

Natural Language Processing for Interactive and Personalized Qur'anic Education

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Abstract: The development of artificial intelligence technology, particularly Natural Language Processing (NLP), has opened significant opportunities for transforming Qur'anic learning methods. NLP, as a branch of AI focused on the interaction between computers and human languages, offers new approaches to understanding, analyzing, and teaching the text of the Qur'an in a more interactive and personalized manner. This article examines the utilization of NLP technology in the context of Qur'anic education, from the application of Arabic word morphology analysis to paragraph search systems based on meaning, and the development of virtual assistants capable of answering questions about the contents of the Qur'an. This approach not only enhances accessibility and learning efficiency but also strengthens semantic and contextual understanding of the holy verses. The study also highlights linguistic challenges in processing classical Arabic, as well as the importance of quality annotations and digital corpora. Through a literature review and case study implementation, this article demonstrates that the integration of NLP in Qur'anic learning is a strategic step to enrich Islamic education methods in the digital era, while also bridging the younger generation to the values of the Qur'an through relevant technology.

Keywords: Natural Language Processing; Quran Learning; Intelligence Artificial; Arabic; Islamic Educational Technology; Analysis of the Qur'an Text.

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INTRODUCTION

In the rapidly evolving digital era[1][2], the utilization of technology in the field of education has become an inevitability, including in the context of Qur'anic learning. One of the technologies that demonstrates significant potential in this domain is Natural Language Processing (NLP), a branch of Artificial Intelligence (AI) that focuses on the processing and understanding of natural language by machines[3]. NLP technology has been widely implemented across various applications such as automatic translation, chatbots, sentiment analysis, and language-based information retrieval[4].

Within the context of Qur'anic learning[5][6][7], NLP possesses the capability to automatically process classical Arabic texts[8][9][10], facilitate semantic and syntactic analysis of Qur'anic

verses, and provide an interactive interface that enables learners to gain a deeper understanding of the meanings and contexts of the Qur'an. This opens up new opportunities for developing learning systems that are more adaptive, efficient, and personalized[11][12].

However, the application of NLP to Qur'anic texts also presents several challenges, including the complexity of Arabic linguistic structures, the need for a well-annotated and representative corpus, and the sensitivity required when processing religious content. Therefore, an in-depth study is essential to explore how this technology can be appropriately and responsibly integrated into Qur'anic learning. This article aims to review the fundamental concepts of NLP, explore its applications in Qur'anic education, and identify the challenges and future prospects associated with its implementation.

RELATED WORKS

Studies on the utilization of Natural Language Processing (NLP) technology in the context of Qur'anic texts have shown significant progress over the past decade[13]. Several works have focused on morphological and syntactic analysis of Arabic[14][15][16], which forms a crucial foundation for understanding the structure of Qur'anic verses. For instance, research by Habash et al. (2009) developed a standard Arabic morphological analysis system that can be applied to religious texts. Similarly, [17] constructed a Qur'anic ontology system to support concept- and meaning-based verse retrieval.

There are also notable initiatives in developing NLP-based digital tools for Islamic education, such as the Quranic Arabic Corpus, which offers linguistic annotation and multilingual translation. This project enables students and researchers to explore verse meanings through morphological mapping, interpretation layers, and inter-verse relationships. Furthermore, the study by [18] emphasizes the critical need for well-annotated digital corpora to train accurate NLP models capable of processing classical Arabic[19].

However, most existing studies still concentrate on technical components or general-purpose implementations, with relatively few focusing on the integration of NLP in Qur'anic learning scenarios, particularly within formal and non-formal educational settings. Therefore, this article seeks to address this gap by proposing a more pedagogically oriented and applicable approach to the use of NLP technology in the study of sacred texts.

METHODS

This study employs a qualitative descriptive approach, utilizing library research and case study methods as the foundation for analysis. The primary objective of this methodology is to identify and evaluate how Natural Language Processing (NLP) technology has been or can be effectively and ethically applied in the context of Qur'anic education.

The research was conducted in the following stages:

1. Literature Collection

The authors collected and reviewed a wide range of scholarly sources, including journal articles, conference proceedings, books, and open-source technology platforms related to NLP, Arabic linguistics, and digital Qur'anic studies. The main focus was on

publications discussing classical Arabic processing and the application of NLP in Islamic contexts.

2. Classification of NLP Applications

The collected literature was categorized based on types of NLP applications relevant to Qur'anic learning, such as morphological analysis, thematic verse classification, semantic search, and Quranic question-answering systems[20].

