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AI for Tourism: State of the Art

Claudio Rossi

*Dipartimento di Economia; Università degli Studi di Perugia; claudio@eurosoftlab.com
<https://orcid.org/0000-0003-2270-6322>*

Abstract: Tourism is one of the most important sectors of the global economy, generating billions of euros in revenue and supporting millions of jobs. However, the tourism industry also faces many challenges, such as changing consumer preferences, environmental impacts and competitive pressures. In this paper, we explore how specialized and generative AI, a branch of artificial intelligence that can create novel content, such as text, images, or audio, can support hotels and other tourist accommodation companies in enhancing their products and services, improving their marketing and communication strategies and optimizing their operations and management. We review the existing literature on AI and its applications in tourism and propose potential use cases of generative AI for tourist companies. We also present some examples of generative AI tools that can be used for these purposes and discuss their benefits and limitations. Finally, we offer some conclusions and future implications for research and practice in this emerging field.

Theoretical implications of the present paper suggest that the incorporation of generative AI in the tourism sector can significantly advance the current understanding of AI applications in service industries. By leveraging machine learning techniques, such as deep neural networks and generative adversarial networks, the tourism industry can create novel content and optimize various operations. This study enriches existing literature by identifying new use cases for generative AI, thus providing a foundation for further academic inquiry. Practically, our findings reveal several actionable insights for tourism companies. Generative AI tools can be harnessed to personalize customer experiences, enhance marketing efforts, and streamline operational management.

Keywords: *Artificial Intelligence; Generative Artificial Intelligence; Operational Management; Customer Satisfaction; Personalized Travel.*

JEL Codes: L83; O33; M15; C45; M31; L26

1. Introduction

Tourism is one of the most dynamic and diverse sectors of the global economy, contributing to about 10% of the world's gross domestic product (GDP) and employment, according to the World Tourism Organization (UNWTO, 2019).

Tourism also plays a vital role in promoting cultural exchange, social development and environmental conservation. However, the tourism industry also faces many challenges, such as changing consumer preferences, environmental impacts and competitive pressures. These challenges require tourism businesses to constantly innovate and adapt to the evolving market and societal demands, as well as to leverage the opportunities offered by new technologies and digitalization.

One of the key components of the tourism industry is the accommodation sector, which includes hotels, resorts, bed and breakfasts, hostels and other forms of lodging for tourists. The accommodation sector accounts for about 20% of the total tourism revenues and employment and has a significant influence on the quality and satisfaction of the tourist experience (UNWTO, 2019). Therefore, it is crucial for accommodation providers to enhance their products and services, improve their marketing and communication strategies and optimize their operations and management, in order to attract and retain customers, increase their profitability and competitiveness and create positive social and environmental impacts.

Generative AI is a relatively new and emerging field of research, which aims to create novel and realistic content, such as text, images, or audio, using machine learning techniques, such as deep neural networks, generative adversarial networks, or variational autoencoders (Goodfellow et al., 2020; Kingma & Welling, 2014). Generative AI has various applications in different domains, such as computer vision, natural language processing, speech synthesis, music generation, art and design (CAO et al., 2020).

Artificial intelligence (AI), defined as the ability of machines to perform tasks that require human intelligence, such as reasoning, learning and creativity (Russell & Norvig, 2016), is one of the most promising technologies that can help tourism businesses achieve these goals. AI can provide various benefits for tourism businesses, such as increasing efficiency and productivity, reducing costs and errors, improving decision making and planning, personalizing and customizing offers and experiences and enhancing customer loyalty and satisfaction (Buhalis & Sinarta, 2019). AI can also enable tourism businesses to generate novel and valuable content, such as text, images, or audio, that can be used for various purposes, such as creating new products and services, improving marketing and communication strategies and optimizing operations and management. This branch of AI is known as generative AI.

In this paper, we explore how generative AI can support hotels and other tourist companies in enhancing their products and services, improving their marketing and communication strategies and optimizing their operations and management. We review the existing literature on AI and its applications in tourism and propose some potential use cases of generative AI for tourist accommodation providers. We also present some examples of generative AI tools that can be used for these purposes and discuss their benefits and limitations. Finally, we offer some conclusions and future implications for research and practice in this emerging field.

