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Evolution of the Use of Artificial Intelligence in Mobile Applications to Improve the Efficiency of Public Service

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ABSTRACT

The integration of artificial intelligence (AI) into mobile applications has transformed public service delivery by enhancing efficiency, accessibility, and responsiveness. This study employs a bibliometric approach to analyze the evolution of AI applications in public service, focusing on research trends, key contributors, and thematic developments from 2000 to 2024. The findings reveal a rapid increase in research output since 2018, driven by advancements in enabling technologies such as IoT, 5G, and machine learning, as well as global challenges like the COVID-19 pandemic. Key application areas identified include healthcare, smart cities, and governance, with AI-powered mobile apps demonstrating significant potential in addressing societal needs. However, challenges related to data privacy, algorithmic bias, and technical infrastructure persist. This study underscores the importance of ethical frameworks, interdisciplinary collaboration, and localized solutions to maximize the impact of AI in public service delivery. The findings offer valuable insights for researchers, practitioners, and policymakers seeking to leverage AI for smarter and more equitable public services.

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1. INTRODUCTION

The rapid evolution of artificial intelligence (AI) technologies has profoundly influenced various domains, including public service. Mobile applications, in particular, have emerged as a vital medium for delivering efficient, scalable, and user-friendly public services. Governments and organizations worldwide increasingly leverage AI-powered mobile applications to enhance citizen engagement, streamline service delivery, and ensure real-time problem-solving. For instance, virtual assistants, predictive analytics, and machine learning algorithms integrated into mobile platforms have revolutionized the way citizens interact with public systems [1]. These innovations have set the stage for public service efficiency, aligning with the global push toward digital transformation and sustainable development.

The potential of AI in mobile applications is not merely a technological leap

but a socio-economic enabler. AI-based mobile services facilitate equitable access to public utilities, reduce bureaucratic bottlenecks, and address the challenges of resource allocation in growing urban populations [2]. Applications such as automated tax filing, AI-driven healthcare triage, and intelligent transportation systems exemplify this trend. Particularly in developing regions, these applications hold the promise of bridging digital divides and promoting inclusive governance, thus marking a paradigm shift in public service delivery.

However, the integration of AI into public service mobile applications comes with its own set of challenges, including data privacy concerns, algorithmic bias, and the need for robust regulatory frameworks. As AI systems grow more sophisticated, ensuring that they remain transparent, ethical, and accountable has become paramount. Studies indicate that improper implementation can exacerbate inequalities or lead to public mistrust in digital governance systems [3]. Hence, understanding the trajectory and impact of AI in this domain is crucial for harnessing its full potential while mitigating associated risks.

Bibliometric analysis, as a research methodology, provides valuable insights into the growth, trends, and thematic focuses within a specific field of study. By examining academic publications, citation networks, and collaborative patterns, bibliometric studies shed light on the intellectual structure and progression of research areas [4]. Applying this methodology to the evolution of AI in mobile applications for public service can help identify research gaps, key contributors, and future directions, enabling policymakers and technologists to make informed decisions.

Despite the burgeoning interest and investment in AI-powered mobile applications for public service, there remains a lack of comprehensive understanding of the field's evolution. While numerous studies have focused on individual applications or technologies, few have examined the overarching trends, challenges, and opportunities in this domain from a bibliometric perspective. This knowledge gap limits the ability of stakeholders to grasp the broader context of AI integration in public service and hinders the formulation of cohesive strategies for future advancements. Furthermore, discrepancies in research focus across regions, limited interdisciplinary collaborations, and the absence of longitudinal studies underscore the need for a systematic review of the field's development.

This study aims to analyze the evolution of the use of artificial intelligence in mobile applications to improve the efficiency of public service using a bibliometric approach. By mapping the growth trajectory of research in this area, identifying influential works and authors, and uncovering thematic trends, the study seeks to provide a holistic understanding of the field. The insights derived will not only highlight key advancements but also offer actionable recommendations for researchers, practitioners, and policymakers striving to harness AI for enhancing public service efficiency.

