

# Topic Modelling in Travel

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# Booking.com

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# Section 1

## Introduction

# Travel Agents



# Online Travel Agents

**Booking.com**  
Booking.com: 127,729 hotels worldwide, 34+ million hotel reviews.

Recently viewed My lists Sign in or create an account Manage booking

Home Fine Dining Cycling Museums Sightseeing Beach All Themes

Make your next booking on the go! Download Booking.com's free app

### Search

527,000+ hotels, apartments, villas and more ...

Destination/Hotel Name:  
Q.e.g. city, region, district or specific hotel

Traveling for:  Business  Leisure

Check-in Date:  Day  Month  Check-out Date:  Day  Month

I don't have specific dates yet

Show properties for:  
 Couples

+ Additional search options

**Search**

### Book Now, Pay When You Stay!

With FREE cancellation on most rooms

Want to know which city to visit next?  
Find out which places are recommended for the following combinations

**Netherlands & Cycling** **Germany & Hiking**

Or, add your own interests

**Bangkok**  
Thailand

### villas.com

Booking a vacation rental just got easier!  
152,681 homes and apartments worldwide

**Explore +**

### Lisbon

1092 properties

141 people looking at this destination

Ideal properties for a weekend break  
Available rooms from Friday, August 15, 2014 to Saturday, August 16, 2014

**Hotel Aif Avenidas** ★★★★★

Single € 399 Double € 402

Score from 789 ratings: Excellent 8.6

Latest booking: 1 hour ago

There are 5 people looking at this hotel.

**Check availability**

**Hotel Dom Sancho I** ★★

Single € 238 Double € 238

Score from 833 ratings: Good 7.8

Latest booking: 1 hour ago

There are 2 people looking at this hotel.

**Check availability**

Navigation icons: Home, Back, Forward, Refresh, Print, List, Search, etc.

# Booking.com

- ▶ Largest OTA, second largest e-shop

# Booking.com

- ▶ Largest OTA, second largest e-shop
- ▶ Traffic switching from paid to organic

# Booking.com

- ▶ Largest OTA, second largest e-shop
- ▶ Traffic switching from paid to organic
- ▶ User Engagement is crucial



## Section 2

### Endorsement data

# The Destination Finder

The image shows the Booking.com Destination Finder interface. At the top, the Booking.com logo is on the left, and navigation links for 'Recently viewed', 'My lists', 'Sign in or create an account', and 'Manage booking' are on the right. The main heading reads 'Not sure where to go?' with the subtext 'Add your interests and let us do the rest'. Below this is a search bar with the placeholder text 'Try adding countries, regions, continents or specific travel interests'. Underneath the search bar are three input fields: 'Check-in Date', 'Check-out Date', and 'Guests', followed by a blue 'Search' button. A small green checkmark icon and the text 'Book Now, Pay When You Stay! With FREE cancellation on most rooms' are positioned below the search bar. The main content area features three destination cards: Barcelona (2195 Properties), Porto (386 Properties), and Cape Town (488 Properties). Each card includes a 'Check prices' button, a green checkmark icon, and a list of top reasons to visit. Barcelona's reasons are 'Architecture, Shopping, and Beach'. Porto's reasons are 'Great for Wine, Food, and Gourmet Food'. Cape Town's reasons are 'Great for Wine, Food, and Shopping'. Each card also has a row of icons representing various travel interests and a blue plus sign for more options.

Booking.com

Recently viewed My lists Sign in or create an account Manage booking

## Not sure where to go?

Add your interests and let us do the rest

Try adding countries, regions, continents or specific travel interests

Check-in Date Check-out Date Guests Search

Book Now, Pay When You Stay! With FREE cancellation on most rooms

**Barcelona** [Check prices](#)  
2195 Properties

Top reasons to visit: **Architecture, Shopping, and Beach**

**Porto** [Check prices](#)  
386 Properties

Top reasons to visit: **Great for Wine, Food, and Gourmet Food**

**Cape Town** [Check prices](#)  
488 Properties

Top reasons to visit: **Great for Wine, Food, and Shopping**

Navigation icons: back, forward, search, list, refresh, home

# The Destination Finder

Endorsement	# given	# destinations	# users
Shopping	513536	9105	467143
Food	242647	13595	228130
Beach	237035	8255	220603
Adventure	9622	2327	9374
Chinatown	2041	132	1992

# The big city problem

The screenshot shows a travel search interface with a search bar at the top containing the text "Beach" and a subtext "Keep adding more". Below the search bar are fields for "Check-in Date", "Check-out Date", and "Guests", followed by a blue "Search" button. A promotional banner below the search bar reads "Book Now, Pay When You Stay! With FREE cancellation on most rooms".