1.1 Research design and methodology

This paper explores how generative AI can support hotels and other tourist accommodation companies in enhancing their products and services, improving their marketing and communication strategies, and

optimizing their operations and management. The research design involves a comprehensive review of the existing literature on AI and its applications in tourism.

The author proposes potential use cases of generative AI for tourist companies and presents examples of generative AI tools that can be used for these purposes. He also discusses the benefits and limitations of these tools and offers conclusions and future implications for research and practice in this emerging field.

The research method includes reviewing the existing literature on AI and its applications in tourism, proposing potential use cases of generative AI for tourist accommodation providers, and presenting examples of both generative and specialized AI tools. The application of AI in tourism accommodation and touristic destinations is still at an early stage, but this paper will explore the state-of-the-art technologies applied to tourism and will propose both practical applications and future scenarios.

The author discusses the benefits and limitations of these tools and offers conclusions and future implications for research and practice in this emerging field.

2. Generative AI

Generative AI is a subset of AI that aims to create new content or data that is not directly derived from existing data, but rather follows the patterns and distributions learned from the data (Goodfellow et al., 2020). Generative AI can be seen as a form of artificial creativity, as it can produce novel and original content that can be useful or appealing for humans. Generative AI can also be seen as a form of artificial augmentation, as it can enhance or complement human creativity and capabilities. Generative AI can be applied to various domains and modalities, such as natural language, images, audio, video, music, art, design and games.

Generative models are probabilistic models that learn the underlying distribution of the data and can generate new data samples from that distribution. Generative models can be further divided into two categories: parametric and non-parametric models. Parametric models assume a fixed and predefined form of the distribution, such as a Gaussian or a mixture of Gaussians and estimate the parameters of the distribution from the data. Examples of parametric generative models include hidden Markov models (HMMs), Bayesian networks and Gaussian mixture models (GMMs). Non-parametric models do not assume a fixed form of the distribution, but rather infer it from the data. Examples of non-parametric generative models include kernel density estimation (KDE), Dirichlet process and Gaussian process (GP).

One of the most popular and powerful types of generative models is the large language model (LLM), which is a neural network that learns to predict the next word or token in a sequence of text, given the previous words or tokens. LLMs can be trained on large amounts of text from various sources and domains, such as books, news articles, social media posts, web pages and scientific papers, and can generate coherent and diverse texts on various topics and styles, given a prompt or a context. LLMs can also perform various natural language processing (NLP) tasks, such as text summarization, machine translation, question answering, sentiment analysis and text classification, by using different input formats or prefixes (Brown et al., 2020).

LLMs are based on the transformer architecture, which is a type of neural network that relies on self-attention mechanisms to encode and decode sequences of text, without using recurrent or convolutional layers. Transformers can capture long-range dependencies and complex relationships among words or tokens and can handle variable-length inputs and outputs. Transformers can also be pre-trained on large-scale unlabeled text data and fine-tuned on specific downstream tasks with labeled data, which can improve their performance and generalization (Vaswani et al., 2017).

Some of the most well-known and widely used LLMs include GPT-3, BERT, XLNet, T5 and DALL-E. GPT-3 is a generative pre-trained transformer model that can generate fluent and diverse texts on various topics and styles, given a prompt or context. GPT-3 has 175 billion parameters and was trained on 45 terabytes of text data from the internet, which covers a wide range of domains and languages. GPT-3 can perform various NLP tasks, such as text summarization, machine translation, question answering, sentiment analysis and text classification, by using different input formats or prefixes. GPT-3 can also generate non-textual content, such as images, diagrams, or tables, by using text descriptions or ASCII codes (Brown et al., 2020). BERT is a bidirectional encoder representation from transformers model that can encode both the left and the right context of a word or a token and can generate a vector representation for each word or token in a sequence of text. BERT has 340 million parameters and was trained on 16 gigabytes of text data from Wikipedia and BookCorpus, which covers mainly English language and general domain knowledge. BERT can perform various NLP tasks, such as text summarization, machine translation, question answering, sentiment analysis and text classification, by using different input formats or prefixes and by adding an additional output layer for each task (Devlin et al., 2019).