2. LITERATURE REVIEW

2.1 Artificial Intelligence in Public Service

Artificial intelligence (AI) has significantly reshaped public service delivery, enabling governments and organizations to offer innovative solutions to longstanding inefficiencies. AI-powered tools, including machine learning algorithms, natural language processing, and computer vision, have been integrated into various public services to enhance their accessibility, responsiveness, and cost-effectiveness. For instance, smart chatbots are now widely used for citizen inquiries, offering real-time assistance while reducing the workload on

human staff [5]. Similarly, predictive analytics models have improved urban planning by forecasting population growth and optimizing resource allocation [5]. These applications underscore AI's transformative potential to create smarter, more connected public services.

Despite these advancements, integrating AI into public service is not without challenges. Ethical considerations, such as algorithmic bias, privacy concerns, and the lack of transparency in decision-making processes, often hinder widespread adoption [6]. Studies have highlighted that poorly implemented AI systems can reinforce systemic biases, leading to inequitable access to services. Additionally, the lack of technical expertise within many public sector organizations creates significant barriers to adoption. Understanding these challenges is essential for developing AI systems that are inclusive, fair, and effective in addressing public service needs.

2.2 *Mobile Applications in Public Service*

Mobile applications have revolutionized the way citizens interact with public services, offering unparalleled convenience and efficiency. From healthcare and education to transportation and governance, mobile apps have become indispensable tools for delivering public utilities. Governments globally have invested in developing e-governance platforms to enhance service delivery, with mobile applications playing a pivotal role in this transformation [7]. Notable examples include mobile health apps used during the COVID-19 pandemic for contact tracing, telemedicine consultations, and vaccination scheduling [8].

However, the success of mobile applications in public service often depends on their design, usability, and integration with existing systems. Research has shown that user-centered design approaches, which prioritize ease of use and accessibility, significantly impact adoption rates [9]. Additionally, mobile apps must address issues such as data security, interoperability, and scalability to meet the growing demands of urban populations. The literature also highlights the importance of tailoring mobile applications to local contexts, as generic solutions often fail to address region-specific challenges effectively [10].

2.3 *Intersection of AI and Mobile Applications*

The convergence of AI and mobile applications has unlocked new possibilities for enhancing public service efficiency. AI technologies embedded in mobile apps enable features such as real-time language translation, automated problem resolution, and intelligent decision-making. For example, AI-powered mobile apps in the healthcare sector can diagnose medical conditions based on user inputs and recommend appropriate treatments [11]. Similarly, transportation apps leverage machine learning algorithms to provide dynamic route planning, thereby reducing congestion and commute times [12].

Several studies have explored the implications of this intersection. Research by [6] emphasizes the role of AI-enabled mobile applications in fostering citizen engagement and participatory governance. By providing personalized experiences and real-time feedback mechanisms, these apps empower citizens to actively contribute to policy-making and service improvements. Another study by [13] highlights the potential of AI-powered mobile apps in reducing operational costs for public service providers by automating repetitive tasks and optimizing resource use.

Despite these benefits, integrating AI into mobile applications presents unique challenges. One prominent issue is ensuring the ethical use of AI in public services. Concerns about data privacy, informed consent, and algorithmic accountability are particularly pronounced in the mobile app ecosystem, where large volumes of sensitive user data are collected and analyzed [14]. Additionally, technical limitations such as poor internet connectivity and low computational power of mobile devices in some regions restrict the adoption of advanced AI features.

2.4 Bibliometric Analysis in AI Research

Bibliometric analysis has emerged as a powerful tool for understanding research trends and mapping the intellectual landscape of a specific field. It involves the systematic evaluation of academic literature using quantitative methods, such as citation analysis, co-authorship networks, and keyword clustering. Bibliometric studies provide valuable insights into the evolution of research topics, influential publications, and collaborative patterns, thereby helping researchers identify knowledge gaps and future directions [4].