Below the search bar, the results are sorted by "Number of Endorsements". Three destination cards are displayed:

- Barcelona** (Spain): 2195 Properties. 7380 guests have endorsed this place for "Beach".
- Rio de Janeiro** (Brazil): 1672 Properties. 5502 guests have endorsed this place for "Beach".
- Miami Beach** (USA): 287 Properties. 4600 guests have endorsed this place for "Beach".

Each card includes a "Check prices" button, a set of icons for various amenities (checkmark, bag, shield, fork and knife, camera), and a blue plus sign icon for more options.


# The big city problem


Food Keep adding more


Check-in Date Check-out Date Guests [Search](#)


✔ **Book Now, Pay When You Stay!** With FREE cancellation on most rooms.


Sort by: Number of Endorsements





**Rome**   
4118 Properties [Check prices](#)


 8552 guests have endorsed this place for "Food"








**Paris**   
2570 Properties [Check prices](#)


 8885 guests have endorsed this place for "Food"





**Barcelona**   
2195 Properties [Check prices](#)

 8091 guests have endorsed this place for "Food"

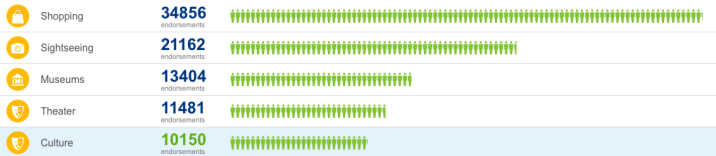


Navigation icons: back, forward, search, refresh, etc.

# The shopping problem

London 

[Book now](#)



# The shopping problem

Barcelona 

[Book now](#)



Sightseeing **5793**    Nightlife **3616**    Tapas **3614**    City Trip **3600**    Monuments **3128**    Art **2950**    Museums **2370**

Gourmet Food **2206**    History **1676**    City Walks **1328**    Walking **1303**    Friendly People **1250**    Ambiance **1177**

[Show all](#)

# Topics

There must be an alternative way to organise endorsements.

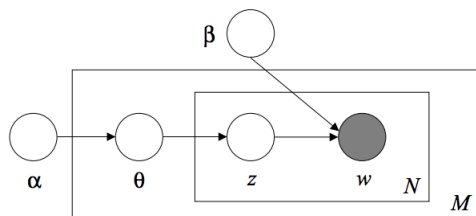
- ▶ Where different activity topics can be present in a city
- ▶ Where different cities share the same topics
- ▶ Where each topic produces endorsements with a different probability
- ▶ Where topics share endorsements



## Section 3

# Latent Dirichlet Allocation

# Latent Dirichlet Allocation



We assume that each one of our  $M$  trips...

Returns  $N \sim \text{Poisson}(\xi)$  endorsements

Because it had a  $\theta \sim \text{Dir}(\alpha)$  topics distribution

For each endorsement  $w_n$

There was a responsible topic  $z_n \sim \text{Multinomial}(\theta)$

That generated  $w_n$  from  $p(w_n|z_n, \beta)$

## 40 topics

### topic 2

Snorkelling 0.23

Diving 0.19

Sun-Bathing

0.11

Walking-with-

Kids 0.10

### topic 7

Beer 0.48

Hot-Springs

0.38

Food 0.06

Christmas-

Markets 0.02

### topic 23

Shopping 0.28

Monuments

0.12

Culturally-

Diverse-Food

0.10

Business 0.08

### topic 39

Nightlife 0.49

Party 0.21

Opera 0.06

Port 0.06

# The Good

London 

[Book now](#)

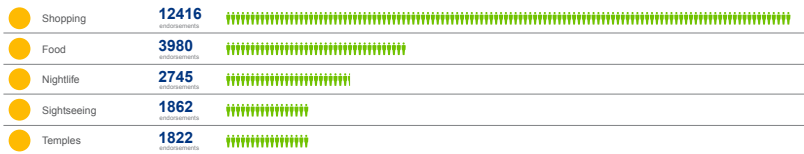


London		
<b>Topic 25</b> (0.29)	<b>Topic 10</b> (0.10)	<b>Topic 18</b> (0.10)
Shopping (0.40)	Museums (0.8)	Shopping (0.78)
Sightseeing (0.36)	Parks (0.03)	Christmas (0.05)
Theatre (0.36)	Galleries (0.03)	Culture (0.04)

