Chapter 2: Literature Review on Deep learning and Hotel Surveys

**The Business Problem**

The hospitality industry had long relied on customer satisfaction surveys as a tool for gauging guest experience, informing operational improvements, and guiding strategic decision-making. While it was once sufficient to manually analyze and interpret information from these surveys, new tools had emerged that allowed actionable insights in record time—and even enabled the prediction of future trends. Over the past five years, the adoption of deep learning drastically transformed the landscape of data analysis, pushing the boundaries of what was possible in extracting insights from unstructured sources like surveys. A review of recent academic literature sourced through Google Scholar highlighted how researchers applied deep learning techniques alongside sentiment analysis, text summarization, and AI-generated responses to enhance the interpretation of customer survey data. These approaches aimed to uncover emotional nuance, extract concise insights from unstructured feedback, and generate intelligent responses that mirrored human interaction—particularly within service-driven industries like hospitality. This research proved vital for understanding the insights deep learning could uncover from survey analysis and identifying the gaps that still remained.

**History of Machine Learning in the Hotel Industry Analysis**

*Application of Machine Learning in the Hotel Industry: A Critical Review* by Alotaibi (2020) explored the gradual integration of AI and machine learning into hotel operations. Alotaibi posed three guiding questions: Where was machine learning being implemented in the hotel industry? What techniques were being used? And which countries were leading in adoption? His findings indicated that, although uptake varied by region, machine learning was most commonly applied to pricing optimization, guest preference modeling, and operational efficiency. However, the review placed limited emphasis on guest feedback systems—particularly surveys. This gap in the literature created an opportunity to examine how deep learning techniques could extract sentiment insights and forecast guest needs from unstructured survey data. Although Alotaibi did not explicitly address the role of deep learning in feedback analysis, this approach offered strong potential for enhancing the operational efficiency he emphasized.

The review identified several popular machine learning use cases, including demand forecasting, dynamic pricing, guest segmentation, and cancellation prediction—all contributing to improved financial and operational outcomes. These applications typically appealed to hotels seeking quick returns and scalable decision-making tools. Large chain hotels, in particular, prioritized demand and pricing forecasts due to the clear business value they provided. Notably, most of the techniques cited in the review predated the widespread adoption of deep learning, which did not gain traction in hospitality research until around 2019. As a result, the industry historically favored traditional algorithms such as decision trees, regression models, and clustering methods. Geographically, China accounted for approximately 20% of the research and adoption, followed by the United States at 14%. In contrast, Portugal, Spain, and the United Kingdom showed limited engagement, while Middle Eastern countries—particularly those in the GCC—emerged as growing contributors to machine learning research in hospitality.

Alotaibi’s conclusion reinforced the idea that, while machine learning held significant promise for the hospitality sector, its current applications remained narrow in scope. The review emphasized the need to address understudied areas such as guest feedback and online review analysis, which could reveal important social influences on customer behavior. By highlighting the growing need for natural language processing and textual feature extraction in review analysis, Alotaibi indirectly affirmed the relevance of applying deep learning to survey data. This project directly addressed that gap by examining how modern AI techniques—particularly sentiment analysis, summarization, and auto-repliers—could enhance hospitality decision-making beyond logistics and pricing. Ultimately, understanding and responding to customer experiences remained central to solving some of the industry's most persistent challenges.

**Sentiment Analysis Research**

Sentiment analysis became a foundational technique within Natural Language Processing (NLP), widely used to extract emotion, opinion, and intent from text. According to Hossen et al. (2021), sentiment analysis was “the most significant to improve a business site,” highlighting its importance within hotels. As a result, a growing body of research explored how deep learning–based sentiment analysis of hotel surveys addressed critical business challenges and revealed emerging trends in customer preferences. Studies such as *Hotel Review Analysis for the Prediction of Business Using Deep Learning* (Hossen et al., 2021), *An Improved Model for Sentiment Analysis on Luxury Hotel Review* (Chang et al., 2020), *Performance Comparison of Machine Learning and Deep Learning Models for Sentiment Analysis of Hotel Reviews* (Sanwal et al., 2023), and *A Deep Learning-Based Analysis of Customer Concerns and Satisfaction: Enhancing Sustainable Practices in Luxury Hotels* (Pang et al., 2025) provided insight into how these techniques were deployed to capture guest sentiment and support strategic decision-making in the hospitality industry.