In the context of AI research, bibliometric analyses have shed light on the rapid growth and diversification of the field. A study by [15] highlights the increasing focus on interdisciplinary applications of AI, particularly in domains such as healthcare, education, and public administration. Similarly, [16] emphasize the growing interest in ethical AI, driven by concerns about bias, fairness, and transparency. These analyses have also revealed regional disparities in AI research output, with developed countries leading in publications and citations, while developing regions face challenges such as limited funding and technical expertise.

The application of bibliometric methods to AI in mobile applications for public service is relatively unexplored, presenting a unique opportunity for this study. By examining publication trends, influential authors, and thematic focuses, a bibliometric analysis can provide a comprehensive overview of the field's progression. Such an approach not only enhances our understanding of existing research but also identifies opportunities for interdisciplinary collaborations and practical implementations.

3. METHODS

This study employed a bibliometric analysis approach to explore the evolution of artificial intelligence (AI) in mobile applications for improving public service efficiency. Data were collected from **Scopus**, focusing on peer-reviewed articles published between 2000 and 2024. The search strategy incorporated keywords such as "artificial intelligence," "mobile applications," "public service," and "efficiency." Collected data were analyzed using **VOSviewer** to map publication trends, identify influential authors and uncover thematic clusters through co-occurrence and citation network analyses. The analysis also examined research gaps and emerging trends by visualizing keyword networks and citation trajectories.

4. RESULTS AND DISCUSSION

4.1 Yearly Publication

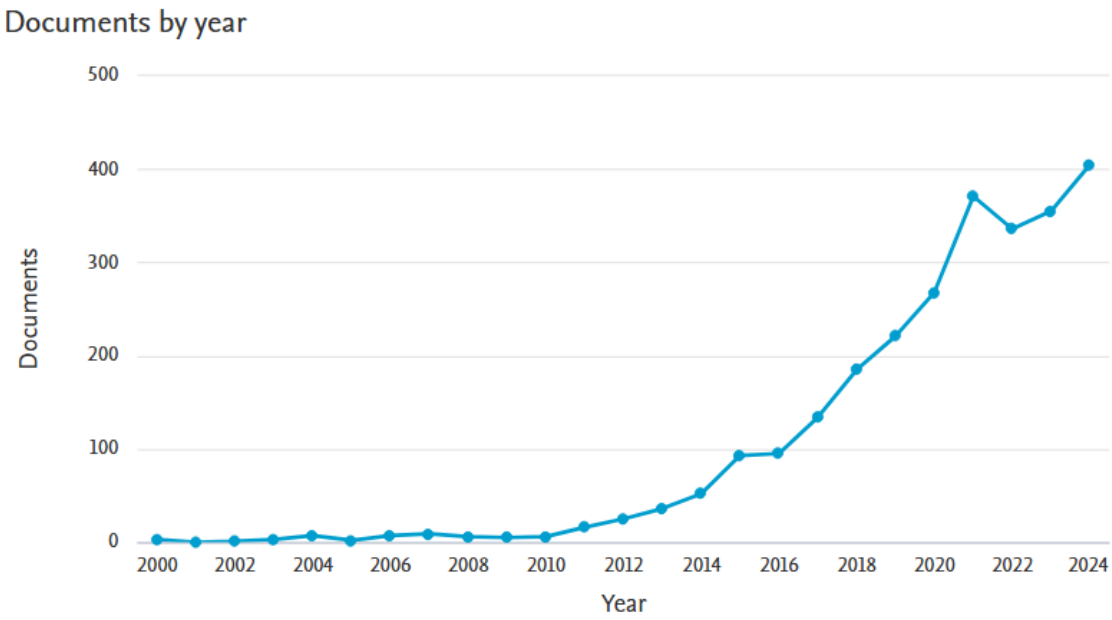

Figure 1. Yearly Publication
Source: Scopus, 2024

The graph illustrates the yearly trend of publications related to the use of artificial intelligence in mobile applications for public service from 2000 to 2024. It shows a steady but minimal number of publications between 2000 and 2012, indicating limited research activity during this period. From 2013 onwards, there is a noticeable increase in publications, with a significant surge starting in 2018. This rapid growth reflects the rising interest and advancements in AI technologies and their application in mobile public services. The peak in publication numbers appears around 2021, which could be attributed to the heightened adoption of digital and AI-driven solutions during the COVID-19 pandemic. Although there is a slight dip in 2022, the trend rebounds in 2023 and 2024, suggesting sustained research interest and ongoing innovations in this field.