2.1. *AI for tourism*

Tourism is a complex and multifaceted phenomenon, involving various stakeholders, activities, destinations, cultures and preferences. Therefore, tourism poses many challenges and opportunities for data analysis, modeling and decision making, which can benefit from the application of generative AI techniques.

Generative AI can be used to create novel and realistic content related to tourism, such as images, videos, texts, sounds, or maps, which can enhance the quality and diversity of the tourism experience. For example, generative AI can be used to synthesize virtual tours of historical sites, generate personalized travel recommendations, create realistic simulations of natural environments, or produce artistic renditions of tourist attractions. Moreover, AI can be used to analyze and understand the behavior and preferences of tourists, such as their travel patterns, motivations, satisfaction and feedback, which can help optimize the design and management of tourism products and services. For example, AI can be used to model the demand and supply of tourism resources, segment and profile the tourism market, predict the impact of tourism on the environment and society, or generate actionable insights for tourism policy and planning.

2.1.1. Parametric generative models for tourism

Parametric generative models assume a fixed and predefined form of the data distribution and estimate the parameters of the distribution from the data. Some of the common parametric generative models used for tourism are Hidden Markov Models (HMMs), Bayesian networks and Gaussian Mixture Models (GMMs).

HMMs are probabilistic models that capture the sequential and temporal dependencies of discrete data, such as texts or symbols. HMMs have been used to model the travel behavior and preferences of tourists, based on their sequences of visited locations, activities, or preferences. For example, Yuan et al. (2014) proposed a latent topic HMM to discover the latent travel topics and patterns of tourists from their trajectories. Yuan et al. (2019) proposed a multi-dimensional HMM to model the temporal, spatial and semantic aspects of tourist mobility. Pan et al. (2016) proposed a probabilistic latent preference analysis model, which combines HMM and latent Dirichlet allocation (LDA), to infer the latent preferences of tourists from their check-in data.

Bayesian networks are probabilistic graphical models that capture the conditional dependencies and causal relationships of variables, such as attributes, features, or ratings. Bayesian networks have been used to model the tourism demand and supply, based on the factors that influence the decision making of tourists and providers. For example, Chang et al. (2021) proposed a model to predict the hotel occupancy rate, based on hotel customer reviews, room prices, occupancy rates and other hotel data. Roumiani et al. (2022) proposed a neural network to estimate the tourism carbon footprint. Hsu et al. (2019) proposed a Bayesian network to analyze the satisfaction and loyalty of tourists, based on their expectations, perceptions and emotions.

GMMs are probabilistic models that assume that the data are generated from a mixture of Gaussian distributions, each representing a cluster or a component. GMMs have been used to segment and profile the tourism market, based on the similarities and differences of tourists in terms of their demographics, behaviors, or preferences. For example, Zheng and Zhang (2023) proposed a model that combines gray models and neural networks to predict tourism demand, based on factors like tourism price and exchange rate. Kim, M. J., Hall, C. M. & Chung N. (2023) proposed a mixed method approach to explore the roles of AI and smart apps in influencing public transport usage among different age and gender groups for domestic tourism.

2.1.2. Non-parametric generative models for tourism

Non-parametric generative models do not assume a fixed form of the data distribution, but rather infer it from the data. Some of the common non-parametric generative models used for tourism are Kernel Density Estimation (KDE), Dirichlet process and Gaussian Processes (GPs).

KDE is a non-parametric method that estimates the density of the data by placing a kernel function, such as a Gaussian or a uniform, at each data point. KDE has been used to generate and visualize the spatial distribution of tourists, based on their locations or trajectories. For example, Liang, Ahmad & Mohidin (2023) used a KDE to explore the distribution on points of interest (POI), demonstrating that the spatial distribution is significantly influenced by social economy, industrial base, transportation conditions, tourism market, and natural resources. Scholz & Jeznik (2020) used a KDE methodology to study tourists' distribution and sentiment, based on Twitter data. Lee & Tsou (2018) proposed a KDE based methodology to study geo-tagged photos posted on Flickr social network and collected by tourists, demonstrating how the tourists' movement pattern changes according to the season.

