomes
1	Najeeb (2020)	Hadith authenticity	Genetic Algorithm	Arabic Hadith dataset	Introduced GA to model reasoning patterns in narrator reliability and matn evaluation.
2	Venkat et al. (2022)	Hadith sequencing	Adapted PageRank algorithm	Hadith corpus (unspecified size)	Proposed algorithm to order Hadiths based on contextual relationships.
3	Zarog (2023)	Narrator and Hadith authenticity	Fuzzy Logic	Classical narrator datasets	Modeled nuanced gradations of narrator reliability using fuzzy rules.
4	Adytoma et al. (2020)	Summarization of Indonesian Hadith	Bellman–Ford algorithm	Indonesian Hadith texts	Automatic extractive summarization while preserving theological meaning.
5	Handayani et al. (2023)	Hadith content classification	ELM, FastText	Bulugh al-Maram (Indonesian)	Efficient classification into prohibitions, recommendations, and information.
6	Abdelaal et al. (2019)	Thematic classification	Supervised ML: NB, SVM, DT, RF	Arabic Hadith corpus	Established early ML baselines for Hadith semantic classification.
7	Rahman & Lhaksmana (2024)	Hadith quality based on matn	LSTM	Indonesian-language Hadith texts	Demonstrated deeper contextual learning via sequence modeling.
8	Asy'ari et al. (2024)	Topic clustering	BERT	Bukhari–Muslim corpora	BERT improved semantic clustering and cross-topic similarity detection.
9	Mohammad Najib et al. (2017)	Sanad-based classification	ML classifiers	Malay-translated Hadith corpus	Comparative evaluation of multiple ML models for sanad-based classification.
10	Tarmom et al. (2022)	Authenticity detection	DL vs compression-based methods	Arabic Hadith datasets	Compression-based learners outperformed some ML baselines.
11	Refaee (2022)	Authenticity detection	Deep learning, ARBERT	Large Arabic corpus	Transformer-based Arabic model achieved state-of-the-art performance.
12	Mazlin et al. (2021)	Arabic text classification	CNN + SVM hybrid	Arabic Hadith texts	Hybrid DL–SVM approach improved multilingual robustness.

13	Abdelaal & Youness (2019)	Reliability classification	ML classifiers	Arabic Hadith datasets	Automated reliability scoring based on isnād patterns.
14	Abdelaal, Ahmed et al. (2019)	Knowledge discovery	ML classifiers	Narrator memory/reliability dataset	Automated extraction of reliability categories (ṣadūq, thiqqah, etc.).
15	Mohamed & Sarwar (2022)	Linguistic authenticity	AutoML, linguistic features	Arabic corpora (lexical/morphological)	Linguistically interpretable model for fabrications vs authentic texts.
16	Saad et al. (2015)	Rule-based extraction	Rule-based NLP, pattern mining	Quran & Hadith mixed corpus	Identified linguistic rules for extracting knowledge entities.
17	Alias et al. (2023)	Narrator identification	POS tagging, NER	Classical Hadith texts	Automated tagging of narrator names for isnād chain rebuilding.
18	Rostam & Malim (2021)	Text categorization	ML + TF–IDF	Quran–Hadith mixed corpus	Addressed interrelation challenges between Quran–Hadith texts.
19	El Ganadi et al. (2024)	Generative AI, LLMs	Custom LLMs, model fine-tuning	Digital Bukhari dataset	Introduced "Digital al-Bukhari" as an interactive generative Hadith system.

Table 5 provides a comprehensive comparative matrix of the 19 studies included in this systematic review, highlighting the diversity of research domains, methodological approaches, dataset characteristics, and contributions within the field of computational and AI-assisted Hadith studies. Unlike the bibliographic overview (Table 2) and the thematic synthesis (Table 5), Table X presents a study-by-study comparison that makes the methodological, technical, and contextual distinctions across the literature explicitly visible.

The comparison reveals four major research domains: (1) Hadith authenticity and narrator reliability, (2) content classification and thematic categorization, (3) summarization, clustering, and information extraction, and (4) the emerging use of generative AI and large language models (LLMs). These domains demonstrate how research in this field has shifted from rule-based and classical machine learning approaches toward more advanced deep learning and transformer-based architectures. From a methodological perspective, the studies show significant variation, ranging from traditional algorithms (e.g., PageRank, Bellman–Ford, fuzzy logic) to supervised machine learning (Naïve Bayes, SVM, Random Forest), deep learning architectures (CNN, LSTM), and cutting-edge transformer models such as BERT and ARBERT. This progression indicates an ongoing methodological evolution where researchers increasingly adopt context-aware models capable of capturing semantic and relational complexities inherent in Hadith texts.