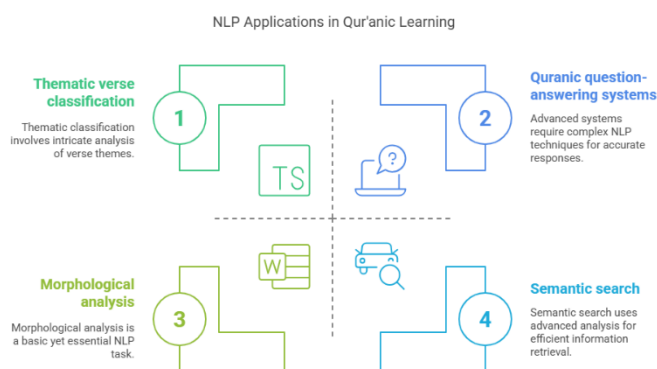


Figure 1. NLP Application in Quranic Learning

3. Case Study Analysis

The research also included analysis of existing case studies and prototypes that have been developed, such as the Quranic Arabic Corpus, Tarteel AI, and other interactive learning platforms utilizing NLP. This stage examined the features, advantages, limitations, and potential integration of such systems into Islamic educational frameworks.

4. Evaluation and Synthesis

The results from literature collection and case analysis were synthesized to formulate key findings concerning the benefits, challenges, and strategic recommendations for applying NLP in Qur'anic education. The evaluation considered pedagogical, linguistic, and Islamic ethical dimensions.

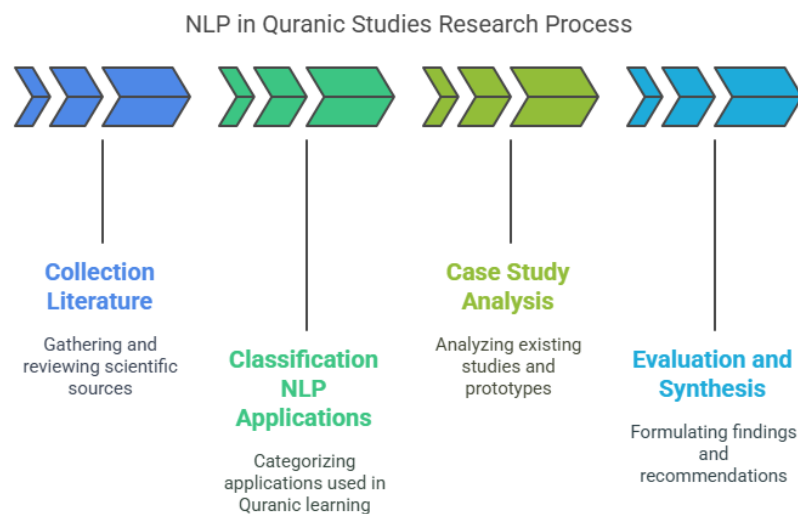


Figure 2. NLP in Quranic Studies Research Process

This method chosen For give description comprehensive about NLP's position in Al-Quran education and For compile base development technology similar in the future.

RESULT AND DISCUSSION

Based on results studies literature and analysis to several platforms and applications that utilize NLP in context learning the Qur'an, found that technology This give contribution significant in expand access and improve effectiveness of the teaching and learning process of the Qur'an.

Analysis Morphology and Syntax

NLP technology is capable of identify structure morphological and syntactic Arabic in text of the Qur'an in accurate. For example, the Quranic Arabic Corpus provides word-by-word annotations, including root words, word forms (patterns), and function grammatical. This is very helpful. student in understand structure classical Arabic, which tends to complex and different from modern Arabic.

Table 1. Example of Morphological and Syntactic Annotations from the Quranic Arabic Corpus

No	Surah & Ayat	Kata Arab	Akar Kata	Pola Kata (Pattern)	Fungsi Gramatikal	Terjemahan
1	Al-Fatihah 1:1	الرَّحْمَنُ	ر-ح-م	فَعْلان	Isim (Kata benda)	Yang Maha Pengasih
2	Al-Fatihah 1:2	الْحَمْدُ	ح-م-د	أَلْ + فَعْلٌ	Mubtada (Subjek kalimat)	Segala puji
3	Al-Baqarah 2:2	ذَٰلِكَ	ذ-ل-ك	اسم إشارة	Isim Isyarah (kata tunjuk)	Itu
4	Al-Baqarah 2:2	لَا	ل-ا	حرف نفي	Harf Nafi (partikel negasi)	Tidak
5	Al-Baqarah 2:2	رَيْبٌ	ر-ي-ب	فَعْلٌ	Maf'ul (objek)	Keraguan
6	Al-Ikhlas 112:1	قُلْ	ق-و-ل	فعل أمر	Fi'il Amar (kata kerja perintah)	Katakanlah

Search Verse Semantics

NLP applications allow search the verses of the Qur'an do not only based on literal keywords, but also based on meaning or theme specific (semantic search). This is very relevant in activity study thematic (maudhu'i), where students can access verses that discuss draft similar although use different editorial.

