Modelling the Role of Social Media in Hotel Selection Using Bayesian Networks

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Presenter's Resume

Alexandros Bousdekis

- Current position
  - Post-doctoral Researcher (Athens University of Economics and Business)
    - Title of postdoctoral research: "Advanced data analytics and knowledge discovery for e-service customization"

- Education
  - PhD in Information Systems (National Technical University of Athens)
  - MSc in Manufacturing Systems Engineering (University of Warwick, UK)
  - BSc in Production and Management Engineering (Technical University of Crete)

Outline

- Introduction

- Research Methodology

- Results

- Conclusions & Future Work

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Motivation

- **Consumers increasingly use social media** to search for information, compare alternative products and services, and make decisions for activities.

- **Online review comments have become an increasingly popular information source in travel planning** and have a profound effect on consumers' buying decisions, particularly in hotel booking.

- In this context, **social media** have gathered the research interest as **a major form of electronic Word-Of-Mouth (eWOM) to prospective travellers** facilitating the sharing and seeking of experiences as well as influencing future customer demand and hotels' financial performance.

- Social media have provided a **new distribution channel for businesses** to communicate with their customers.

Research Objective

- Existing literature is rich on research works about the influence of social media to consumers' decisions.

- However, the identification of the relationships between the way travellers use social media and the criteria for selecting hotels is still an underexplored area.

- We propose a methodology for **modelling the role of social media in hotel selection using Bayesian Networks (BN)**.

- To the best of our knowledge, despite their applicability in a wide range of problems and scenarios, **BNs have not been used for identifying the influence of social media to the decisions of travellers about the hotel selection.**

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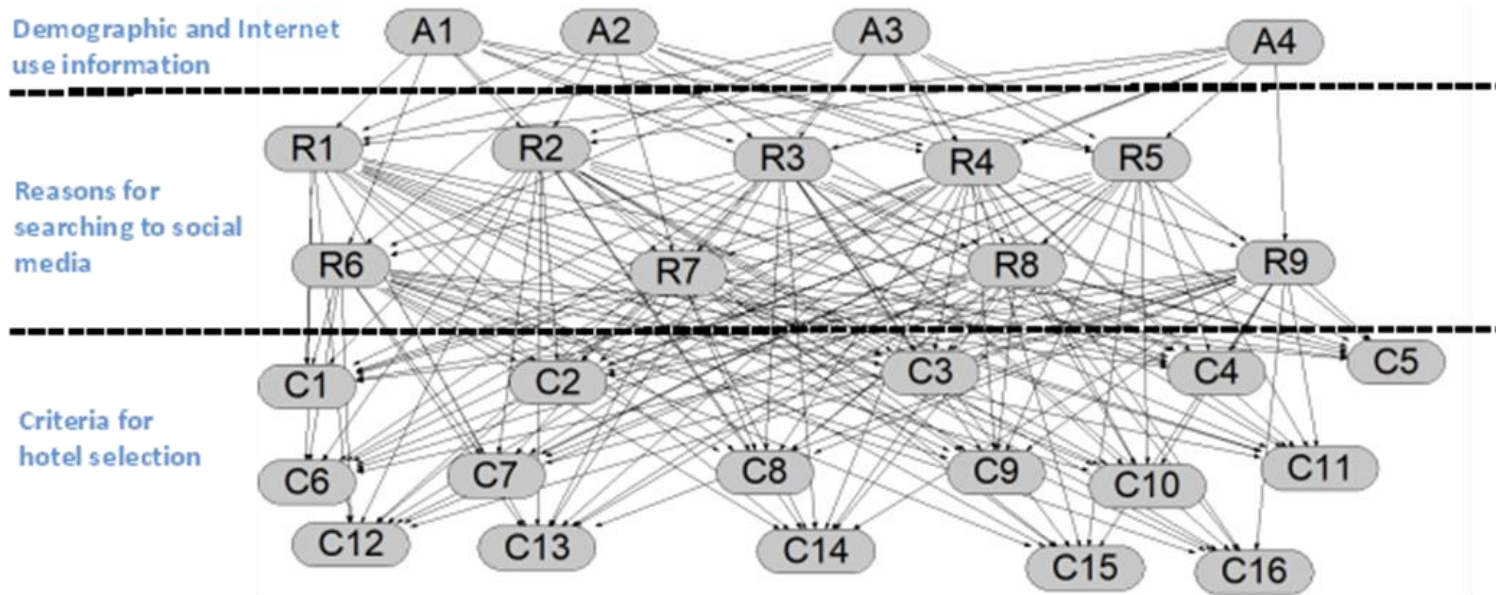
Research Methodology

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Data Collection and Structuring

- The data is collected in the form of a questionnaire completed by social media users.

- The questions lay on **three categories**:

  - *Demographic and internet use*

  - *Reasons of searching information on social media*

  - *Criteria for hotel selection*

Modelling the Relationships

- In order to model the relationships between the reasons of searching information on social media and the criteria according to which the users select a hotel for vacation, we applied BNs.