4.2 Citation Analysis

Table 2. Top Cited Research

Citations	Authors and year	Title
3246	[17]	MonoSLAM: Real-time single camera SLAM

Citations	Authors and year	Title
2075	[18]	Machine Learning: Algorithms, Real-World Applications and Research Directions
1877	[19]	Fog and IoT: An Overview of Research Opportunities
1616	[20]	6G Wireless Networks: Vision, Requirements, Architecture, and Key Technologies
1418	[21]	Edge Intelligence: Paving the Last Mile of Artificial Intelligence With Edge Computing
1294	[22]	Towards 6G wireless communication networks: vision, enabling technologies, and new paradigm shifts
989	[23]	Digital technology and COVID-19
909	[24]	Parallel convolutional processing using an integrated photonic tensor core
890	[25]	A Metaverse: Taxonomy, Components, Applications, and Open Challenges
884	[26]	Machine Learning Paradigms for Next-Generation Wireless Networks

Source: Publish or Perish Output, 2024

4.3 Keyword Co-Occurrence Analysis

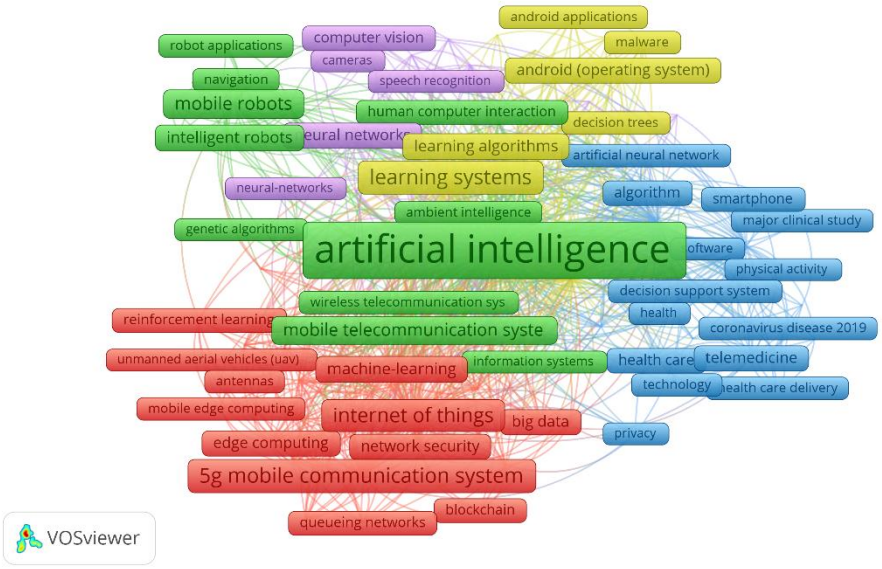

Figure 1. Network Visualization
Source: Data Analysis Result, 2024

This visualization maps the co-occurrence of keywords in research related to artificial intelligence (AI) in mobile applications and public services. The central and largest node, "artificial intelligence," indicates its dominant role as the core focus of the research domain. Surrounding this node, several clusters represent different thematic areas of study, connected through lines that illustrate the relationships and overlaps between these topics. The strength of the connections between nodes indicates the frequency with which these keywords co-occur in the same studies, highlighting interdisciplinary and cross-domain research trends.

The green cluster, anchored by terms such as "learning systems," "intelligent robots," and "neural networks," focuses on AI

technologies and their underlying algorithms. These terms suggest a concentration of studies that delve into the technical development of AI models, emphasizing areas like learning algorithms and robotic applications. This cluster reflects the technological backbone of AI integration, particularly in intelligent decision-making systems and autonomous devices. The prominence of this cluster underscores its foundational role in advancing mobile applications and public services.

