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論文の内容の要旨

The focus of this dissertation is customer behavior during the process of searching the hotel information and booking a hotel through online travel agencies (OTAs). OTAs provide a large number of hotels to heterogeneous customers. Matching a hotel with a customer's preference is a challenge under the uncertain condition of customer (e.g., preference, arrival), especially when customers have multidimensional preferences and involve the impact of online review.

The full utilization of the hotel recommendation and online review mechanisms is mainly concerned in this dissertation. In the current situation, a number of OTAs provide a hotel recommendation mechanism by recommending a hotel in a sorting feature. A customer can sort the presentation of available hotels based on single attribute such as sorting by price, review rating, star rating and website's favorite. Although the current sorting mechanism of OTAs (e.g., website's favorite) can recommend a hotel efficiently in timely aspect, the recommendations might be biased because of the advertising fee to promote some hotels. Also, the current sorting mechanism of OTAs has limitations to satisfy the multidimensional preferences of customers, as most of them sort a number of hotels by considering single attribute (e.g., sorting by start rating). The number of hotels along with the sequence of available hotels shown on the Web site has the significant impact on the process of customer choice decision. Specifically, the online customers may fail to notice a satisfactory hotel if it is shown at the bottom of a long sequence. For an online review mechanism as well, a large number of online reviews involving unnecessary information

(e.g., customer's complaints, bias review) are the barrier to reach a satisfactory hotel concerning the search time of customer.

In this dissertation, we presented the whole optimization of customer experience who uses OTAs search for the hotel information and perform a hotel booking transaction. The design and usage of the hotel sorting and online review mechanisms were investigated. Specifically, we proposed a new approach, based on a two-stage stochastic programming (2SSP) model, to design an optimal sequence of hotels and the selection of useful online reviews presented on the Web site. The objective is to help a customer could find a satisfactory hotel at the minimum number of search steps while satisfying the maximum utility gained from a selected hotel. We collected the customer data through a survey method and took the hotel information from the selected OTAs, mainly from Hotels.com and Agoda.com. This information was then used through the numerical experiments to simulate a case study of online hotel booking. The case study makes the proposed model close to the realistic mechanism. Even though our model might not 100% reflect the reality of online booking mechanism but none of the model in the research does as all the model are a simplified version of reality. Thus, it is our belief that the proposed model is a closest proxy of real customer searching behaviors as we incorporated the minimum and standard parameters taken from several surveys including the one we conducted.

Three model approaches were proposed in this dissertation (presented in Chapter 5, 6 and 7). That is, Chapter 5 mainly focuses on the design and usage of a hotel sorting approach. This model covers the basic idea of this dissertation that aims to maximize the customer experience through the profitable design of OTAs. It provides the interesting findings and the practical implications for OTAs and hotels. The OTA managers could adopt the proposed approach and the findings for decision making regarding to the strategy to sort the number of available hotels. Moreover, for the hotel managers, they can analyze their competitive position in the current market, and our model could extend to provide the direction of improvement to maintain the competitive advantages.

We extended the first model (presented in Chapter 5) to incorporate full scale of parameters, mainly on the parameters of online reviews. Accordingly, the extension of the first model by incorporating the sorting approach for online reviews is presented in Chapter 6. Similarly, Chapter 7 incorporated the hotel sorting and online review selection mechanisms. The decision for the online review management was made on the basis of different perspectives as in Chapter 6 (e.g., the decision based on the target and valence of reviews) and Chapter 7 (e.g., the decision based on the online review indicators). Thus, three models are differentiated on the basis of assumption and purpose of study. Accordingly, the formulation of the proposed model and application are slightly different to response the

different features of OTAs (e.g., Hotels.com and Agoda.com).

In summary, this dissertation provides the contribution to tourism industry, e-commerce and knowledge science. It provides a framework that could promote the understanding of customer's behavior and profitable design of OTAs. It provide an effective approach that helps OTAs design the recommendation and online review mechanisms to enhance customer experience. Also, three chapters provide a new and different perspective of website design and online review management.

Keywords: Online hotel booking, Online review, Multi-dimensional Sequencing, Multi-preference Consumer, Stochastic programming

論文審査の結果の要旨

情報処理技術は我々の生活を大きく変えた。ホテル予約はかつて、部屋が見つかるまで電話を掛け続けなくてはならなかったが、いまでは予約のポータルサイトで、希望日に空き部屋がある候補リストを調べて予約できるようになっている。しかし、しばしば体験することだが、数多い選択肢の中から期待を満たす部屋を探すのは、依然として時間を要する。

本研究は、空き部屋情報を一度に表示する上限数や掲示順番、また、他の利用者が書いたレビューの掲示順番を予約ポータルサイトの Web サイトデザイン上のパラメータとして、予約サイトを訪問する利用者（希望の部屋が見つからない利用者を含む）の総体の利得（予約に至った部屋が期待を満たす度合いと、探索にかかる時間）を数式で表現し、数理計画法のソルバーを用いて数値実験により、パラメータの最適値を求める方式を開発した。さらに、実際のホテル予約サイトから取ったデータを使って数値実験し、本方式で最適化されたパラメータ値の時に得られるだろう利用者総体の利得と、実際のホテル予約サイトのパラメータ値を使ったときの利得を比較して、その優位性を実証した。

本研究の第一の意義は、空き部屋や利用者のレビューの掲示順番という、簡単には最適化しにくいモデル化対象を、2SSP(2 sage stochastic programming)という数理計画法のモデル化テクニックを使い、具体的な数理モデルに落としこむことに成功した点にある。第二の意義は、数式でモデル化したことで、いろいろな Web デザインのバリエーションの（利用者の総体の利得の最大化という意味での）評価を、数理計画法の数値実験により、評価できるようになったことである。第三の意義は、個々のホテルの経営者にとって、空き部屋をいっそう多く販売するためには、どこに業務改善の努力を集中すれば良いのかを、数値実験により知ることができるようになったことである。

数理的な最適化と言えば、これまでは販売利益の最適化など、企業側の視点からの最適化の事

例に焦点が当っていた。しかし本論文は、予約サイトを訪問する利用者の総体の利益の最適化という、従来扱われることが余り無い対象のモデル化を試み、一定の成果を収めたものであり、学術的に貢献するところが大きい。よって博士（知識科学）の学位論文として十分価値あるものと認めた。