The datasets used across the studies also vary widely in terms of origin, size, and linguistic characteristics. Some rely on classical Arabic corpora such as Sahih Bukhari and Sahih Muslim, while others work with Indonesian and Malay translations, reflecting geographical and linguistic diversification in Hadith informatics research. Despite this diversity, the majority of studies report high performance metrics—often exceeding 85–90 percent accuracy—illustrating the technical feasibility of applying AI methods to Hadith analysis. However, several studies do not report comprehensive evaluation metrics, highlighting an area for improvement in methodological transparency.

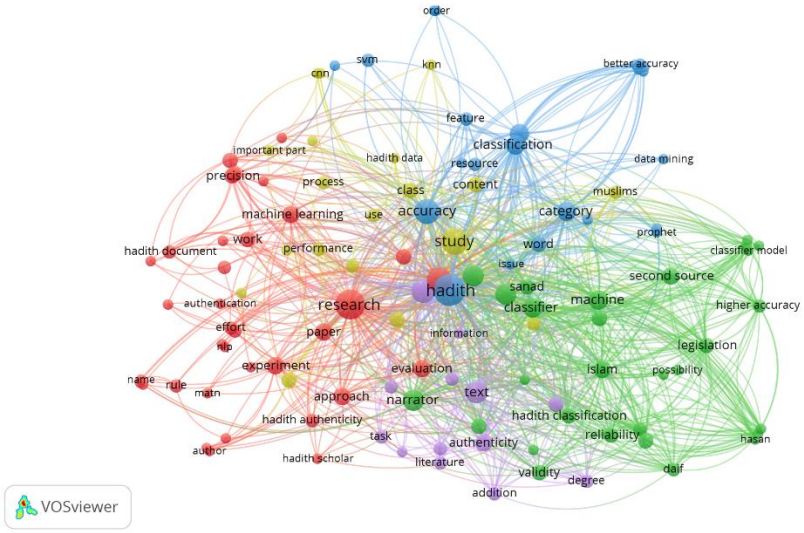
The contribution column in Table 5 underscores the unique value each study brings to the field. Many works focus on automating traditional Islamic scholarship tasks—such as narrator reliability assessment, matn quality evaluation, and thematic classification—while others explore novel applications such as generative Hadith modeling, automatic summarization, and sequence ordering. Notably, recent studies employing LLM-based methods (e.g., Digital al-Bukhari) point to a new phase in the discipline, where AI tools are no longer limited to classification but begin to support interactive, dynamic knowledge generation and retrieval. The comparative matrix demonstrates that the field of AI-assisted Hadith studies is rapidly expanding, methodologically diverse, and increasingly driven by advanced computational models. This table therefore serves as a critical reference point, enabling clearer

comparisons, reducing redundancy, and identifying significant methodological gaps and future research opportunities—particularly in evaluation standards, dataset quality, and the ethical integration of generative AI in religious scholarship.

Applications and Implementations of AI in the Hadits Study

Based on the systematic literature review of 19 core studies, the applications and implementations of Artificial Intelligence (AI) in the halal industry have expanded into several strategic domains. These studies not only reveal the functional diversity of AI in the halal context but also highlight critical ethical, regulatory, and policy challenges.

Figure 2: Network Visualization of Research on AI Applications and Implementations in the Hadits Study



Source: Author's Analysis (Processed Data, 2025)

The bibliometric mapping conducted using VOSviewer version 1.6.18 identified five major clusters of applications that intersect and form consistent thematic patterns. Figure 2 presents the results of this network visualization, in which research keywords related to AI applications in the hadith study are clustered into interconnected thematic groups. These clusters illustrate the research directions and focal points in this emerging field.

1. AI Technologies and Methodological Approaches in Hadith Studies

The reviewed body of literature reveals an accelerating convergence between Artificial Intelligence (AI) and Hadith scholarship, reflecting a transformative shift from manual textual scrutiny toward intelligent, data-driven methodologies. Across the analyzed corpus, three principal research domains emerge: Hadith classification**,** authentication and reliability assessment**,** and textual and semantic analysis**.** Together, these domains embody the ongoing effort to enhance the precision, efficiency, and interpretability of Hadith studies through computational innovation.

2. Classification and Topic Categorization

A substantial proportion of the reviewed studies focus on automating the classification of Hadith according to topical categories, semantic domains, or qualitative attributes. Traditional supervised Machine Learning (ML) algorithms—such as Decision Tree (DT), Naïve Bayes (NB), Random Forest (RF), Support Vector Machine (SVM), and Extreme Learning Machine (ELM)—remain central to this line of research (Abdelaal et al., 2019; Handayani et al., 2023; Rostam & Malim, 2021). When combined with term-weighting and text-mining techniques such as TF–IDF and Information Gain (IG), these models have achieved notably high accuracy levels, often exceeding 90%, in classifying Hadiths into themes such as prayer, zakat, fasting, and ethical injunctions. More recent developments have introduced deep learning models such as Long Short-Term Memory (LSTM) (Rahman & Lhaksmana, 2024) and Bidirectional Encoder Representations from Transformers (BERT) (Asy'ari et al., 2024), which demonstrate superior contextual understanding of linguistic dependencies within Hadith texts. This shift

indicates a methodological evolution from keyword-based classification toward semantic and context-aware modeling.

