

# Artificial Intelligence Applications in Cultural Tourism: Opportunities and Challenges

## Case Study: Biskra City

تطبيقات الذكاء الاصطناعي في السياحة الثقافية: الفرص والتحديات  
دراسة حالة: مدينة بسكرة

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### Abstract:

This study aims to examine the role of artificial intelligence (AI) in enhancing cultural tourism by improving visitor experiences, providing instant translations, and offering virtual and augmented reality experiences. The research is based on a key issue: how effective these technologies are in developing cultural tourism while ensuring the sustainability of heritage sites. The findings indicate that AI contributes to improving tourism management through intelligent data analysis and facilitates the documentation and digital reconstruction of archaeological sites. However, these applications face challenges related to infrastructure, high costs, and ethical considerations. The study recommends developing national strategies to support AI in tourism, fostering collaboration between the public and private sectors, and organizing training programs for stakeholders to ensure an interactive and sustainable tourism experience

; Tourism Management , Instant Translation , Cultural Tourism **Key words:** Artificial Intelligence , Smart Experiences

### الملخص:

تهدف هذه الدراسة إلى فحص دور الذكاء الاصطناعي في تعزيز السياحة الثقافية من خلال تحسين تجارب الزوار، وتوفير الترجمة الفورية، وتقديم تجارب الواقع الافتراضي والواقع المعزز. ويستند البحث إلى إشكالية رئيسية هي: ما مدى فعالية هذه التقنيات في تطوير السياحة الثقافية مع ضمان استدامة المواقع التراثية؟ تشير النتائج إلى أن الذكاء الاصطناعي يساهم في تحسين إدارة السياحة عبر التحليل الذكي للبيانات، ويسهل توثيق وإعادة بناء المواقع الأثرية رقمياً. ومع ذلك، تواجه هذه التطبيقات تحديات تتعلق بالبنية التحتية، وارتفاع التكاليف، والاعتبارات الأخلاقية. توصي الدراسة بوضع استراتيجيات وطنية لدعم الذكاء الاصطناعي في السياحة، وتعزيز التعاون بين القطاعين العام والخاص، وتنظيم برامج تدريبية للمؤسسات المعنية لضمان تجربة سياحية تفاعلية ومستدامة.

الكلمات المفتاحية: الذكاء الاصطناعي ؛ السياحة الثقافية ؛ الترجمة الفورية ؛ إدارة السياحة ؛ التجارب الذكية .

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## **1. INTRODUCTION**

Cultural tourism is a key driver of economic and social development, playing a crucial role in preserving heritage, promoting cultural exchange, and fostering global understanding (UNESCO, 2018). As the tourism industry undergoes digital transformation, artificial intelligence (AI) has emerged as a disruptive force capable of revolutionizing cultural tourism experiences. AI-powered applications are now widely used to enhance visitor engagement, improve accessibility, and optimize tourism management (Gretzel et al., 2020; Tussyadiah & Miller, 2019; Seghiri, 2023).

AI-driven innovations, such as real-time language translation, augmented and virtual reality (AR/VR) experiences, and smart tourism assistants, enable visitors to interact with cultural sites in unprecedented ways (Xiang, Fesenmaier, & Werthner, 2021; Zandi, 2023; Cassani et al., 2024). These technologies not only improve visitor experiences but also contribute to the sustainable preservation of heritage sites by optimizing visitor flow and reducing physical degradation through digital reconstruction (Buhalis & Amaranggana, 2015; Stylianou-Lambert, 2023; European Parliamentary Research Service, 2023). In the specific context of Biskra, where cultural and architectural heritage is deeply rooted, such tools offer an opportunity to both protect and promote local identity (Ferrara, Cerquetti, & Sardanelli, 2023).

Furthermore, AI facilitates the analysis of tourist behaviors, allowing for data-driven decision-making in tourism management (Khan et al., 2021; Neuhofer et al., 2015; Duarte et al., 2020). Machine learning models, recommendation systems, and predictive analytics now allow local tourism stakeholders to design more tailored and efficient strategies (Sampaio de Almeida et al., 2025).

