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| 学位論文題目 | A Study on Predictive Data Modeling towards Rural Mobility of Japan for the Sustainable Revitalization of Regional Tourism Activities<br>（地域観光活動の持続的活性化のための地方交通の予測データモデリングに関する研究） |
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# 学位論文内容の要旨


In our world, specifying that a problem has existed in a well-organized and advanced society, describing it accurately, and collecting awareness, are challenging tasks to analyze social dynamics. This research has focused on collecting, observing, and analyzing Japanese people's interests, expectations, and tendencies living in rural areas, mainly focusing on the prefecture Hokkaido, a sub-prefecture Okhotsk.

According to the preliminary analysis findings, Japan has a rapid population aging problem and a negative population growth rate. It is one of the most urbanized countries in the OECD, as 57% of its population live in predominantly urban areas. Although it has almost 30 years of slow economic growth, Japan is still the world's 3rd largest economy. Japan is also the first very highly developed country in Asia.

Furthermore, Japan has a well-developed domestic travel and tourism industry. Its total contribution to Japanese GDP is making it one of the most influential sectors. However, both the country's GDP and the tourism industry's participation gradually declined since 1998. The statistical data indicates that today in Japan, fewer people than in the past are traveling for leisure. Perhaps the reason for this is that people feel more comfortable in their usual habitat. Nevertheless, comparing historical statistical data values from the past and present in a frequentist way may not correct this phenomenon's proper comprehension—the consideration of living habits changes throughout time.

The development of popular technologies such as the Internet, communication, home entertainment systems is essential for a better interpretation and inference of the real state of Japanese daily routine and understanding of their insight leisure.

As explained in the previous paragraph, the necessity of interpreting different terms of time with several different kinds of parameters brought me to the Bayesian inference approach. From my perspective, the usage of Bayesian statistics, which I implemented in the technical part of the study to prove my concept, has given a better conceptual quality of probability.

I begin by presenting the research target's background by constructing a data analysis model to transform the collected data regarding Japanese domestic torusim expenditure last 25 years into a meaningful graphical format. The anomalies and sustainable development possibilities were analyzed for Japan's rural areas economy and tourism by Big Data analytics and Probabilistic Programming. Moreover, I applied a Monte Carlo simulation combined with a Bayesian statistic to strengthen the model's reliability and implement it on a cloud computing platform to acquire precision and speed a parallel computation with the Apache Spark platform.

Thanks to increasing the Internet's popularity in everyday life, measuring public awareness has become more efficient since the content generator role has altered from specialists to ordinary people. People are creating a massive amount of data every second. Therefore, analysis of Big Data using the Internet has become essential to comprehend human behavior from multiple perspectives, including scientific, economic, political, historical, and sociological.

Furthermore, I analyzed the impact of inadequate public bus services on Japan's rural cities' social lives from the tourism informatics perspective. To understand our community's viewpoint on public bus service, I surveyed a selected group of people's opinions. I do this in two categories: the people's initial and then secondary views regarding the service quality and accessibility.

Details of the method I used inside the study clearly explained the integrity of a statistic and probability science knowledge.

The case-based specific study presents the status of public transportation services provided in Japan's rural cities by collecting the opinions of a group of people that we estimate to benefit from the service. Especially in Japan's local regions, public transport service frequency is not sufficient. Thus my research intends to present the points of determination and improvement of the issue through the individuals' opinions. Moreover, the research endeavors the multiple benefits of adequate public transport services for local communities by regional development prospects and tourism relations.

I want to display the importance of local public transport services' position for the local business owner from an economic perspective because it correlates with revitalizing domestic tourism expectations. In this way, I revealed an increase in people's rate in favor of bus services from 60% to 71%. Additionally, by implementing Machine Learning techniques on the other population parameters, classifying the person's secondary opinion rate reached 78%, sufficient to implement in practice for this task, and further optimize bus services.

Finally, I supply thorough evidence for my approach's usability supported by regional development decision-makers' detailed data analyses. I present that solving the problem could improve the group's daily quality of life and bring liveliness to local economies.

## 論文審査結果の要旨

従来，社会学的観点による分析研究が中心であった観光に関わる処処の系統的研究に対して，情報科学的アプローチに基づく定量的解釈や ICT 応用による新たな観光形態，それらが観光分野にもたらす効果などを議論する観光情報学が注目されている．

著者は，この観光情報学の観点に立ち，情報科学的アプローチ的分析により日本の地方観光の課題を巨視的視点と微視的視点から確率的に説明し，その持続可能性を予測した．第一に，世界各国の経済活動ビッグデータに対してベイズ統計とモンテカルロシミュレーションを適用することによって日本の地方観光の現状を確率的にモデリングして分析を行なった．第二に，地方大学生を長期滞在観光客とみなし，彼らに対して実施した地方公共バスに関する意識調査の結果をモデル化することで地方観光における公共交通への潜在的需要と持続的変化を議論した．また，人工知能アプローチによる公共交通への需要予測手法を提案し，同手法が有効であることを明らかにした．

これを要するに，著者は，情報科学を駆使したデータ駆動型解析によって地域観光が抱える潜在的課題を定量的に把握し高度に予測するための新知見を得たものである．これは，観光情報学分野において貢献するところ大なるものがある．よって著者は，北見工業大学博士（工学）の学位を授与される資格があるものと認める．