Dirichlet process is a non-parametric Bayesian model that allows the number of components or clusters to grow with the data. Dirichlet process has been used to discover and analyze the latent topics or themes of tourism texts, such as reviews, blogs, or news. For example, Sutherland et al. (2020) proposed a Dirichlet based model to combine topic modeling and sentiment analysis to forecast hotel demand. Afaq, Gaur & Singh (2022) proposed a Dirichlet mixed model to perform topic modeling and sentiment analysis on online reviews of global chain hotels.

GP is a non-parametric Bayesian model that defines a prior distribution over the functions that map the inputs to the outputs, such as regression or classification functions. GP has been used to predict and optimize the tourism performance and outcomes, based on the input factors or features. For example, Wu et al. (2012) proposed a GP regression model to forecast the tourism demand, based on different historical data (prices in destination, transportation costs and others).

3. AI applications for small touristic companies

Most of the proposed studies focus on the application of AI to tourism in the territories, but AI, especially the new low-cost system like OpenAI ChatGPT, Microsoft Copilot and other similar generative AIs, can be successfully applied even to medium or small touristic companies, which face various challenges and opportunities in the competitive and dynamic tourism industry.

One of the most interesting applications of generative AI is to create personalized and tailored travel products and services for tourists, based on their preferences, needs, and expectations. For example, generative AI can be used to generate customized itineraries, recommendations, or offers, based on the tourists' profiles, interests, and feedback. This can enhance the customer satisfaction and loyalty, as well as increase the revenue and profitability of the touristic companies.

Another application of generative AI is to generate engaging and attractive content and media for marketing and promotion purposes, such as images, videos, texts, or audio. For example, generative AI can be used to synthesize realistic and high-quality images or videos of touristic destinations, attractions, or activities, based on the tourists' preferences or emotions. This can enhance the appeal and attractiveness of the touristic products and services, as well as stimulate the curiosity and imagination of the tourists.

AI-powered recommendation systems can analyze customer data to provide personalized travel suggestions tailored to individual preferences and past behavior. This helps small companies deliver a more engaging customer experience and increase sales. For example, a small travel agency can use an AI system to generate customized travel packages for each customer, based on their budget, destination, activities, and feedback. The system can also send personalized notifications and reminders to the customers, such as weather updates, travel tips, or special offers. This can improve customer retention and loyalty, as well as generate word-of-mouth referrals.

AI chatbots and virtual assistants can provide 24/7 customer support, answer common queries, and even help with booking and planning. This improves responsiveness and frees up staff time for other tasks. For example, a small hotel can use an AI chatbot to interact with potential guests, answer their questions about the facilities, amenities, and rates, and help them make reservations and payments. The chatbot can also send confirmation emails, check-in instructions, and welcome messages to the guests, as well as provide them with local information and tips during their stay.

AI can automate repetitive tasks like revenue management, inventory control, and customer segmentation. This streamlines operations and reduces costs for small companies with limited resources. For example, a small restaurant can use an AI system to analyze the customer demand, adjust the menu prices, and optimize the food inventory, based on the season, weather, and events. This can improve the profitability and efficiency of the restaurant, as well as reduce food waste and environmental impact.

AI algorithms can monitor online reviews and social media to detect customer sentiment and identify areas for improvement. This provides valuable feedback for small businesses to enhance their offerings. For example, a small tour operator can use an AI system to analyze the reviews and ratings of its customers on platforms like TripAdvisor, Facebook, or Twitter, and identify the strengths and weaknesses of its services, such as the quality of the guides, the itinerary, the accommodation, etc.

AI enables small companies to deliver highly targeted and relevant marketing messages to potential customers, increasing campaign effectiveness and return on investment. By using AI algorithms to analyze customer data, such as demographics, behavior, preferences, and feedback, small companies can segment their audience and tailor their messages to suit their needs and interests. For example, a small travel agency can use an AI system to generate personalized emails for each customer, highlighting the benefits and

features of the travel products or services that match their profile and budget. This can increase the conversion rate and customer loyalty, as well as reduce the marketing costs and efforts.

