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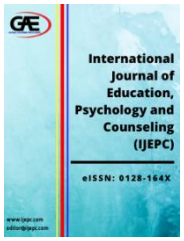


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# ARTIFICIAL INTELLIGENCE IN HADITH EDUCATION: A SYSTEMATIC LITERATURE REVIEW OF ASTRONOMICAL STUDIES

Muhammad Dzunnun Mohd Nazir[1], Mesbahul Hoque*[2], Mohd Nor Adzhar Ibrahim[3], Norhasnira Ibrahim [4], Mansir Abubakar[5]

[1] Faculty of Quranic and Sunnah Studies, Universiti Sains Islam Malaysia
3251940@raudah.usim.edu.my https://orcid.org/0009-0005-6806-9156
[2] Faculty of Quranic and Sunnah Studies, Universiti Sains Islam Malaysia
mesbahul@usim.edu.my https://orcid.org/0000-0001-5867-5914
[3] Faculty of Quranic and Sunnah Studies, Universiti Sains Islam Malaysia
mnor.adzhar@usim.edu.my https://orcid.org/0000-0001-6578-5126
[4] Faculty of Quranic and Sunnah Studies, Universiti Sains Islam Malaysia
norhasnira@usim.edu.my https://orcid.org/0000-0003-1322-7805
[5] Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA, Shah Alam
mansir@uitm.edu.my https://orcid.org/0000-0001-9733-2906
*Corresponding Author

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**Abstract:**

Astronomical hadith, particularly those related to lunar observation and the determination of the Islamic calendar, play an important role in Islamic studies. In recent years, Artificial Intelligence (AI) has emerged as a powerful tool for analyzing complex astronomical data. This study examines the application of AI in the study of astronomical hadith through a Systematic Literature Review (SLR). The objectives are to identify previous studies, analyze the AI models used, and determine existing research gaps. The review was conducted using a systematic approach involving the identification, screening, and analysis of relevant scholarly sources, followed by thematic analysis. The findings reveal a growing use of AI technologies, particularly in studies related to crescent moon visibility and lunar phases. Models such as Machine Learning (ML), Artificial Neural Networks (ANN), and Convolutional Neural Networks (CNN) have been applied to improve analytical

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accuracy. The thematic analysis identified key themes, including astronomical data analysis, crescent moon prediction, parameter modeling, and lunar image processing. However, most studies focus on technical aspects and lack integration with hadith studies, indicating the need for a more integrated approach.

**Keyword:**

Artificial Intelligence (AI), Astronomical Hadith, Islamic Studies



## Introduction

Hadith refers to anything attributed to the Prophet ﷺ from his sayings, actions, approvals, and his physical and moral characteristics, whether before or after his appointment as a messenger (Mohd Fauzi Mohd Amin & Shumsudin Yabi, 2020). It is the second primary source of Islam after the Quran, serving as guidance in aspects of creed, worship, and human life (Al-Marʿashli, 2011). In addition, hadith also encompasses various types of knowledge such as astronomy (Ningrum & Fabianti, 2024).

Astronomical knowledge in Islam is closely related to religious practices in Islam, such as determining the direction of the *Qibla*, the beginning of the *Hijri* month, and prayer times (Rakhmad & Hidayat, 2025). This knowledge has long developed in line with the needs of Muslims to determine the timing of worship accurately. Therefore, astronomical hadiths play an important role in forming the foundation for practices such as determining the start of *Ramadan* and *Shawwal* as well as the daily worship schedule of Muslims.

In current developments, artificial intelligence (AI) has become one of the most important technologies in data processing and text analysis (Rashid & Kausik, 2024). AI encompasses various techniques such as Natural Language Processing (NLP), Machine Learning (ML), and Deep Learning (DL), which enable computers to analyze text automatically and systematically (Apaydin, 2025).