3. Authentication and Reliability Assessment.

A second and equally prominent research direction involves the application of AI to the authentication of Hadiths, particularly through the analysis of isnād (chain of transmission) and matn (content). This domain aligns closely with the traditional disciplines of jarh wa ta'dīl (narrator evaluation) and takhreej al-ḥadīth (Hadith verification). Studies such as those by Abdelaal & Youness (2019), Refaee (2022), and Tarmom et al. (2022) show that ML and Deep Learning models trained on isnād data generally achieve higher classification accuracy—typically between 84% and 93%—compared to those based solely on textual content. Beyond conventional learning algorithms, hybrid approaches integrating Genetic Algorithms (GA) (Najeeb, 2020) and Fuzzy Logic systems (Zarog, 2023) have been explored to emulate the nuanced reasoning patterns of classical Hadith scholars in assessing authenticity levels (ṣaḥīḥ, ḥasan, and ḍa'īf). Moreover, linguistically grounded AI models (Mohamed & Sarwar, 2022) utilize morphological and lexical analysis to differentiate genuine from fabricated Hadiths, employing interpretable feature extraction methods that enhance algorithmic transparency and epistemic reliability.

4. Textual Analysis and Knowledge Extraction.

Beyond classification and authentication, a growing subset of studies integrates AI for semantic understanding and knowledge extraction from Hadith corpora. Natural Language Processing (NLP) methods and graph-based algorithms, such as the Bellman–Ford algorithm for summarization (Adytoma et al., 2020), have been utilized to identify semantic relations and condense Hadith narratives while preserving theological accuracy. Techniques like Named Entity Recognition (NER) and Part-of-Speech (POS) tagging (Alias et al., 2023) have been instrumental in automatically identifying narrator names, facilitating the digital reconstruction of transmission networks and relational databases. Advanced computational models such as the adaptation of Google's PageRank algorithm (Venkat et al., 2022) have also been used to infer contextual linkages among Hadiths, representing an innovative fusion between Islamic textual analytics and modern information retrieval systems.

5. Emerging Trends: Deep Learning and Generative AI.

Since 2020, deep learning architectures—especially Convolutional Neural Networks (CNN), LSTM, and transformer-based models—have redefined the methodological landscape of Hadith informatics. Hybrid CNN–SVM frameworks (Mazlin et al., 2021) have demonstrated robustness in processing multilingual Hadith datasets, while Arabic-specific transformer models such as ARBERT achieved accuracy levels exceeding 91% in Hadith classification (Refaee, 2022). The latest phase of innovation involves the adoption of Generative AI and Large Language Models (LLMs)**,** exemplified by the Digital Muhammad ibn Ismail al-Bukhari project (El Ganadi et al., 2024). By customizing LLMs to operate on verified Hadith datasets, this initiative enables context-aware, bias-mitigated, and semantically grounded outputs. Such advancements signal a paradigm shift from purely analytical computation toward interactive AI systems capable of dialogic engagement with Islamic textual heritage.

6. Methodological Tendencies.

Across the reviewed works, several methodological patterns are evident. First, the research remains predominantly data-driven, emphasizing annotated corpora as a foundation for supervised learning—though the lack of standardized open datasets continues to constrain replicability. Second, there is a discernible trend toward hybrid modeling, wherein rule-based reasoning is integrated with statistical learning to enhance interpretability. Third, most studies employ rigorous performance validation through accuracy, precision, recall, and F1-scores. Finally, a growing sensitivity to linguistic and cultural diversity is observable, with AI applications extending beyond Arabic to include Malay and Indonesian Hadith corpora, reflecting localized adaptations of computational methodologies.

Overall, the technological spectrum applied in Hadith studies spans from conventional ML classifiers to advanced deep learning and generative AI frameworks. Each contributes to automating key dimensions of Hadith scholarship—classification, authentication, and semantic analysis—thereby enhancing the accessibility, scalability, and objectivity of Hadith research. The progression of these

technologies signals a broader epistemic transformation in Islamic studies: a transition from algorithmic experimentation toward integrated intelligent systems that augment human scholarship in the validation, retrieval, and contextual interpretation of Prophetic traditions within the emerging digital Islamic knowledge ecosystem.