These are some of the examples of how AI can be applied for small touristic companies, which can benefit from the advantages and opportunities of generative AI, such as data augmentation, pattern discovery, knowledge extraction, and content creation. However, these applications also require careful consideration and evaluation of the quality, reliability, and ethics of the generative models and their outputs, as well as the alignment with the goals and values of the touristic companies and their customers.

While AI adoption may require upfront investment, the benefits in terms of improved customer experience, operational efficiency, and competitiveness can be significant for small tourism businesses. Partnering with AI solution providers or leveraging off-the-shelf tools can make the technology accessible even for resource-constrained small companies.

4. Discussion

AI is a rapidly evolving field that offers many opportunities and challenges for creating new data samples from existing data. The main benefits of AI are that it can augment the existing data and enhance the performance and robustness of various tasks, such as image synthesis, natural language generation, data analysis, etc. It can also learn the underlying patterns and distributions of the data and enable the discovery of new insights and knowledge, such as latent factors, causal relationships, hidden features, etc. Furthermore, it can enable the exploration and creation of novel and artistic data samples that can stimulate human creativity and innovation, such as style transfer, image manipulation, text rewriting, etc., all of which can contribute to great enhancements in work patterns for every kind of touristic company.

However, AI also has some drawbacks that need to be addressed. It may suffer from mode collapse, overfitting, and lack of diversity and quality, which may affect the reliability and usefulness of the generated data samples. Moreover, it may generate unrealistic, inaccurate, or inappropriate data samples that may mislead or harm the users or consumers, such as fake news, spam, etc.

AI has the potential to impact various domains and sectors, providing new value and benefits for society. However, it also raises several ethical and social issues that need to be considered and addressed.

Firstly, there is the question of how to ensure the fairness, accountability, and transparency of generative models and the data samples they generate, especially when used for decision-making, recommendation, or persuasion purposes. This involves developing mechanisms to audit and explain the outputs of these models to prevent biases and ensure they are used responsibly.

Secondly, protecting the privacy, security, and ownership of data and generated data samples is crucial, particularly when they involve sensitive or personal information or intellectual property rights. This requires robust data protection measures and clear policies on data usage and ownership.

Thirdly, preventing the misuse or abuse of generative models and their outputs is essential, especially when they could be used for malicious or unethical purposes, such as deception, manipulation, or exploitation. This involves implementing safeguards and monitoring systems to detect and prevent such activities.

Lastly, balancing the roles and responsibilities of humans and machines in the generative process is important, especially when it involves human creativity, expression, or judgment. This requires a thoughtful approach to integrating AI into creative processes, ensuring that human input and oversight are maintained.

By addressing these issues, we can harness the potential of generative AI while mitigating its risks and ensuring it is used ethically and responsibly. These are some of the questions and challenges that need

to be addressed by the generative AI community and the stakeholders, in order to ensure the responsible and beneficial use of AI for the common good.

The following tables show how AI has been used in tourism, to analyze tourists behavior and to forecast touristic demand. All these studies used AI to create dedicated applications to resolve specific problems, generating extremely useful tools for touristic destinations or big touristic companies, but this kind of approach can hardly be used by small companies because it requires in-depth knowledge or significant investment to acquire the required knowledge.

Model	Author	Year	Application
HMM	Yuan et al.	2014	Travel behavior and preferences
HMM	Yuan et al.	2019	Temporal, spatial, and semantic aspects of tourist mobility
HMM & LDA	Pan et al.	2016	Latent preferences from check-in data
Bayesian Network	Chang et al.	2021	Hotel occupancy rate prediction
Neural Network	Roumiani et al.	2022	Tourism carbon footprint estimation
Bayesian Network	Hsu et al.	2019	Satisfaction and loyalty analysis
Gray Models & Neural Networks	Zheng and Zhang	2023	Tourism demand prediction
Mixed Method	Kim et al.	2023	AI and smart apps' influence on public transport usage

Table 1: Parametric models used in tourism

Model	Author	Year	Application
KDE	Liang et al.	2023	Analyze spatial distribution of POI
KDE	Scholz & Jeznik	2020	Study tourists' distribution and sentiment
KDE	Lee & Tsou	2018	Study geo-tagged photos
Dirichlet process	Sutherland et al.	2020	Perform topic modeling and sentiment analysis on online reviews
Dirichlet process	Afaq et al.	2022	Perform topic modeling and sentiment analysis on online reviews
GP	Wu et al.	2012	Forecast the tourism demand,

Table 2: Non-parametric models used in tourism

Unlike the tools presented in previous tables, the new generative AI tools, like ChatGPT, don't require in-depth knowledge to be used and are free to use or require small fees to be used, this could be the beginning of a new era of tools used by small touristic companies to create a wide range of services for their customers, or to relieve employees from repetitive or time-consuming tasks.