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In the context of Islamic studies, AI has been widely used in the analysis of hadith texts, particularly in the classification of hadith, *sanad* analysis, and *matan* as well as the automatic *takhrij* process (Sani & Abdulmumini, 2025). This technology shows great potential in assisting researchers to handle very large and complex hadith data. However, most previous studies have focused more on the use of AI in hadith in general without giving special attention to astronomical hadith. This has led to a lack of specific analysis of hadith related to astronomical phenomena, even though this field holds significant importance in the context of Muslim worship.

In this regard, there is a need to conduct a systematic literature review (SLR) to identify the development of previous studies, the application of AI in the study of astronomical hadith, as well as its potential uses. This study is also important to identify research gaps and the direction of future studies in this field. Therefore, this study aims to systematically examine past research related to the use of AI in the study of astronomical hadith. Subsequently, it exposes the themes found in the selected previous studies. This study is expected to contribute to the development of hadith knowledge and AI technology integratively, as well as open space for interdisciplinary research between hadith, astronomy, and AI.

**Objective of the Study**

Based on the SLR conducted by Sulisto et al. (2024), it was found that studies related to the use of AI in the field of Hadith have shown significant development. The study identified a total of 48 studies between 2009 and 2022, indicating that this research is increasingly developing and gaining attention among researchers.

From the study, it was found that research related to hadith in the field of computer science is more focused on six main themes, namely classification, verification, corpus development, application, search, and question-answering systems. However, the main focus of the study was found to lean more towards a general approach in hadith text processing compared to studies specifically related to certain categories such as astronomical hadith.

**Methodology of the Study**

This study uses an SLR approach because this method is important for identifying, evaluating, and synthesizing previous studies that are of high quality and relevant to the use of AI in astronomical hadith research. This approach allows researchers to gain a comprehensive and systematic overview of the development of studies in the field.

The literature search process was conducted using several major academic databases such as Springer Nature Link, ScienceDirect, ProQuest, Sage Journals, and JSTOR, chosen for their ability to provide extensive, up-to-date scientific sources related to technology and Islamic studies. These databases also offer access to a variety of journal articles and e-books relevant to the research topic.

To ensure that the study selection process is carried out systematically and transparently, this study uses the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework as the main guide. The analysis process is carried out through four main stages, namely identification, screening, eligibility and final selection which is inclusion.

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Through this approach, only studies that are truly relevant to the use of AI in the context of astronomical hadith will be selected for analysis, thereby enabling the production of more accurate and comprehensive findings.

***Identification***

The identification stage is the first step in the process of an SLR guided by the PRISMA 2020 framework. At this stage, articles that are potentially relevant to the study's topic and objectives are collected thoroughly and systematically to ensure comprehensive literature coverage. In addition, Boolean search techniques are used by combining operators such as 'AND', 'OR' as well as parentheses '()' to obtain scholarly articles related to the research theme. The keywords used are based on the main concepts of the study, namely artificial intelligence, hadith, and Islamic astronomy. For the purpose of identifying relevant articles, the search strategy was implemented using several academic databases as follows:

**Table 1: Databases and Corresponding Search**

| DATABASE | SEARCH |
|---|---|
| Springer Nature Link | ("Digital Technology" OR "Artificial Intelligence" OR "Machine Learning") AND (Hadith OR Islamic) AND (Astronomy OR Falak) |
| ScienceDirect | |
| ProQuest | |
| Sage Journals | |
| JSTOR | |

***Screening***

At the screening stage, several criteria were established to ensure that only articles truly relevant to this study were selected for analysis. This process aims to enhance the accuracy, validity, and quality of findings through systematic literature screening.

First, the selected article must be directly related to the use of AI in astronomical studies, specifically those involving applications in hadith text analysis, natural language processing, or computational approaches in the study of astronomical hadith such as the determination of the crescent moon, prayer times, and Islamic astronomical phenomena. Articles that focus solely on the technical aspects of AI without a connection to hadith or the context of Islamic astronomy will be excluded.

