

## Chapter 2

# Deep Learning and Machine Learning Techniques for Analyzing Travelers' Online Reviews: A Review

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### **ABSTRACT**

*Social media platforms play a tremendous role in the tourism and hospitality industry. Social media platforms are increasingly becoming a source of information. The complexity and increasing size of tourists' online data make it difficult to extract meaningful insights using traditional models. Therefore, this scoping and comprehensive review aimed to analyze machine learning and deep learning models applied to model tourism data. The study revealed that deep learning and machine learning models are used for forecasting and predicting tourism demand using data from search query data, Google trends, and social media platforms. Also, the study revealed that data-driven models can assist managers and policymakers in mapping and segmenting tourism hotspots and attractions and predicting revenue that is likely to be generated, exploring targeting marketing, segmenting tourists based on their spending patterns, lifestyle, and age group. However, hybrid deep learning models such as inceptionV3, MobilenetsV3, and YOLOv4 are not yet explored in the tourism and hospitality industry.*

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## INTRODUCTION

The exponential growth of social media platforms plays a tremendous role in the hotel and tourism industry. Social media platforms such as TripAdvisor, Expedia, Facebook, YouTube, and Twitter together with electronic word of mouth (eWOM) are increasingly becoming a source of information in the tourism industry (Luo & Xu, 2021). Tourists share their experiences and opinions on social media platforms. These platforms provide tourists and travelers with a vast amount of information that subsequently influence their decision-making process. Travelers' user-generated data provides online reviews and ratings on information such as tourist destinations, security and safety, hospitality services, among others. Such travelers' online reviews and ratings could be utilized to improve services delivery, budgeting, improve customer experience, market segmentation, tourists forecasting, hotel room price and demand forecasting, predict tourists' behavior and make informed decisions. Owing to the dynamic business environment exacerbated by the outbreak of the coronavirus disease 2019 (COVID-19) pandemic (Chitungo et al., 2021; Mbunge, 2020), the hotel and tourism industry need to incorporate emerging technologies such as deep learning and machine learning techniques to address emerging challenges and exploring new opportunities by analyzing travelers' online reviews. Also, analyzing ever-increasing travelers' online reviews using conventional methods such as collaborative filtering recommender systems is highly computational intensive (Calheiros, Moro, & Rita, 2017), not scalable in the context of big data especially when online reviews become voluminous, variety, velocity, variability and veracity. To extract and utilize meaningful insights hidden in travelers' online reviews, there is a need for incorporating deep learning and machine learning techniques to predict tourists' behavior, tourists forecasting, demand forecasting, and for developing recommender systems for hotel recommendations and identification of deceptive reviews in e-tourism platforms.

In the tourism and hospitality industry, technology is evolving drastically, moving from generalized analysis to customers using traditional methods to the application of deeper and wider computing technologies. This is evidenced by the integration of emerging technologies such as deep learning and machine learning in the tourism and hospitality industry. Deep learning (DL) is a subfield of machine learning (ML) that involves the application of computing models inspired by biological neurons. Deep learning models are composed of multiple processing layers that learn representations of data with multiple levels of abstraction, to extract meaningful information from the dataset (Mbunge, Simelane, Fashoto, Akinnuwesi, & Metfula, 2021). DL models extract features through multiple layers of nonlinear processing units using either supervised or unsupervised learning (Mubarak, Cao, & Ahmed, 2021). Deep learning models have been greatly recognized in voice and speech recognition (Tu, et al., 2019), visual and object recognition, segmentation, image classification and detection since their inception from artificial neural networks (ANNs). Such deep learning models include convolutional neural networks (CNN), long short-term memory (LSTM) among others. However, there has been significant progress made towards the application of DL and ML in the tourism and hospitality industry. Both machine learning and deep learning use basic principles of artificial neural networks. ANNs are biologically inspired neurons that extract features using training function either supervised or unsupervised learning algorithm (Fashoto, Mbunge, Ogunleye, & den Burg, 2021). The most prominent supervised learning algorithm called BackPropagation has been applied in several ANNs to minimize network's errors through gradient descent (Mbunge, Vheremu, & Kajiva, 2017).

However, the BackPropagation algorithm in ANNs is severely affected by the local minima problem (Choi, Ju-Hong, & Deok-Hwan, 2008). To improve the performance of ANNs while minimizing local

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