Table 2. Example of Semantic-Based Quranic Verse Search on the Theme of "Patience"

No	Theme	Surah & Verse	Excerpt (Arabic)	Translation (English)	Semantic Keyword
1	Patience	Al-Baqarah 2:153	يَا أَيُّهَا الَّذِينَ آمَنُوا اسْتَعِينُوا بِالصَّبْرِ	O you who have believed, seek help through patience and prayer...	الصَّبْر (patience)
2	Patience	Ali 'Imran 3:200	يَا أَيُّهَا الَّذِينَ آمَنُوا اصْبِرُوا...	O you who have believed, persevere and endure...	اصْبِرُوا (be patient)
3	Patience	Al-Anfal 8:46	وَاصْبِرُوا إِنَّ اللَّهَ مَعَ الصَّابِرِينَ	And be patient. Indeed, Allah is with the patient.	الصَّابِرِينَ (the patient)
4	Patience	Az-Zumar 39:10	إِنَّمَا يُؤْفَى الصَّابِرُونَ أَجْرُهُمْ	Indeed, the patient will be given their reward without account...	الصَّابِرُونَ (those who are patient)

System and Virtual Assistant

A number of AI development has allow building a chatbot or capable virtual assistant answer question around the contents of the Qur'an with refer to direct to relevant verses and interpretations. For example, applications like Ask Quran and Tarteel AI started integrating NLP for understand question users and provide answer contextual.

Table 3. Examples of Quranic Virtual Assistants Using NLP

No	Application Name	Developer / Organization	Key Features	NLP Functionality	Output Example
1	Ask Quran	Islam.com / Community-driven	Question-answer system for Quranic content	Natural language question parsing, semantic matching	Q: What does the Quran say about patience? A: Al-Baqarah 2:153...
2	Tarteel AI	Tarteel Inc.	Voice-based Quran recitation and correction assistant	Speech recognition, verse matching, contextual tagging	Q: "What comes after Al-Fatihah?" A: Surah Al-Baqarah...
3	Quran GPT	Independent (experimental)	AI-powered chatbot referencing Quranic verses	GPT-based language modeling, tafsir integration	Q: Who is mentioned as a prophet in Surah Maryam? A: Prophet Isa (Jesus), verses 16–36
4	Alfanous Search	Open Source Islamic Tools	Advanced Quranic semantic search engine	Morphological analysis, root extraction, theme-based search	Input: Mercy Result: All verses related to الرَّحْمَن, الرَّحِيم, etc.

Learning Interactive and Personalized

Integration of NLP in application learning allow existence adaptive system to ability users. With analyze pattern learn and respond user, system can adapt material, giving bait come back automatic, even facilitate better pronunciation and understanding Good.

Table 4. NLP-Based Features in Interactive and Personalized Quran Learning Apps

No	Application Name	Adaptive Feature	NLP Technology Used	Description of Personalization	Example Scenario
1	Tarteel AI	Real-time recitation correction	Speech-to-text, pronunciation modeling	Detects mispronunciations and gives immediate feedback	User recites verse; system highlights and corrects mistakes
2	Quran Companion	Learning progress tracking	User behavior analysis, spaced repetition system	Tracks user's memorization level and adjusts review intervals	Slows down or repeats verses user struggles with
3	Learn Quran Tajwid	Phonetic guidance and syllable detection	Arabic phoneme detection, morphological parsing	Helps users pronounce complex tajwid rules properly	Visual cues for elongation and stopping signs
4	Ayat Memorizer	Personalized verse recommendation	Semantic tagging, learning analytics	Suggests next verses to memorize based on previous achievements	Recommends shorter or easier verses when user gets stuck
5	QuranEra	AI-based interactive Q&A & tutor bot	NLP-driven chatbot, adaptive learning flow	Answers user questions and adapts difficulty based on responses	If user gives incorrect answer, system simplifies explanation

However, some challenge Still become attention main. Among them is annotation data limitations For classical Arabic text, difficulties in handle ambiguity semantics, as well as risk interpretation meaning that is not in accordance If system No trained with true. Therefore Therefore, the role of Arabic commentators and language experts remains important in development process technology this is to keep it in accordance with values Islam.

CONCLUSION

Utilization Natural Language Processing (NLP) technology in learning the Qur'an shows potential big in support the process of Islamic education more interactive, personal, and efficient. Through NLP capabilities in analyze structure classical Arabic, doing search semantics, up to provide web-based virtual assistant text holy, technology This can become tool very effective help in understand and teach the contents of the Qur'an, especially for generation young and friendly with the digital world. This study find that various applications and platforms have start applying NLP in context Islam, even though challenge technical and

conceptual Still need overcome. Among them is the need corpus annotated Arabic in a way accurate, processing appropriate meaning context religious, and involvement interpreter and linguist in the development process. Integration of NLP in learning the Qur'an is not only is innovation technology, but also part from endeavor For bridge the values of the Qur'an with needs of the times. With the right and responsible approach answer, technology This can become strong means in strengthen understanding and love towards the Qur'an in the digital era.

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