Secondly, the article publication period is set between 2016 and 2026 to ensure that the studies analyzed reflect current developments as well as the evolution of AI usage in the fields of Hadith studies and Islamic astronomy.

Third, only unique and non-repetitive articles will be selected. Any articles found to have the same title will be removed to avoid bias and data duplication in the study analysis.

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Fourth, only sources that have undergone a peer-reviewed process, such as academic journal articles and recognized conference proceedings, will be accepted. Non-academic sources or those that have not undergone a scientific evaluation process will be excluded to ensure the credibility and validity of the study.

Fifth, this study will only consider documents that are fully accessible (full-text accessible) for the purpose of analysis. Documents that cannot be obtained or fully accessed have been excluded to ensure the accuracy and validity of the study findings.

**Table 2: Selection and Inclusion Criteria**

| Criteria | Selection Criteria | Exclusion Criteria |
|---|---|---|
| Relevance | Related to AI and Islamic astronomy | Not related or only focused on the technical aspects of AI |
| Publication Date | 2016 - 2026 | Before 2016 |
| Uniqueness | Unique and non-repetitive article | Duplicate article |
| Reliability | Peer-reviewed sources (academic journals/proceedings) | Non-academic / non-peer-reviewed source |
| Accessibility | Article with full access | Articles that do not have full access or cannot be accessed |

***Eligibility***

At the qualification stage, all articles that have passed the screening process will be read thoroughly. Articles that do not meet the established criteria will be excluded from the analysis. This evaluation focuses on several key parts of the articles, namely the abstract, introduction, methodology, study findings, and discussion, to ensure relevance to the research topic.

This process aims to ensure that only articles that are truly relevant to the use of AI in Islamic astronomical studies, particularly in the context of astronomical hadith such as the determination of the crescent moon, prayer times, and celestial phenomena, are selected for further analysis.

Besides, an assessment is also carried out on the research methods and data used in each article to evaluate their quality level. This step is important to ensure that the findings analyzed are based on solid evidence, appropriate methodology, and contribute significantly to the field of study.

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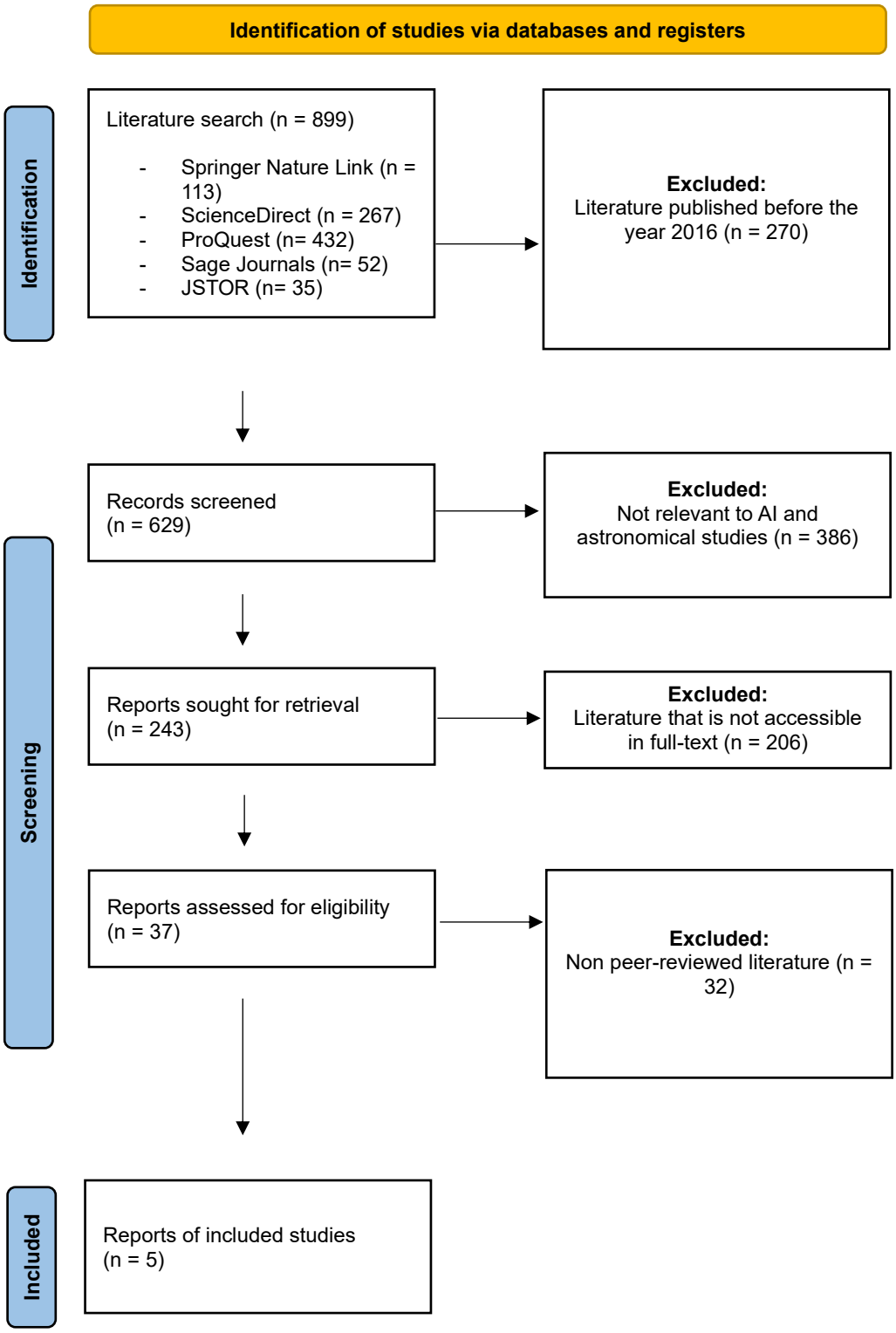