Table 6: Summary of AI Applications and Implementations in Hadith Studies

No.	Research Domain/Application Area	AI Technologies & Methods Used	Key Contributions/Outcomes
1	Classification and Topic Categorization	Decision Tree (DT), Naïve Bayes (NB), Random Forest (RF), Support Vector Machine (SVM), Extreme Learning Machine (ELM), TF–IDF, Information Gain (IG), Long Short-Term Memory (LSTM), BERT	Automated thematic classification of Hadiths (e.g., prayer, zakat, fasting, ethics) with accuracy often >90%; shift from keyword-based to semantic and context-aware modeling.
2	Authentication and Reliability Assessment (Isnād and Matn)	Machine Learning (ML), Deep Learning (DL), Genetic Algorithm (GA), Fuzzy Logic, Morphological and Lexical Analysis	Automation of jarḥ wa ta'dīl and takhreej al-ḥadīth; AI-assisted assessment of narrator reliability and Hadith authenticity (ṣaḥīḥ, ḥasan, ḍa'īf); improved accuracy (84–93%) and interpretability through hybrid and linguistically grounded models.
3	Textual and Semantic Analysis / Knowledge Extraction	Natural Language Processing (NLP), Named Entity Recognition (NER), Part-of-Speech (POS) tagging, Bellman–Ford algorithm, Graph-based and PageRank algorithms	Extraction of semantic relations, automatic narrator identification, and digital reconstruction of transmission networks; enhancement of textual retrieval and theological summarization accuracy.
4	Emerging Trends: Deep Learning and Generative AI	Convolutional Neural Networks (CNN), LSTM, Transformers (e.g., BERT, ARBERT), Large Language Models (LLMs)	High-performance Arabic-language Hadith classification (>91% accuracy); introduction of interactive and context-aware Hadith dialogue systems (e.g., Digital al-Bukhari project) leveraging verified Hadith datasets.
5	Methodological Tendencies and Patterns	Hybrid Rule-Based & Statistical Learning, Annotated Corpora, Multilingual Modeling	Increasing hybridization of reasoning and data-driven models; improved performance validation (accuracy, precision, recall, F1-score); growing inclusion of Malay and Indonesian corpora reflecting localized AI adaptations.

Source: Author's Analysis (Processed Data, 2025)

Findings, Limitations, and Challenges in Applying AI to Hadith Studies

The reviewed literature demonstrates that the integration of Artificial Intelligence (AI) into Hadith studies has yielded substantial progress in automating and enhancing key scholarly tasks, ranging from authentication and classification to summarization, clustering, and semantic retrieval. However, despite these advancements, the field remains characterized by a number of methodological, epistemological, and technical challenges that highlight both the promise and the current limitations of this emerging interdisciplinary domain.

1. Main Findings: Toward Automated Hadith Authentication and Knowledge Extraction

Most studies converge on the utility of machine learning (ML) and deep learning (DL) in modeling traditional Hadith methodologies such as takhreej al-hadith and jarh wa ta'dil. Early

approaches relied on supervised learning for classification and feature extraction, focusing on the sanad (chain of transmission) and matan (content) as key dimensions of authenticity evaluation. For instance, Abdelaal and Youness (2019) and Abdelaal et al. (2019) demonstrated that decision tree and Naïve Bayes classifiers could achieve accuracies exceeding 92%, effectively distinguishing between sahih, hasan, da'if, and mawdu' traditions. More recent contributions using deep learning architectures, such as LSTM (Rahman & Lhaksmana, 2024) and ARBERT (Refaee, 2022), confirmed the superiority of neural approaches for matan-based classification, achieving accuracies above 90%.

Parallel developments focused on text representation and linguistic analysis, emphasizing the computational handling of Arabic morphology and narrative structure. Mohamed and Sarwar (2022) proposed automatic machine learning with linguistic feature evaluation, identifying n-gram and morphological segmentation as key predictors of Hadith authenticity. Similarly, the work by Alias et al. (2023) on automated isnad tagging achieved precision and recall rates above 93%, improving the scalability of narrator identification.

Complementary innovations were also observed in knowledge discovery and retrieval applications, including automatic text summarization (Adytoma et al., 2020), content clustering using BERT (Asy'ari et al., 2024), and algorithmic sequencing of Hadith based on PageRank adaptation (Venkat et al., 2022). These efforts collectively reflect a growing shift from rule-based systems to data-driven, representation-learning paradigms, marking a significant epistemic transition in how Islamic textual traditions are computationally modeled.

2. Limitations: Fragmented Datasets, Benchmark Gaps, and Contextual Constraints

Despite these achievements, the literature repeatedly underscores the absence of standardized and publicly available benchmark datasets as a major limitation hindering reproducibility and comparative evaluation. Only a few studies, such as Refaee (2022) and Mohamed & Sarwar (2022), contributed open corpora suitable for benchmarking; most rely on proprietary or limited datasets (e.g., *Ṣaḥīḥ Muslim, Bulūg al-Marām*), often restricted by language, translation, or corpus size. This fragmentation reduces the generalizability of models and limits the transferability of results across different Hadith collections and linguistic contexts.