The evolution of machine learning techniques significantly enhanced the accuracy of sentiment analysis in recent years. For example, Hossen et al. (2021) applied a Long Short-Term Memory (LSTM) model to hotel review data and achieved an accuracy rate of 86%, illustrating the effectiveness of deep learning architectures in capturing complex language patterns and emotional nuance in guest feedback. By contrast, Chang et al. (2020) explored sentiment analysis by comparing survey responses with overall review ratings from online book platforms. Their study employed a Random Forest classifier to evaluate the consistency between textual sentiment and numerical ratings, highlighting the model’s ability to detect nuanced emotional tone across different feedback formats.

While both traditional machine learning models and deep learning methods had their strengths and weaknesses, research showed that deep learning tended to be more effective at understanding complex language and emotional tone. Models like LSTM and transformer-based systems proved especially adept at capturing how people expressed themselves over time in written feedback. Simpler models like Random Forest or logistic regression often missed those subtle patterns. This shift from easy-to-explain models to more advanced ones reflected a growing focus on accuracy and depth when analyzing large amounts of open-ended survey responses. Since this project aimed to use similar tools for analyzing hospitality surveys, the strong performance of deep learning models made them a promising option for uncovering meaningful insights and identifying trends in guest satisfaction.

That comparison between traditional and deep learning models was precisely what Sanwal et al. (2023) explored in their performance analysis of sentiment classification tools. Their study directly evaluated classical approaches—such as Logistic Regression, Support Vector Machines, Random Forests, and Decision Trees—against more advanced deep learning models like LSTM and BERT. Using a hotel review dataset, they assessed each model’s effectiveness through metrics such as accuracy, precision, recall, and F1-score. The results clearly favored deep learning, with BERT achieving the highest overall performance due to its ability to interpret context and subtle emotional cues. Its bidirectional structure and contextual embeddings enabled it to capture sentiment more accurately than traditional models. LSTM also demonstrated strong results, particularly in handling the sequential flow of customer feedback. These findings strengthened the case for using deep learning in hospitality sentiment analysis, especially when nuanced understanding was key to driving better decisions.

Reinforcing this growing body of evidence, recent research continued to underscore the value of deep learning in understanding guest sentiment. For instance, Pang et al. (2025) applied deep learning to explore how customer sentiment could inform sustainable practices in luxury hotels. Their study analyzed over 29,000 hotel reviews from Henan Province, China, using a combination of topic mining and aspect-based sentiment analysis. This approach enabled them to identify six key areas of customer concern—such as family experiences, service quality, and amenities—and evaluate how each influenced satisfaction at both the overall and aspect-specific levels. Notably, their framework introduced “sentiment quadruples,” which captured the category, aspect term, opinion term, and polarity of each review, offering a more nuanced understanding of guest feedback. By linking sentiment insights to sustainability goals, they demonstrated how deep learning supported not only operational improvements but also long-term strategic planning in hospitality.

Collectively, these studies reinforced the growing shift toward using deep learning as the most robust and accurate method for determining guest sentiment in the hospitality setting. As researchers continued to explore the full potential of these tools, a related focus emerged around *text summarization*—an equally valuable method for distilling lengthy, open-ended survey responses into concise, actionable insights. The following section examined how deep learning was being leveraged not only to detect sentiment but also to automatically summarize guest feedback for faster and more effective decision-making.

**Text Summarization**

Building on the success of sentiment analysis in hospitality research, Bompotas et al. (2020) explored how deep learning could be used not only to classify but also to summarize hotel reviews. Their system categorized feedback by sentiment polarity—positive, negative, or neutral—and generated concise summaries to help businesses quickly interpret large volumes of customer responses. By combining neural network models with opinion mining techniques, the authors demonstrated the value of real-time, sentiment-aware summarization in streamlining decision-making. Importantly, their method also uncovered recurring themes within guest feedback, allowing hotel managers to identify consistent areas of praise or concern. This thematic insight was critical for translating raw sentiment into targeted business actions, reinforcing the role of summarization as both a diagnostic and strategic tool. Their work highlighted a growing shift in hospitality research toward making unstructured feedback both readable and actionable—further supporting this project’s emphasis on applying deep learning to enhance the analysis of open-ended survey responses.