**Figure 1: PRISMA 2020 Systematic Literature Flow Diagram**

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***Data Collection and Data Analysis***

This study uses an SLR approach based on the PRISMA protocol to identify, screen, and collect studies related to the use of digital technology, specifically AI, in the context of hadith and astronomy research. This approach ensures that the research findings are obtained systematically and orderly. The study process is divided into four main phases, namely identification, screening, eligibility, and final inclusion.

In the identification phase, a total of 899 academic sources were obtained from several major databases, namely Springer Nature Link (n = 113), ScienceDirect (n = 267), ProQuest (n = 432), Sage Journals (n = 52), and JSTOR (n = 35). These databases were chosen because they cover technology and social science fields relevant to the research topic. In this phase, a total of 270 articles were excluded because they were published before 2016, leaving 629 articles for the next process.

Next, in the screening phase, a total of 629 articles were examined, and 386 articles were excluded because they were not related to AI and the field of astronomy. After this process, a total of 243 articles were identified for further evaluation.

In the next phase, a total of 243 articles were assessed in terms of accessibility. A total of 206 articles were excluded for not having full-text access, leaving 37 articles to be evaluated in the eligibility phase.

In the qualification phase, all 37 articles were read thoroughly, and 32 articles were excluded because they did not undergo a peer-review process. Finally, 7 articles were selected to be included in the analysis of this study.

Overall, this process demonstrates that a strict procedure has been implemented to ensure that only articles that are truly relevant and of high quality are included in the study. Articles that have passed all phases of the SLR are then analyzed using thematic analysis based on the Braun and Clarke (2006) approach. This method was chosen due to its ability to identify patterns and themes in the literature review. Thematic analysis involves six main stages, namely understanding the data, generating initial codes, identifying themes, reviewing themes, defining and naming themes, and producing the final report.