Nodes of the Bayesian Network

Layers	Nodes		Node Values
Demographic and internet use	A1	Age group	{15-20, 21-25, 26-30, 31-35, 36-40, 41-45, 46-50, >50}
	A2	Frequency of vacations	{once per 2 years, once per year, twice per year, three times per year, more than three times per year}
	A3	Frequency of staying at hotel in vacations	{always, very often, often, rarely, never}
	A4	Frequency of using social media for hotel information	{always, very often, often, rarely, never}
Reasons of searching to social media	R1	Trust the social media users	{Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree}
	R2	Possibility of asking opinions	
	R3	Search engines are not helpful	
	R4	Socializing	
	R5	Quick responses	
	R6	Easy procedure	
	R7	Better quality of responses	
	R8	Costless	
	R9	Funny	
Criteria for hotel selection	C1	Personnel	{Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree}
	C2	Reliable booking procedure	
	C3	Fast check-in / check-out	
	C4	Immediate service and problem solving	
	C5	Hotel security and privacy assurance	
	C6	Cleanliness	
	C7	Reasonable price	
	C8	Convenient parking	
	C9	Comfortable bed	
	C10	Comfortable public spaces	
	C11	Interior design	
	C12	Location	
	C13	External environment	
	C14	Quality of hotel restaurant	
	C15	Availability of mini bar in the rooms	
	C16	Belonging to a reputable hotel chain	

Outcome

- Based upon this structure, the BN is subject to reasoning in order to compute all the **Conditional Probabilities Tables (CPT)**.

- The outcome indicates the **probability assigned to each selection criterion** (bottom layer) **given the reasons a user searches for information in social media** (intermediate layer) **and some demographic and internet use information** (top layer).

- Therefore, **the model can answer questions such as**:
  - "What is the probability that a user ...
    - ... will select a hotel according to the criteria of the reliable booking procedure (C2) and the cleanliness (C6) ...
    - ... given that he/she uses the social media for socializing (R4) and for receiving better quality of responses (R7) ...
    - ... while he/she belongs to the age group 31-35 (A1), he/she goes for vacations once per year (A2), he/she stays at a hotel often (A3) and he/she often uses social media for hotel information (A4)?".

Added value

- The model is able to **identify, represent and store in the database complex relationships** aiming at **supporting marketing and hotel operations** in response to **different customers' profiles**.

- In this way, the **hotels can:**
  - **focus on specific target groups** according to their strengths
  - **improve their operations** that result in lower rating of certain criteria.

- Moreover, it is able to serve as a model for **predicting the criteria** according to which a social media user will select a hotel.

- The model is **extensible to additional nodes per each layer** in case more information needs to be incorporated.

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Implementation

- The proposed approach was applied on a dataset of **360 social media users**.

- The implementation and execution of the experiments were performed using the BN functionalities of the **pgmpy (Probabilistic Graphical Models using Python) package in Python**.

Indicative Results

Highest Conditional Probabilities (CP)

Criteria (Child Nodes)	Parent Nodes		CP
C_i	R_i	A_i	
C6 *Cleanliness*	R1={Neutral}, R2={Agree}, R3={Disagree}, R4={Agree}, R5={Strongly Agree}, R6={Neutral}, R7={Disagree}, R8={Neutral}, R9={Strongly Disagree}	A1={36-40}, A2={once per year}, A3={very often}, A4={often}	*0.395*

Criteria (Child Nodes)	Parent Nodes		CP
C_i	R_i	A_i	
C1 *Personnel*	R1={Disagree}, R2={Agree}, R3={Strongly Disagree}, R4={Strongly Disagree}, R5={Agree}, R6={Neutral}, R7={Neutral}, R8={Agree}, R9={Strongly Disagree}	A1={46-50}, A2={twice per year}, A3={very often}, A4={rarely}	*0.362*

Classification Performance

	Predicted Positive	Predicted Negative
Actual Positive	True Positive (TP) = 41	False Negative (FN) = 9
Actual Negative	False Positive (FP) = 3	True Negative (TN) = 32

$$Precision = \frac{TP}{TP + FP} = \frac{41}{41 + 3} = 93.1\%$$

$$Recall = \frac{TP}{TP + FN} = \frac{41}{41 + 9} = 82\%$$

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Conclusions and Future Work

- **Conclusions**
  - **Social media** have gathered the research interest as **a major form of eWOM to prospective travellers**.
  - To that end, we proposed a **model for identifying, complex relationships in the hotel selection decision making process** aiming at supporting marketing and hotel operations in response to different customers' profiles.
  - The proposed model was applied to a **dataset of 360 social media users**.

- **Future work**
  - We plan to use fuzzy pattern matching methods for mining also online review comments, as well as clustering and fuzzy sets qualitative analytics algorithms for extracting user profiling insights of hotel customers.
  - These directions have the potential to further enhance decision making process in hotel management from both a marketing (e.g., revealing key groups of customers and target groups) and an operations management (e.g., for improving service quality if it receives negative review rating) perspective.

Thank you!