Despite these advantages, integrating AI into cultural tourism is not without challenges. Key concerns include the high cost of technological infrastructure, the need for digital literacy among stakeholders, and ethical issues related to data privacy and cultural representation (Ivanov, Webster, & Berezina, 2017; Abu Eyadah & Odaibat, 2024; Boudjema, 2022). Additionally, questions surrounding cultural authenticity and potential Western-centric algorithmic biases must be carefully addressed (Zandi, 2023; Ferrara et al., 2023).

This study aims to explore the role of AI in enhancing cultural tourism experiences while ensuring heritage preservation. It seeks to answer the following research question: How can artificial intelligence contribute to the development of cultural tourism and the enhancement of visitor experiences while preserving heritage sites?

## **2. Research Hypotheses:**

Based on the research problem, this study is based on the following hypotheses:

- AI enhances cultural tourism experiences by providing interactive content and instant translations.
- AI applications help preserve heritage sites through digitization and the reconstruction of landmarks using augmented and virtual reality technologies.
- Smart systems contribute to managing tourist flows and reducing overcrowding at archaeological sites, promoting tourism sustainability.
- AI applications in cultural tourism face challenges, including the need for digital infrastructure, high costs, and ethical considerations.

### **3. Significance and Objectives of the Study**

This study represents a valuable contribution to the field of cultural tourism by examining how artificial intelligence (AI) technologies can enhance tourist experiences, with a focus on the city of Biskra. Its significance and objectives can be summarized as follows:

- Promoting sustainable cultural tourism through the use of advanced technologies such as augmented reality and AI.
- Contributing to the digitization and preservation of cultural heritage for future generations.
- Offering innovative, AI-based solutions to improve tourism management and address the challenges facing heritage-rich cities.
- Analyzing the role of AI in enriching cultural tourism experiences.
- Identifying practical AI applications, including automatic translation, virtual reality simulations, and intelligent visitor flow management.
- Presenting relevant case studies illustrating AI integration in the tourism sector of Biskra as a model.
- Exploring the current challenges and future opportunities associated with AI in cultural tourism.

### **4. Literature Review and Previous Studies**

The literature review examines previous studies on AI applications in cultural tourism, highlighting key findings and interpretations. Gretzel et al. (2020) emphasize that AI enhances tourism services through smart applications, demonstrating its role in modernizing tourism experiences. Tussyadiah & Miller (2019) focus on AI's ability to improve real-time translation and accessibility, underscoring its contribution to inclusive tourism experiences. Buhalis & Amaranggana (2015) highlight how smart tourism destinations leverage AI for management, emphasizing its role in optimizing tourism infrastructure. Khan et al. (2021) explore AI's role in heritage preservation through digital tools, supporting its importance in protecting and documenting cultural heritage. Finally, Neuhofer et al. (2015) illustrate how interactive AI content enhances cultural engagement, showcasing AI's transformative impact on visitor experiences. These studies collectively demonstrate AI's potential in enriching cultural tourism, improving accessibility, and ensuring sustainable heritage management

**Table 1.** Summary of Previous Studies on AI Applications in Cultural Tourism

Study	Key Findings	Interpretation
Gretzel et al. (2020)	AI enhances tourism services through smart applications.	Demonstrates the role of AI in modernizing tourism experiences.
Tussyadiah & Miller (2019)	AI improves real-time translation and accessibility.	Highlights AI's contribution to inclusive tourism experiences.
Buhalis & Amaranggana (2015)	Smart tourism destinations leverage AI for management.	Emphasizes AI's role in optimizing tourism infrastructure.
Khan et al. (2021)	AI assists in heritage preservation through digital tools.	Supports AI's importance in protecting and documenting cultural heritage.
Neuhofer et al. (2015)	Interactive AI content enhances cultural engagement.	Shows how AI transforms visitor experiences.

*Source: Created by the Author*

**5. Definitions of Artificial Intelligence (AI):**

Artificial Intelligence (AI) is a multidisciplinary field that focuses on creating machines capable of simulating human intelligence. The concept has been defined in various ways depending on the perspective of researchers. According to McCarthy (1956), who is credited with coining the term "Artificial Intelligence," AI refers to "the science and engineering of making intelligent machines, especially intelligent computer programs." This definition highlights the computational aspect of AI, emphasizing the development of algorithms that enable machines to perform tasks requiring intelligence.