The red cluster, centered on "internet of things (IoT)" and "5G mobile communication system," represents the technological infrastructure enabling AI applications. The inclusion of terms such as "edge computing," "blockchain," and "big data" points to the critical interplay between AI and IoT in creating smart systems for real-time processing and secure data management. This cluster highlights how advancements in connectivity and data infrastructure facilitate the deployment of AI in diverse contexts, including mobile applications. Its strong connections to other clusters emphasize the dependence of AI-powered mobile applications on robust telecommunication systems.

The blue cluster focuses on application domains, particularly healthcare, as evidenced by keywords such as "telemedicine," "health care," and "decision support systems." This thematic area reflects the role of AI-powered mobile applications in addressing critical public service needs, especially in healthcare delivery and pandemic response (e.g., "coronavirus disease 2019"). This cluster highlights the practical benefits of AI in improving access, efficiency, and personalization in public services. Its interconnection with other clusters showcases the multidisciplinary nature of AI applications, which draw on technical innovations, infrastructure, and user-centered design to address societal challenges.

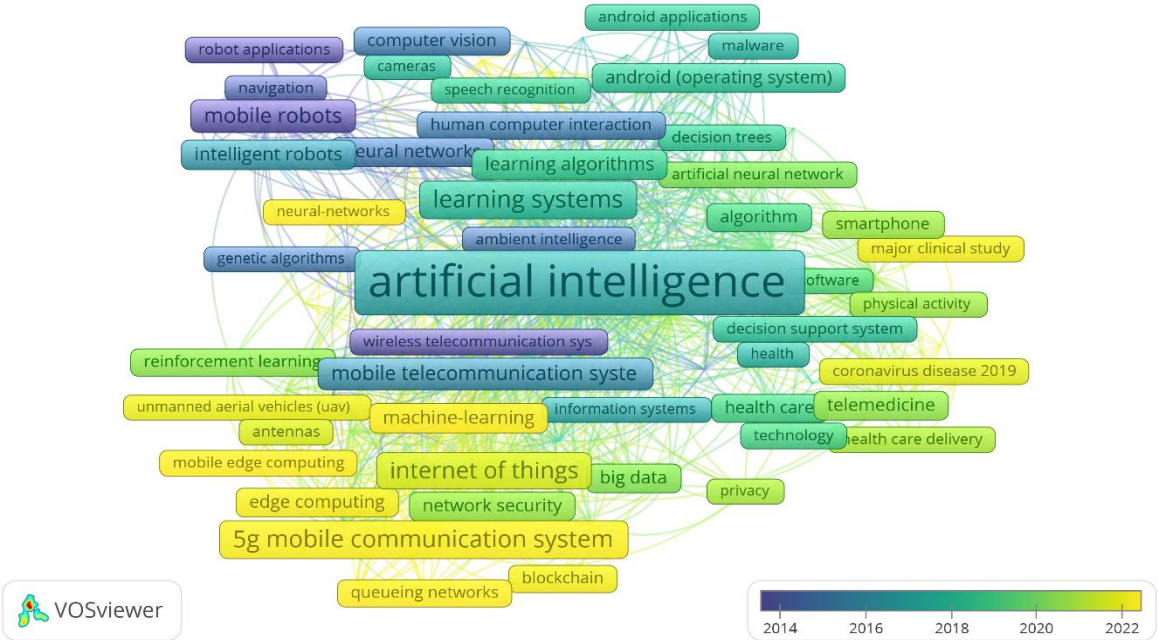

Figure 2. Overlay Visualization

Source: Data Analysis Result, 2024

This visualization represents the co-occurrence of keywords in research focused on artificial intelligence (AI) in mobile applications, highlighting trends over time using a color-coded timeline. The central and most prominent node, "artificial intelligence," reflects its dominant position in the research landscape. The color gradient indicates the

evolution of topics from earlier studies (purple, representing research around 2014) to more recent themes (yellow, representing studies around 2022). This chronological insight reveals how research in this field has progressively evolved to include emerging technologies and application areas.