**Table 3: Summary of Previous Studies**

| No. | Author | Findings | Codes | Theme |
|---|---|---|---|---|
| 1. | (Abdulrazzaq & Chyad, 2024) | 1. Deep learning (DL) is used to analyze large data from telescopes and space missions.<br>2. DL algorithms assist in the discovery and classification of new objects in the sky, galaxy classification, and the prediction of space phenomena. | Deep Learning in Astronomy | AI Applications in Astronomical Analysis |

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| | | 3. The use of DL accelerates the process of astronomical data analysis and enables the processing of very large and complex data. | | |
| 2. | (Allawi, 2022) | 1. This study discusses the use of artificial neural networks (ANN) to predict the visibility of the crescent moon in Iraq, an important aspect in Islamic astronomy.<br><br>2. ANN successfully identified three areas of crescent moon visibility: not visible (I), possibly visible (P), and definitely visible (V). This helps in constructing the *Hijri* calendar based on actual observations, not just astronomical calculations.<br><br>3. The study found that ANN can simulate observational data with over 72% accuracy, and the results indicate that machine learning approaches can improve traditional astronomical predictions. | ANN for crescent visibility | AI in Crescent Moon Forecasting |
| 3. | (Al-Rajab et al., 2023) | 1. This study emphasizes that the determination of the beginning of the month of Ramadan heavily depends on astronomical observation of the crescent moon. Various astronomical parameters are used, such as the latitude of the moon and the time between sunset and moonset.<br><br>2. The study found that traditional observation of the crescent moon is often inaccurate because it is influenced by factors such as atmospheric conditions, the observer's location, and individual skill. Therefore, a combination of several astronomical parameters is required for more accurate predictions.<br><br>3. Complex and nonlinear astronomical data are more suitable | Astronomical and ML parameters | AI Applications in Astronomical Analysis |

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|---|---|---|---|---|
| | | to be analyzed using machine learning algorithms, which are capable of handling various astronomical features and providing more efficient and accurate predictions. The study also constructs a new dataset based on observations from various countries and years, as well as adding additional astronomical features to improve the accuracy of the prediction model. | | |
| 4. | (Nissar et al., 2025) | 1. This study demonstrates that machine learning techniques, particularly Convolutional Neural Networks (CNN), can be used to determine the age of the moon (day in the synodic month) solely through images of the moon.<br><br>2. The developed CNN model successfully classified the moon phases with an accuracy of up to 82.74% using a dataset of moon images obtained from NASA.<br><br>3. This study also shows that variations in lighting and the movement of the moon (libration) cause differences in the appearance of the moon on the same day in different synodic months, making the classification task more challenging.<br><br>4. The study results emphasize the potential use of automation and AI in the field of astronomy, especially for applications such as automatically determining the moon phase through images taken by users. | CNN and the image of the moon | AI in Astronomical Image Processing |
| 5. | (Loucif et al., 2024) | 1. This study found that the use of machine learning is capable of predicting the visibility of the crescent moon with a high level of accuracy, thereby indicating great | ML for crescent moon sighting | AI in Crescent Moon Forecasting |

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| | | potential in assisting the early determination of the *Hijri* month.<br><br>2. Among the models used, Gradient Boosting showed good performance, while the Extra Trees model provided the best results after the optimization process, followed by ensemble models that slightly improved prediction accuracy.<br><br>4. In addition, geographical factors were found to influence model performance, with higher accuracy in certain regions such as Africa and Asia. The use of a global dataset covering a 13-year *period* also increased the reliability of the findings.<br><br>5. Overall, this study indicates that AI technology can be an effective and consistent tool in supporting the efforts to standardize the *Hijri* calendar globally. | | |

***Findings of the Study***

This chapter presents research findings from an SLR that was conducted regarding the use of AI in the study of astronomical hadith. Specifically, this chapter compiles and analyzes previous related studies to provide a comprehensive overview of the development of this field. The findings presented in this chapter are the result of a synthesis from selected studies that have undergone a screening process according to SLR procedures.