Russell and Norvig (2020) provide a broader definition, categorizing AI into four main approaches: systems that think like humans, systems that act like humans, systems that think rationally, and systems that act rationally. Their work underscores the diverse interpretations of AI, ranging from mimicking human cognition to optimizing decision-making processes.

Historically, the roots of AI can be traced back to the mid-20th century, with Alan Turing's (1950) seminal work on machine intelligence, where he proposed the "Turing Test" as a measure of a machine's ability to exhibit intelligent behavior indistinguishable from that of a human. The field gained formal recognition in 1956 during the Dartmouth Conference, organized by McCarthy, Minsky, Rochester, and Shannon, marking the official birth of AI as a scientific discipline (Nilsson, 2010).

Since its inception, AI has evolved significantly, encompassing subfields such as machine learning, natural language processing, computer vision, and robotics. These advancements have expanded the scope of AI applications, influencing various sectors, including cultural tourism, healthcare, finance, and autonomous systems (Goodfellow, Bengio, & Courville, 2016).

**The table 2.** presents various definitions of AI from different scientific sources

Author(s)	Definition	Source
McCarthy (1956)	AI is the science and engineering of making intelligent machines.	McCarthy, J. (1956). Proposal for the Dartmouth Conference.
Russell & Norvig (2010)	AI is the study of agents that receive percepts from the environment and perform actions.	Russell, S., & Norvig, P. (2010). Artificial Intelligence: A Modern Approach.
Turing (1950)	AI is a system that exhibits intelligent behavior equivalent to or indistinguishable from human behavior.	Turing, A. M. (1950). Computing Machinery and Intelligence. <i>Mind</i> , 59, 433-460.
Nilsson (1998)	AI is the activity devoted to making machines intelligent.	Nilsson, N. J. (1998). Artificial Intelligence: A New Synthesis.
Poole & Mackworth (2017)	AI is the study of computational agents that act intelligently.	Poole, D., & Mackworth, A. (2017). Artificial Intelligence: Foundations of Computational Agents.