Furthermore, a methodological gap persists in the harmonization of evaluation metrics. Reported accuracies—though often exceeding 85%—are difficult to compare due to variations in preprocessing, feature engineering, and annotation schemes. Several studies also exhibit imbalanced reliance on textual features, frequently neglecting the socio-historical metadata (e.g., narrator reliability, contextual transmission chains) that are crucial to traditional Hadith criticism. This imbalance results in computational models that excel at pattern recognition but lack tafsiri (interpretive) sensitivity to the epistemic nuances of Hadith scholarship.

In addition, technical studies such as Adytoma et al. (2020) and Najeeb (2020) acknowledge performance trade-offs between extraction-based and abstractive methods or between algorithmic complexity and interpretability. For example, while genetic algorithms and Bellman-Ford graph models improved entity extraction and summarization efficiency, their results were often constrained by small datasets and limited semantic representation.

3. Epistemological and Technical Challenges: Between Algorithmic Precision and Hermeneutical Authenticity

Beyond data and methodology, a more profound challenge lies in reconciling algorithmic rationality with the epistemological framework of Islamic scholarship. Traditional Hadith sciences rely on human expertise, ethical accountability (amanah), and contextual discernment, whereas AI models operate primarily through statistical correlations. This divergence raises concerns about the hermeneutical validity of algorithmically generated judgments and the potential erosion of interpretive depth when sacred texts are treated merely as linguistic data.

El Ganadi et al. (2024) highlight these concerns in their exploration of generative AI through the "Digital Muhammad ibn Ismail al-Bukhari" model. Despite significant progress in mitigating hallucinations and improving textual reliability, issues of bias propagation, interpretive ambiguity, and theological sensitivity remain unresolved. Such findings underscore the necessity of human-in-the-loop frameworks, where domain experts continually audit AI outputs to ensure doctrinal soundness and epistemic integrity.

On a technical level, studies also report linguistic complexity and low-resource challenges in Arabic and Malay Hadith corpora, complicating tasks such as tokenization, disambiguation, and entity recognition (Mazlin et al., 2021; Rostam & Malim, 2021). These linguistic barriers further exacerbate performance inconsistencies across dialects and translations. Moreover, as models evolve toward deep and generative architectures, the interpretability–performance trade-off becomes more pronounced, calling for explainable AI (XAI) approaches tailored to the epistemic ethos of Islamic studies.

4. Synthesis: Toward a Responsible AI-Hadith Research Paradigm

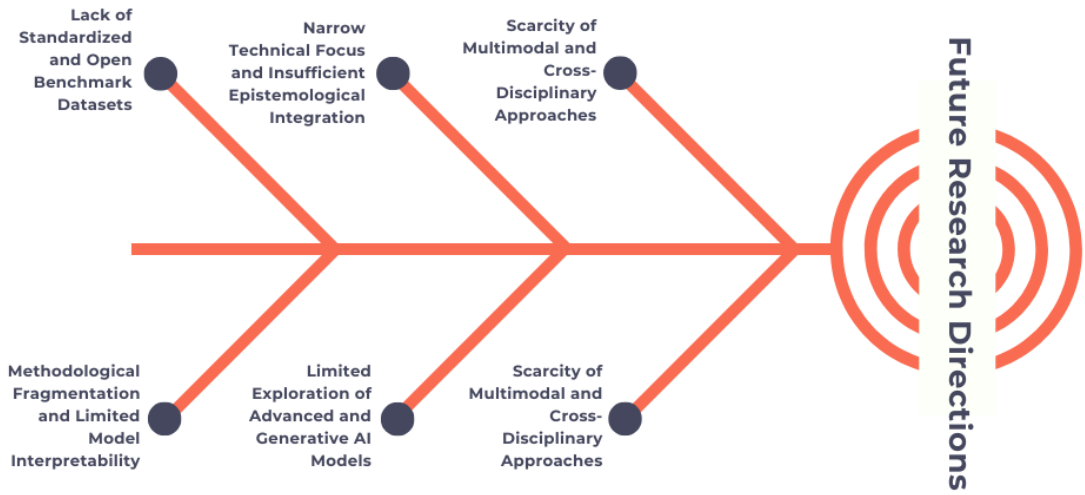
Taken together, the literature reveals a field in transition from computational feasibility to epistemological maturity. The current generation of studies demonstrates that AI can substantially assist scholars in managing vast Hadith corpora, automating classification, and improving access to authentic sources. However, to move beyond technical experimentation, future research must integrate data ethics, explainability, and interdisciplinary collaboration between computer scientists, Islamic scholars, and linguists.