The purple nodes, such as "neural networks," "intelligent robots," and "computer vision," represent foundational topics that were widely explored in earlier years. These terms indicate the initial focus on core AI technologies and algorithms. Early studies likely concentrated on building the theoretical and technical frameworks necessary for AI development. The importance of these foundational areas continues, as they form the backbone for more applied research on AI in mobile applications and public services.

In contrast, the yellow and green nodes, including "5G mobile communication system," "telemedicine," and "coronavirus disease 2019," signify more recent areas of research interest. These keywords highlight how AI research has shifted toward practical applications, particularly in response to real-world challenges such as the COVID-19 pandemic and advancements in connectivity infrastructure. The integration of AI with technologies like IoT, edge computing, and blockchain is another key development in recent years, reflecting the growing emphasis on creating scalable, secure, and efficient solutions. The color-coded timeline underscores the dynamic nature of this research field, showcasing its adaptation to evolving societal and technological needs.

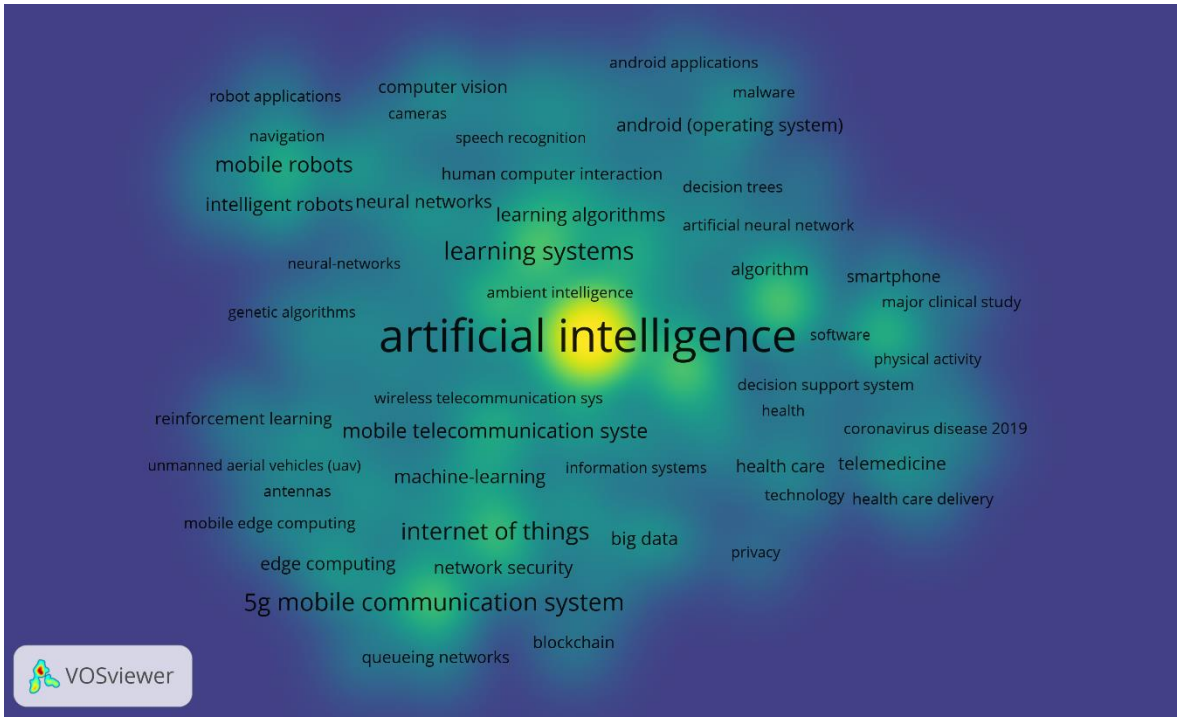

Figure 3. Density Visualization

Source: Data Analysis, 2024

This heatmap visualization highlights the intensity of research focus on keywords related to artificial intelligence (AI) in mobile applications. The central and brightest area, around "artificial intelligence," indicates that it is the most frequently discussed and connected topic in this domain. Surrounding terms such as "learning systems," "machine learning," and "internet of things" also show high levels of intensity, reflecting their centrality and importance in current research. The color gradient transitions from bright yellow (high research intensity) to darker green and blue (lower intensity), visually

emphasizing which areas are most frequently explored.