In the next future, generative AI tools will likely expand their capabilities, allowing touristic firms to leverage these tools and integrating those tools into their process, reducing operational costs and offering more advanced services to their customers.

5. Conclusions and Future Implications

In this paper, we have provided a comprehensive overview and analysis of specialized and generative AI, a novel and exciting field of research and practice that aims to create new data samples from existing data.

We have introduced the main concepts and methods of generative AI and reviewed their applications and evaluations in various domains and tasks related to touristic companies and territories. We have also discussed the current state-of-the-art and the future prospects of AI and highlighted some of the key challenges and opportunities for further development.

We hope that this paper will serve as a useful reference and guide for researchers, practitioners and students who are interested in or working on AI and inspire them to explore new possibilities and solutions for generating realistic and diverse data samples. AI has the potential to transform many fields and industries and to create new value and opportunities for society. However, it also poses some ethical and social risks and challenges that need to be carefully considered and addressed. This paper aims to raise awareness and stimulate discussion on the responsible and beneficial use of generative AI for the common good.

Conflict of interest

All authors declare no conflicts of interest in this paper.

References

- Afaq, A., Gaur, L., & Singh, G. (2022). A latent Dirichlet allocation technique for opinion mining of online reviews of global chain hotels. In *Proceedings of the 3rd International Conference on Intelligent Engineering and Management (ICIEM)*. <https://doi.org/10.1109/ICIEM54221.2022.9853114>
- Brown, T., Mann, B., Ryder, N., Subbiah, M., Kaplan, J., Dhariwal, P., Neelakantan, A., Shyam, P., Sastry, G., Askell, A., ... Amodei, D. (2020). Language models are few-shot learners. *arXiv* (arXiv:2005.14165v4). <https://arxiv.org/abs/2005.14165v4>
- Buhalis, D., & Sinatra, Y. (2019). Real-time co-creation and nowness service: Lessons from tourism and hospitality. *Journal of Travel & Tourism Marketing*, 36(5), 563–582. <https://doi.org/10.1080/10548408.2019.1592059>
- Cao, Y., Li, L., Liu, Y., Yan, Z., Dai, Y., Yu, P., & Sun, L. (2023). A comprehensive survey of AI-generated content (AIGC): A history of generative AI from GAN to ChatGPT. *arXiv* (arXiv:2303.04226v1). <https://arxiv.org/abs/2303.04226v1>
- Chang, Y., Chen, C., Lai, J., Lin, Y., & Pai, P. (2021). Forecasting hotel room occupancy using long short-term memory networks with sentiment analysis and scores of customer online reviews. *Applied Sciences*, 11(21), Article 10291. <https://doi.org/10.3390/app112110291>
- Devlin, J., Chang, M.-W., Lee, K., & Toutanova, K. (2019). BERT: Pre-training of deep bidirectional transformers for language understanding. *arXiv* (arXiv:1810.04805v2). <https://doi.org/10.48550/arXiv.1810.04805>
- Goodfellow, I., Pouget-Abadie, J., Mirza, M., Xu, B., Warde-Farley, D., Ozair, S., Courville, A., & Bengio, Y. (2020). Generative adversarial networks. *Communications of the ACM*, 63(11), 139–144. <https://doi.org/10.1145/3422622>
- Hsu, C., Shih, M., Huang, B., Lin, B., & Lin, C. (2009). Predicting tourism loyalty using an integrated Bayesian network mechanism. *Expert Systems with Applications*, 36(9), 11760–11763. <https://doi.org/10.1016/j.eswa.2009.04.010>
- Kim, M. J., Hall, C. M., & Chung, N. (2023). The influence of AI and smart apps on tourist public transport use: Applying mixed methods. *Information Technology & Tourism*, 26, 1–24.