Ultimately, the advancement of AI in Hadith studies depends not only on algorithmic optimization but also on establishing a methodological synthesis that respects both the logic of data and the spirit of revelation. Addressing benchmark standardization, corpus transparency, and hermeneutical coherence will be decisive in transforming this field from a collection of technical demonstrations into a sustainable, epistemically sound research paradigm.

Research Gaps and Future Opportunities in the Integration of Artificial Intelligence into Hadith Scholarship

The bibliometric and qualitative synthesis of recent research reveals a vibrant yet fragmented landscape in the application of Artificial Intelligence (AI) within Hadith studies. While considerable progress has been made in automating tasks such as text classification (Abdelaal et al., 2019; Handayani et al., 2023), authenticity verification (Refaee, 2022; Tarmom et al., 2022), and topic clustering (Asy'ari et al., 2024), the field remains in a formative stage marked by methodological heterogeneity, limited corpus standardization, and insufficient cross-disciplinary engagement.

Figure 3: Fishbone Diagram of Research Gaps and Future Opportunities



The synthesis of existing literature further indicates that, despite increasing scholarly interest, AI-assisted Hadith research still lacks conceptual and methodological coherence. To better illustrate the major challenges and guide future inquiry, the key research gaps are visualized in the fishbone diagram above. This diagram maps the structural relationship between current limitations and potential areas for advancement, highlighting the six most critical domains requiring focused attention—from data standardization and model interpretability to epistemological integration, generative modeling, multimodal analysis, and ethical governance. Collectively, these dimensions underscore the urgency of

developing a comprehensive and interdisciplinary roadmap that harmonizes technological innovation with the epistemic and ethical principles of Hadith sciences.

The following subsections elaborate on each of these six research gaps and identify corresponding opportunities for future scholarly development.

1. Lack of Standardized and Open Benchmark Datasets

A recurring limitation across nearly all reviewed studies concerns the absence of publicly available, standardized benchmark datasets for Hadith analysis. Despite some efforts to curate corpora (e.g., Refaee, 2022; Mohamed & Sarwar, 2022), existing datasets remain either proprietary, small in scale, or linguistically constrained—predominantly in Arabic or Malay, with few parallel resources in other major Muslim languages such as Urdu or Indonesian. This limitation impedes reproducibility, cross-model comparison, and generalization of findings. Future research should prioritize the creation of large, multilingual, and well-annotated Hadith corpora, developed collaboratively among Islamic scholars, computational linguists, and data scientists. Such benchmark datasets would serve as a critical foundation for advancing transparency and replicability in AI-driven Hadith scholarship.

2. Methodological Fragmentation and Limited Model Interpretability

Most existing works employ diverse machine learning architectures—ranging from Decision Trees and Naïve Bayes classifiers (Abdelaal & Youness, 2019) to contemporary deep learning models such as LSTM (Rahman & Lhaksmana, 2024) and BERT (Asy'ari et al., 2024). While these models have demonstrated promising accuracy, their black-box nature poses significant epistemological challenges within the context of Islamic sciences, which traditionally emphasize transparency, traceability, and interpretability in knowledge derivation. The lack of explainable AI (XAI) approaches limits scholarly confidence and restricts integration with classical Hadith methodologies. Future research should therefore focus on explainable and hybrid AI systems capable of articulating decision pathways in line with established principles of isnād and matn criticism.

3. Narrow Technical Focus and Insufficient Epistemological Integration

A notable gap lies in the dominance of computational experimentation with minimal engagement in epistemological discourse. Studies have largely centered on algorithmic performance—accuracy, precision, and recall—without critically assessing how these systems align with the epistemic logic of Hadith sciences, particularly in areas such as sanad evaluation, narrator reliability, and contextual understanding of matn. The epistemological implications of algorithmic judgment in classifying ṣaḥīḥ, ḥasan, or ḍa'īf Hadiths remain underexplored. Addressing this gap requires interdisciplinary frameworks that integrate AI's technical affordances with uṣūl al-ḥadīth methodologies, fostering a dialogue between computational models and Islamic hermeneutics.

4. Limited Exploration of Advanced and Generative AI Models

The emergence of generative AI and large language models (LLMs) presents both a challenge and an opportunity for Hadith scholarship. Only recent studies, such as El Ganadi et al. (2024), have begun to explore generative approaches in constructing domain-specific models like Digital Muhammad ibn Ismail Al-Bukhari. However, concerns over hallucination, bias, and epistemic reliability underscore the need for cautious yet proactive exploration. Future research should investigate controlled fine-tuning of LLMs with authenticated Hadith sources, incorporating reinforcement learning with human feedback (RLHF) from domain experts to ensure both factual accuracy and theological integrity.