The peripheral terms, such as "unmanned aerial vehicles (UAV)," "edge computing," and "android applications," display lower research intensity, suggesting that these areas, while relevant, are less dominant in the field. Notably, terms such as "telemedicine," "health care delivery," and "coronavirus disease 2019" indicate recent and growing research interest, aligning with the increased role of AI in public health during global crises. This heatmap effectively captures the research landscape, emphasizing core areas of focus while also shedding light on emerging topics that may gain traction in the near future.

Discussion

1. Overview of Research Trends

The findings from this bibliometric study highlight the rapid evolution of research on artificial intelligence (AI) in mobile applications aimed at improving public service efficiency. The upward trend in publications, particularly since 2018, signifies a growing recognition of the transformative potential of AI technologies in public service delivery. This surge corresponds with technological advancements and societal shifts, such as the widespread adoption of 5G, IoT, and edge computing, as well as global events like the COVID-19 pandemic. The pandemic acted as a catalyst, driving the adoption of AI-enabled solutions to address public health challenges, evident in the frequent co-occurrence of keywords like "telemedicine," "health care delivery," and "coronavirus disease 2019." This discussion explores the implications of these trends, research gaps, challenges, and opportunities for future studies.

2. Core Technologies Driving Innovation

The centrality of "artificial intelligence" and related terms such as "machine learning," "neural networks," and "learning systems" in the co-occurrence and heatmap visualizations underscores their foundational role in this research domain. AI technologies form the backbone of innovative mobile applications, enabling functionalities like predictive analytics, real-time decision-making, and personalized service delivery. For example, machine learning algorithms are increasingly used in mobile health applications to provide remote diagnosis, monitor patient conditions, and optimize treatment recommendations. Similarly, neural networks power applications such as speech recognition and computer vision, which are integral to creating more intuitive and user-friendly interfaces for public service platforms.

The findings also emphasize the role of enabling technologies like IoT, 5G mobile communication systems, and edge computing. These technologies provide the necessary infrastructure for AI-driven mobile applications, ensuring seamless data collection, processing, and communication. For instance, IoT sensors integrated with AI can monitor environmental conditions in smart cities, while 5G networks facilitate real-time data exchange, critical for applications requiring high-speed communication, such as autonomous vehicles or disaster response systems. The convergence of these technologies highlights a multidisciplinary approach to innovation, blending AI with communication, data management, and system design.

3. Practical Applications and Societal Impact

The results reveal a strong focus on healthcare applications, as indicated by the frequent co-occurrence of terms like "telemedicine," "health care delivery," and "decision support system." This aligns with global trends, where AI-powered mobile applications have been instrumental in addressing public health challenges, particularly during the COVID-19 pandemic. Applications such as AI-driven symptom checkers, remote patient monitoring systems, and vaccine scheduling platforms have demonstrated the potential of mobile technologies to enhance accessibility,

efficiency, and equity in public health services. These developments underscore the critical role of AI in addressing societal challenges, particularly in resource-constrained settings.

Beyond healthcare, the findings suggest growing interest in other domains, such as smart cities, transportation, and governance. Keywords like "intelligent robots," "navigation," and "internet of things" reflect efforts to leverage AI for public service delivery in urban environments. For instance, AI-powered mobile applications are used in public transportation to optimize routes, reduce congestion, and enhance commuter experiences. In governance, mobile apps integrated with AI enable real-time citizen feedback, participatory decision-making, and streamlined administrative processes, fostering greater transparency and accountability.