**Automated Replier to Hotel Surveys**

Extending the utility of summarization even further, Ku et al. (2019) examined how deep learning could be harnessed not just to distill feedback, but to guide automated and strategic responses from hotel management. Analyzing over 91,000 guest reviews and 70,000 managerial responses across luxury hotels in London, their study revealed that most hotels lacked a consistent strategy in addressing positive versus negative feedback. To remedy this, the authors developed a deep learning–based prioritization model capable of identifying reviews most deserving of a prompt or customized managerial reply. This approach positioned AI not only as a tool for interpreting sentiment and summarizing themes, but also as a proactive engine for customer engagement and digital service optimization. Their findings demonstrated the expanding role of NLP and visual analytics in operational strategy—an evolution this project aimed to build on by generating dynamic survey responses tailored to guest concerns.

**Conclusion**

Collectively, the reviewed literature revealed that the next wave of actionable insights in the hotel industry would be driven by building upon these deep learning advancements. As researchers moved beyond sentiment detection toward summarization and AI-generated responses, the integration of Natural Language Processing into hospitality operations became increasingly strategic. These technologies not only streamlined the interpretation of guest feedback but also enabled more dynamic, data-informed engagement with customers. This evolving toolkit formed the foundation for this project’s objectives: to automate the interpretation of open-ended survey responses and generate tailored replies that elevated the guest experience and informed business decisions.

**References**

Adil, M., Ansari, M. F., Alahmadi, A., Wu, J. Z., & Chakrabortty, R. K. (2021). Solving the problem of class imbalance in the prediction of hotel cancelations: A hybridized machine learning approach. *Processes*, *9*(10), 1713.

Alotaibi, E. (2020). Application of machine learning in the hotel industry: a critical review. *Journal of Association of Arab Universities for Tourism and Hospitality*, *18*(3), 78-96.

Bompotas, A., Ilias, A., Kanavos, A., Makris, C., Rompolas, G., & Savvopoulos, A. (2020). A sentiment-based hotel review summarization using machine learning techniques. In *Artificial Intelligence Applications and Innovations. AIAI 2020 IFIP WG 12.5 International Workshops: MHDW 2020 and 5G-PINE 2020, Neos Marmaras, Greece, June 5–7, 2020, Proceedings 16* (pp. 155-164). Springer International Publishing.

Bonny, Jannatul Jahan, et al. "Deep learning approach for sentimental analysis of hotel review on bengali text." *2022 Second International Conference on Advances in Electrical, Computing, Communication and Sustainable Technologies (ICAECT)*. IEEE, 2022.

Chang, V., Liu, L., Xu, Q., Li, T., & Hsu, C. H. (2023). An improved model for sentiment analysis on luxury hotel review. *Expert Systems*, *40*(2), e12580.

Hossen, M. S., Jony, A. H., Tabassum, T., Islam, M. T., Rahman, M. M., & Khatun, T. (2021, March). Hotel review analysis for the prediction of business using deep learning approach. In *2021 international conference on artificial intelligence and smart systems (ICAIS)* (pp. 1489-1494). IEEE.

Pang, T., Liu, J., Han, L., Liu, H., & Yan, D. (2025). A Deep Learning-Based Analysis of Customer Concerns and Satisfaction: Enhancing Sustainable Practices in Luxury Hotels. *Sustainability*, *17*(8), 3603.

Ku, C. H., Chang, Y. C., Wang, Y., Chen, C. H., & Hsiao, S. H. (2019). Artificial intelligence and visual analytics: a deep-learning approach to analyze hotel reviews & responses.

Sanwal, M., & Mazhar, M. M. (2023). Performance Comparison of Machine Learning and Deep Learning Models for Sentiment Analysis of Hotel Reviews. *Int. J. Inf. Tec. App. Sci*, *5*(1).