5. Scarcity of Multimodal and Cross-Disciplinary Approaches

Most extant research remains text-centric, neglecting the potential of multimodal AI to analyze complementary sources such as audio narrations, manuscript images, and metadata of narrators. Integrating computer vision, speech recognition, and semantic graph technologies could enrich Hadith analytics, enabling more nuanced studies of transmission patterns, narrational networks, and intertextual relationships with Qur'anic and fiqh databases. Moreover, cross-disciplinary collaboration—with fields such as digital humanities, data ethics, and information science—remains underdeveloped, yet is essential for constructing holistic, ethically grounded AI frameworks in Islamic scholarship.

6. Absence of Ethical and Governance Frameworks for AI-Assisted Hadith Research

Despite growing awareness of AI's potential in Islamic studies, few works have addressed the ethical, theological, and governance dimensions of its deployment in Hadith research. The lack of normative guidelines concerning data handling, algorithmic transparency, scholarly accountability, and the preservation of religious authenticity raises serious concerns. As AI systems increasingly mediate interpretive processes, questions arise about authority, authorship, and the legitimacy of machine-generated insights in the domain of sacred knowledge. Future scholarship must therefore develop a robust fiqh al-taṭbīqāt al-ḍarūriyyah (jurisprudence of technological applications) framework—one that articulates ethical parameters, institutional standards, and governance mechanisms ensuring that AI tools augment rather than distort the epistemic integrity of Hadith sciences.

7. Future Research Directions

To advance the integration of AI into Hadith and broader Islamic studies, several strategic directions emerge:

- Development of interoperable digital infrastructures linking Hadith databases with Qur'anic, biographical, and jurisprudential corpora for comprehensive semantic analysis.
- Design of explainable AI models rooted in the epistemology of riwāyah wa dirāyah, providing interpretable reasoning for authenticity judgments.
- Institutional collaboration between Islamic universities, AI research centers, and religious authorities to establish shared ethical guidelines and data governance protocols.
- Exploration of generative AI for educational purposes, such as Hadith summarization, question answering, and pedagogical simulation, under strict scholarly supervision.
- Integration of AI ethics and Islamic epistemology, ensuring algorithmic transparency, accountability, and alignment with *maqāṣid al-sharī'ah*.

In sum, the integration of AI into Hadith scholarship stands at a pivotal juncture. The transition from experimental applications toward epistemically grounded, ethically informed, and methodologically transparent AI systems represents the next frontier. Achieving this transformation demands sustained collaboration between technologists and Islamic scholars to ensure that technological advancement not only enhances efficiency but also preserves the sanctity, authenticity, and interpretive depth of the prophetic tradition.

CONCLUSION

This study provides a systematic synthesis of research on the integration of Artificial Intelligence (AI) into Hadith scholarship, mapping the evolution of publication dynamics, methodological tendencies, technological implementations, and epistemological challenges over the past decade. Through a Systematic Literature Review (SLR) of 19 Scopus-indexed studies published between 2015 and 2024, several key conclusions emerge that collectively address the four guiding research questions (RQ1–RQ4).

First, the trajectory of AI–Hadith research shows a clear upward trend beginning in 2019, indicating growing scholarly interest and methodological diversification. The balance between conference and journal publications demonstrates a transition from early-stage technical experimentation toward mature, peer-reviewed academic inquiry. Thematically, studies have evolved from basic text classification and feature extraction to complex, hybrid approaches integrating deep learning and natural language processing (NLP). This progression reflects a paradigm shift in Hadith scholarship—from traditional, manual textual analysis to data-driven, algorithmic methodologies—supported by regional contributions from Southeast Asia, the Middle East, and Europe.

Second, the reviewed works reveal that AI technologies have been applied across three primary domains: (1) classification and thematic categorization of Hadiths using machine learning (e.g., SVM, Random Forest, and Naïve Bayes), (2) authentication and reliability assessment through modeling of isnād and matn using deep learning, fuzzy logic, and genetic algorithms, and (3) semantic and textual analysis utilizing NLP techniques such as Named Entity Recognition, POS tagging, and semantic graph modeling. More recent innovations—especially transformer-based models (BERT, ARBERT) and generative AI—demonstrate a shift toward context-sensitive, semantically rich representations of Hadith data. Collectively, these advancements mark the emergence of a computational Hadith methodology that augments classical verification practices with intelligent automation.

Third, while AI has significantly enhanced efficiency and scalability in Hadith authentication and classification, several persistent limitations remain. The lack of standardized, publicly available benchmark datasets restricts replicability and cross-model comparison. Methodological fragmentation, limited interpretability of deep learning models, and linguistic resource constraints—especially for Arabic and Malay corpora—further hinder progress. On the epistemological front, tensions persist between algorithmic precision and hermeneutical authenticity, raising concerns about delegating sacred-text interpretation to opaque computational systems. Scholars emphasize the importance of human-in-the-loop frameworks to safeguard theological soundness, transparency, and ethical accountability in AI-assisted Hadith analysis.