Thematic analysis of previous studies shows that the use of AI in the study of astronomical hadiths can be categorized into several main themes. These themes were produced through the process of coding selected studies. The first theme identified is the use of AI in large-scale astronomical data analysis. A study by Abdulrazzaq and Chyad (2024) shows that deep learning techniques are used to process complex astronomical data from telescopes and space missions. This approach enables the classification of celestial objects such as galaxies as well as the detection of new phenomena more quickly and efficiently. This indicates that AI plays an important role in accelerating the processing of large and complex astronomical data. The second theme is the use of AI in predicting the visibility of the crescent moon which has a direct importance in determining the *Hijri* calendar. A study by Allawi (2022) used ANN to classify the visibility of the crescent moon into several categories such as not visible, possibly visible, and definitely visible. In addition, Al-Rajab et al. (2023) as well as Loucif et al. (2024) also emphasized that ML can improve the accuracy of crescent moon predictions by processing various astronomical parameters and global data. These findings indicate that AI has the potential to replace or complement traditional methods in determining the beginning of the

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*Hijri* month. The third theme is the use of AI in astronomical image processing. A study by Nissar et al. (2025) shows that CNN were successfully used to classify the phases of the moon based on images. This model achieved a high level of accuracy and demonstrated that AI is capable of automating visual analysis in astronomy, including determining the age of the moon based on digital images.

Overall, the findings of this SLR indicate that the use of AI in the study of astronomical hadith can be divided into three main themes, namely astronomical data analysis, prediction of crescent moon visibility, and astronomical image processing. These themes show that AI not only improves the accuracy of astronomical analysis but also expands the potential applications in the context of determining the *Hijri* calendar and Islamic astronomical studies.

**Discussion of Findings**

Based on the SLR conducted, the most dominant theme is regarding the use of AI in predicting the visibility of the crescent moon. This is due to the need for the application of science and technology in the observation process, which produces more accurate results (Abdul Niri et al., 2012). Overall, AI helps more in analyzing astronomical data more accurately and quickly, as mentioned by (Abdulrazzaq & Chyad, 2024). In addition, according to Allawi (2022), ANN are able to imitate observational data with an accuracy level exceeding 72%, thereby showing that the use of machine learning approaches has the potential to improve prediction accuracy compared to traditional astronomical methods. However, there are also limitations to the use of AI in the field of astronomy, such as inconsistent data quality and the need for high-powered computers to process very large astronomical data.

Therefore, the findings of this study indicate that AI opens new avenues in the study of hadith, specifically in the aspect of astronomical hadith. Although most existing studies focus more on technical astronomical analysis, the use of AI has the potential to assist in understanding the context of hadith related to celestial phenomena such as the determination of the beginning of the *Hijri* month. In addition, AI can also serve as a supportive tool in linking empirical astronomical data with hadith texts, thereby strengthening the understanding of hadiths related to astronomy in a more systematic and data-driven manner. This is because the author did not find any study that focuses on the aspect of AI and hadith astronomy. This proves that studies on AI and hadith astronomy still require effort and attention as there is a research gap.

**Conclusion**

Overall, this study has successfully achieved the set objectives through a systematic analysis of the literature related to the use of AI in the study of astronomical hadith. The study's findings indicate that there is a significant increase in the use of AI technology, particularly in the field of astronomy related to the determination of phenomena such as the visibility of the new moon and the phases of the moon. Various AI models such as ML, ANN, and CNN have been applied to improve the accuracy of analysis and predictions compared to traditional methods.

In addition, this study also identified several main themes in the use of AI, including astronomical data analysis, crescent moon prediction, astronomical parameter modeling, and lunar image processing. All of these themes indicate that AI serves as an effective tool in handling complex astronomical data as well as supporting the decision-making process in the

context of Islamic astronomy. However, the findings also show that most studies still focus on technical aspects and have not fully integrated the perspective of hadith knowledge.

This study also identified the research gap which is there is still a lack of studies that combine AI with astronomy hadith. Therefore, further research is highly needed to develop a more holistic approach that integrates AI technology with hadith knowledge related to astronomy.

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