- <https://doi.org/10.1007/s40558-023-00272-x>
- Kingma, D. P., & Welling, M. (2014). Efficient gradient-based inference through transformations between Bayes nets and neural nets. In E. P. Xing, & T. Jebara (Eds.), *Proceedings of the 31st International Conference on Machine Learning* (pp. II-1782–II-1790). Retrieved from <https://dl.acm.org/doi/10.5555/3044805.3045091>
- Lee, J., & Tsou, M. (2018). Mapping spatiotemporal tourist behaviors and hotspots through location-based photo-sharing service (Flickr) data. In P. Kiefer, H. Huang, N. Van de Weghe, M. Raubal (Eds.), *Progress in Location Based Services 2018* (pp. 315–334). Springer. https://doi.org/10.1007/978-3-319-71470-7_16
- Liang, W., Ahmad, Y., & Mohidin, H. (2023). Spatial pattern and influencing factors of tourism based on POI data in Chengdu, China. *Environment, Development and Sustainability*, 26, 10127–10143. <https://doi.org/10.1007/s10668-023-03138-8>
- Pan, J., Rao, V., Agarwal, P., & Gelfand, A. (2018). Markov-modulated marked Poisson processes for check-in data. *PMLR*, 48, 2244–2253. Retrieved from <https://proceedings.mlr.press/v48/pana16.html>
- Roumiani, A., Shayan, H., Sharifinia, Z., & Moghadam, S. (2023). Estimation of ecological footprint based on tourism development indicators using neural networks and multivariate regression. *Environmental Science and Pollution Research*, 30, 88239. <https://doi.org/10.1007/s11356-023-28586-7>
- Russell, S., & Norvig, P. (2016). *Artificial intelligence: A modern approach*. Prentice Hall.
- Scholz, J., & Jeznik, J. (2020). Evaluating geo-tagged Twitter data to analyze tourist flows in Styria, Austria. *ISPRS International Journal of Geo-Information*, 9(11), Article 681. <https://doi.org/10.3390/ijgi9110681>
- Sutherland, I., Sim, Y., Lee, S., Byun, J., & Kiatkawsin, K. (2020). Topic modeling of online accommodation reviews via latent Dirichlet allocation. *Sustainability*, 12(5), Article 1821. <https://doi.org/10.3390/su12051821>
- Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A., & Kaiser, A. (2023). Attention is all you need. *arXiv* (arXiv:1706.03762v7). <https://doi.org/10.48550/arXiv.1706.03762>
- World Tourism Organization. (2019). *International tourism highlights: 2019 edition*. World Tourism Organization. <https://doi.org/10.18111/9789284421152>
- Wu, Q., Law, R., & Xu, X. (2012). A sparse Gaussian process regression model for tourism demand forecasting in Hong Kong. *Expert Systems with Applications*, 39(5), 4769–4774. <https://doi.org/10.1016/j.eswa.2011.09.159>
- Yuan, J., Liu, X., Zhang, R., Sun, H., Guo, X., & Wang, Y. (2014). Discovering semantic mobility pattern from check-in data. In B. Benatallah, A. Bestavros, Y. Manolopoulos, A. Vakali, & Y. Zhang (Eds.), *Web Information Systems Engineering -- WISE 2014: 15th International Conference, Thessaloniki, Greece, October 12-14, 2014, Proceedings, Part I* (pp. 464–479). Springer. https://doi.org/10.1007/978-3-319-11749-2_35
- Yuan, K., Cheng, X., Gui, Z., Li, F., & Wu, H. (2019). A quad-tree-based fast and adaptive kernel density estimation algorithm for heat-map generation. *International Journal of Geographical Information Science*, 33(12), 2455–2476. <https://doi.org/10.1080/13658816.2018.1555831>
- Zheng, S., & Zhang, Z. (2023). Adaptive tourism forecasting using hybrid artificial intelligence model: A case study of Xian international tourist arrivals. *PeerJ Computer Science*, 9, e1573. <https://doi.org/10.7717/peerj-cs.1573>