*Source: Created by the Author*

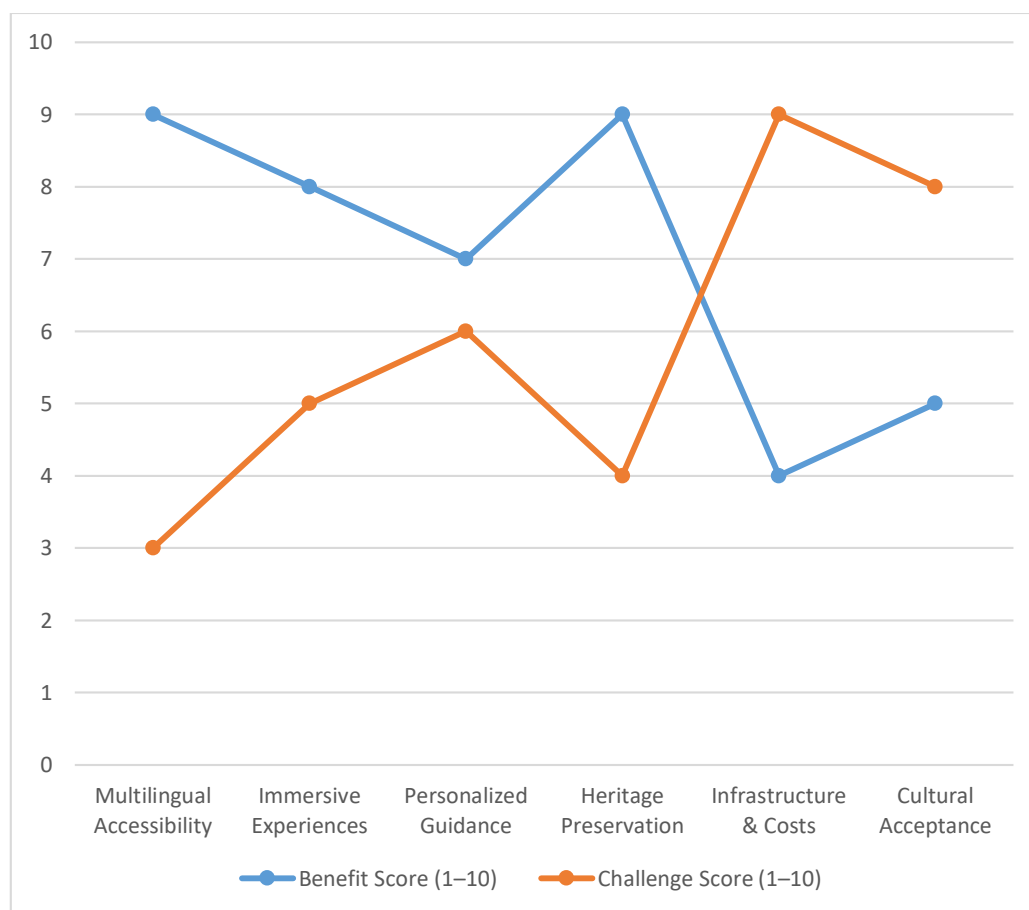
## 6. RESULTS AND DISCUSSION

The analysis confirms that AI significantly enhances cultural tourism by offering multilingual access through translation tools like Google Translate and NLP systems, which can make historical sites such as Qasr Mchounech more inclusive through real-time translation of Berber heritage. Immersive technologies like AR/VR can recreate historic scenes—such as the Souk El-Ghazel or the battles of Zaatcha in Biskra—providing dynamic, educational experiences. AI-powered chatbots, similar to “Ask Mona,” could serve as virtual guides tailored to Biskra’s cultural sites, assisting visitors with site information, routes, and recommendations. Predictive analytics can also optimize tourist flow during major events like the Tolga Date Festival, enhancing safety and satisfaction. Furthermore, AI tools such as NLP and voice recognition contribute to heritage preservation by documenting and translating oral traditions, thereby safeguarding Biskra’s intangible cultural legacy. However, these benefits are accompanied by persistent challenges, including insufficient digital infrastructure in many regions like Biskra, the high costs of deploying and maintaining AI systems, and cultural resistance from traditional communities concerned about authenticity and representation. This underscores the need for strategic planning, inclusive policy frameworks, and greater awareness of AI’s role in cultural heritage preservation.

**Table 3: Applications of AI in Cultural Tourism in Biskra**

AI Application	Cultural Use Case	Expected Benefit
NLP & Translation	Real-time translation of Berber heritage	Multilingual accessibility
AR/VR Technologies	Recreating Souk El-Ghazel & Battles of Zaatcha	Immersive educational experiences
AI Chatbots	Virtual guides at heritage sites (e.g., Ask Mona type)	Personalized tourist assistance
Predictive Analytics	Managing flow at Tolga Date Festival	Improved safety & visitor satisfaction
Voice Recognition	Documenting oral history	Preservation of intangible heritage

**Fig.1.** Perceived Benefits vs. Challenges of AI in Cultural Tourism (Biskra Region)



## 7. EXPERIMENTAL

This study adopts a qualitative-descriptive approach based on case analysis and literature review. It examines various AI applications in cultural tourism globally and applies these concepts to the case of Biskra City. The data sources include scientific articles, institutional reports, and examples from real-world implementations of AI in museums, heritage sites, and urban tourism systems. Focus is placed on AI tools such as real-time translators, virtual/augmented reality platforms, chatbots, and predictive analytics. For Biskra, hypothetical use cases are proposed based on regional cultural assets, including Qasr Mchounech, Souk El-Ghazel, and the Tolga Date Festival.

## 8. CONCLUSION

Artificial Intelligence is reshaping cultural tourism by enhancing accessibility, visitor engagement, and heritage conservation. In Biskra, AI applications such as multilingual interpretation, AR-enhanced storytelling, and data-driven visitor management offer promising pathways to revitalize cultural tourism. However, realizing this potential requires investment in infrastructure, AI training for tourism professionals, and public-private collaboration. Ethical concerns around authenticity and data use must also be addressed through responsible AI governance. Moving forward, integrating AI into Biskra's tourism strategy can help safeguard its cultural legacy while offering enriching, modern experiences to global visitors.

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