4. Ethical and Technical Challenges

While the study highlights the promising potential of AI in mobile applications, it also underscores significant challenges that need to be addressed. One critical issue is data privacy and security, as mobile applications often collect and process large volumes of sensitive user data. The co-occurrence of terms like "privacy" and "network security" indicates ongoing concerns in this area. Ensuring robust data protection mechanisms and transparent data use policies is essential to build public trust in AI-powered systems. Another challenge is the ethical use of AI, particularly in addressing algorithmic bias and ensuring accountability. Research has shown that biased AI models can exacerbate existing inequalities, leading to discriminatory outcomes in public service delivery. For instance, biased algorithms in healthcare applications may fail to provide equitable recommendations for minority groups, undermining the inclusivity of these services. Addressing these issues requires a multidisciplinary approach involving technologists, ethicists, and policymakers to develop frameworks for ethical AI design and implementation. Technical limitations also pose significant barriers, particularly in regions with inadequate digital infrastructure. The adoption of advanced AI features often requires high-speed internet connectivity, substantial computational power, and reliable communication networks. These requirements may not be met in developing regions, limiting the scalability and accessibility of AI-powered mobile applications. The findings suggest a need for localized solutions that account for these constraints, such as lightweight AI models and decentralized data processing techniques.

Research Gaps and Future Directions

The bibliometric analysis reveals several gaps in the existing literature that present opportunities for future research. First, while there is a strong focus on healthcare applications, other critical public service domains, such as education, disaster management, and rural development, remain underexplored. Expanding research into these areas could provide valuable insights into the broader applicability of AI-powered mobile applications. Second, the lack of longitudinal studies examining the long-term impact of AI in public service delivery is evident. Most existing research focuses on short-term benefits, such as cost savings and operational efficiency, without assessing the sustained effects on societal outcomes, such as equity, trust, and inclusivity. Conducting longitudinal studies could provide a more comprehensive understanding of the transformative potential of AI in public services. Third, while ethical considerations are frequently discussed, there is a lack of practical frameworks for implementing ethical AI in mobile applications. Developing actionable guidelines for addressing issues such as bias, accountability, and transparency is crucial to ensure that AI technologies align with societal values. Future research could focus on creating and testing these frameworks in real-world settings.

Opportunities for Interdisciplinary Collaboration

The interconnectedness of keywords in the co-occurrence map highlights the multidisciplinary nature of research in this field. Advancing AI-powered mobile applications for public service requires collaboration between various disciplines, including computer science, data science, social sciences, and public administration. For instance, while technologists can develop advanced algorithms, social scientists can study user behavior and adoption patterns, and policymakers can create regulatory frameworks to ensure ethical implementation. The findings also suggest opportunities for collaboration between academia, industry, and government. Industry partners can provide technological expertise and resources, while governments can facilitate large-scale deployments and ensure alignment with public service goals. Academia, in turn, can contribute to knowledge creation and evidence-based policymaking. Strengthening these partnerships is critical to translating research findings into practical solutions that benefit society.

Implications for Policymakers and Practitioners

The insights from this study have several implications for policymakers and practitioners aiming to harness AI in public service delivery. Policymakers should prioritize investments in digital infrastructure, particularly in underserved regions, to enable the adoption of AI-powered mobile applications. Developing standardized data governance frameworks is also essential to address privacy and security concerns and ensure the ethical use of AI. For practitioners, the findings underscore the importance of user-centered design in developing mobile applications. Ensuring that these applications are accessible, intuitive, and responsive to user needs can significantly enhance adoption rates and impact. Practitioners should also consider the local context when designing AI-powered systems, as generic solutions may not address region-specific challenges effectively.

5. CONCLUSION

This study provides a comprehensive bibliometric analysis of the evolution of artificial intelligence (AI) in mobile applications for improving public service efficiency. The findings reveal a significant growth in research output over the past decade, driven by advancements in AI technologies, infrastructure such as IoT and 5G, and societal challenges like the COVID-19 pandemic. Key areas of focus include healthcare, smart cities, and governance, where AI-powered mobile applications have demonstrated their potential to enhance accessibility, responsiveness, and equity in service delivery. However, challenges such as data privacy, algorithmic bias, and technical limitations remain pressing concerns. Addressing these issues requires multidisciplinary collaboration, ethical frameworks, and localized solutions to ensure inclusive and sustainable implementation. This study highlights the need for continued research to expand AI applications in underexplored public service domains, assess long-term societal impacts, and bridge gaps in infrastructure and accessibility, paving the way for smarter and more equitable public services worldwide.

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