Fourth, despite its progress, AI–Hadith research remains in a formative stage with several critical gaps. These include the absence of multilingual open datasets, limited explainable AI (XAI) applications aligned with *uṣūl al-ḥadīth* principles, and insufficient integration between computational modeling and Islamic epistemology. Future studies should focus on developing interpretable AI frameworks, standardized digital infrastructures, and cross-disciplinary collaborations involving computer scientists, Islamic scholars, and linguists. The emergence of generative AI and large language models (LLMs) also opens promising avenues for interactive Hadith learning, semantic reasoning, and digital preservation, provided these systems are fine-tuned with authentic sources and governed by ethical and epistemological safeguards rooted in *maqāṣid al-sharī'ah*.

The integration of AI into Hadith scholarship represents both a technological advancement and an epistemological turning point. The current landscape reveals a shift toward what may be termed *Digital Hadith Science 2.0*—a paradigm that combines the analytical rigor of AI with the moral and interpretive depth of Islamic scholarship. Realizing the full potential of this transformation will require not only algorithmic innovation but also a sustained commitment to ethical integrity, transparency, and respect for the sanctity of prophetic knowledge. Future research must therefore pursue a balanced synthesis—where the precision of data meets the wisdom of revelation—to ensure that AI serves as a tool for illumination rather than substitution in the continuing evolution of Hadith studies.

Implications, Limitations, and Future Directions

This study provides clear and significant contributions to the advancement of both Islamic studies and artificial intelligence, particularly in the emerging field of Digital Hadith Science. Theoretically, this research offers three major contributions. First, it establishes the *first comprehensive PRISMA-based synthesis* of AI applications in Hadith scholarship, providing a validated and replicable scientific map of the field. Second, it advances an epistemic integration between computational linguistics and uṣūl al-ḥadīth by demonstrating how AI models can emulate elements of classical Hadith criticism—such as isnād verification, narrator profiling, and matan pattern detection—while introducing analytical capacities impossible through manual methods. Third, it formulates a conceptual foundation for Digital Hadith Science as a distinct interdisciplinary paradigm that harmonizes traditional Islamic epistemology with data-driven methodologies. Practically, the study contributes in three concrete ways. First, it provides actionable insights for universities and Islamic higher education institutions seeking to design curricula, research centers, and training programs that integrate AI literacy with classical Islamic scholarship. Second, it offers a strategic framework for Islamic digital repositories and knowledge-management institutions to adopt AI responsibly, ensuring accuracy, transparency, and Sharia-aligned data governance. Third, it highlights the ethical and technical imperatives for AI developers and policymakers—such as dataset integrity, explainability, bias control, and theological accountability—thereby guiding the development of AI systems that are both technologically robust and religiously reliable. Together, these contributions not only advance academic discourse but also provide a roadmap for future collaboration among ulama, AI researchers, and institutional leaders in building credible, ethical, and innovative AI ecosystems for Hadith scholarship. This study ultimately strengthens the foundation for a new era in Islamic knowledge production—one that enhances precision and accessibility while safeguarding the authenticity of the Prophetic tradition.

Despite its comprehensive synthesis, several limitations should be acknowledged. The analysis relies primarily on Scopus-indexed sources, potentially omitting relevant works from non-indexed Arabic and Malay journals. Moreover, the review does not conduct a quantitative meta-analysis of algorithmic performance due to inconsistent reporting across studies; thus, the assessment remains descriptive. The epistemological reflections, while insightful, are interpretive and warrant empirical validation through expert consultation. Furthermore, given the study's temporal scope (2015–2024),

emerging innovations in generative AI and large language models (LLMs) beyond this period may introduce paradigms not yet captured.

Future research should address these gaps through several strategic directions: (1) developing open, standardized, multilingual Hadith datasets to ensure data transparency and reproducibility; (2) designing *Explainable AI (XAI)* systems aligned with *uṣūl al-ḥadīth* principles; (3) integrating Islamic epistemology within AI design through hybrid, human-in-the-loop models; (4) exploring generative and multimodal AI for reconstructing Hadith transmission networks and enhancing digital pedagogy; and (5) establishing governance frameworks grounded in *maqāṣid al-sharīʿah* to guide ethical innovation. In sum, advancing AI-driven Hadith research requires harmonizing technological sophistication with epistemological integrity. Through interdisciplinary collaboration among *ulama*, linguists, and AI experts, the future of Hadith scholarship can evolve toward an ethically responsible and intellectually rigorous digital paradigm.

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