# The Good

Bangkok 🇹🇼

[Book now](#)



Bangkok		
<b>Topic 4</b> (0.27)	<b>Topic 35</b> (0.13)	<b>Topic 23</b> (0.11)
Shopping(0.40)	Culture(0.30)	Shopping(0.28)
Food (0.35)	Temples (0.24)	Monuments(0.12)
Entertainment(0.06)	Food (0.20)	Diverse Food (0.10)

# The Bad

<b>Topic 21</b>
Tapas 0.37
Fishing 0.23
Chocolate 0.13
Kite-surfing 0.06

# The Bad

<b>Topic 21</b>
Tapas 0.37
Fishing 0.23
Chocolate 0.13
Kite-surfing 0.06

Main topic for Brussels

# The Ugly

Careful postprocessing is always required.

- ▶ Naming the clusters is not trivial
- ▶ Endorsements can be controversial, e.g. *People Watching*, *City Trip*
- ▶ Combinations are tricky, e.g. *Meeting People* and *Family Friendly*



# Section 4

## Results

# EMK campaign

Your inspiration for today.

[View this email as a web page](#)

**Booking.com**

My Booking.com

Home



city, region or hotel

Search

## Does this sound like you?

Our team of travel scientists have thought long and hard about your next holiday. Based on your past adventures, they think you have a passion for ...



Beach

Relaxation

Food

The results are in

See which destinations are best for you

# EMK campaign



 Follow

Travel Scientists at @bookingcom are busy testing where my next vacation should be. #DataScience done right. [pic.twitter.com/40Tzv27sUF](https://pic.twitter.com/40Tzv27sUF)



 Follow

Example of using marketing data and getting thing spot on.... 🤖

#busted

Thanks @bookingcom  
[pic.twitter.com/X4l8wlv1x8](https://pic.twitter.com/X4l8wlv1x8)



 Follow

Dear @bookingcom, you should probably fire your team of travel scientists. Hard to be more wrong. [pic.twitter.com/5M3J5lnw9l](https://pic.twitter.com/5M3J5lnw9l)

## EMK campaign

Eng.	Users	Interaction	Net Conversion	Cancellations
Eml 1	34M+	<b>+18.34%</b>	<b>+10.00%</b>	<b>+14.80%</b>
Eml 2	34M+	<b>+18.71%</b>	<b>+7.14%</b>	<b>+4.39%</b>

*Bold numbers represent statistical significance.*

# Menus

**Booking.com** £ 𠂉 Recently viewed Lists Athanasios Noutas Get

Browse by destination theme **Beach** Food Historical Landmarks Museums Shopping

Top results for Beach

United Kingdom	>	Bournemouth	115 properties
Spain	>	Blackpool	389 properties
France	>	Brighton & Hove	118 properties
Italy	>	Scarborough	92 properties
U.S.A.	>	Weymouth	80 properties
Portugal	>	Great Yarmouth	57 properties
Greece	>	Swansea	26 properties
Thailand	>	Torquay	156 properties
Australia	>	Newquay	119 properties
Brazil	>	Folkestone	26 properties





157 hotels, 51 apartments, 41 motels, 18 hostels, 6 villas

Hey Athanasios! Take Booking.com on your trip to Oakland. Get the mobile app.  
Free download

Recent searches

- Bruges**  
Belgium  
1 night (25 Apr - 26 Apr)
- Amsterdam**  
Netherlands  
1 night (25 Apr - 26 Apr)
- Ostend**  
Belgium  
1 night (4 Apr - 5 Apr)

You searched for Santa Barbara, so we think you may like this city too.

**Booking.com**   [Recently viewed](#) [Lists](#)   [Sign in or create an account](#) [Manage booking](#)

[Browse by destination theme](#) [Shopping](#) - [Fine Dining](#) - [Cycling](#) - [Museums](#) - [Sightseeing](#) - **[Beach](#)** -

### Search

506,000+ hotels, apartments, villas and more...

Destination/Hotel Name

Check-in Date   Check-out Date

I don't have specific dates yet

Guests

[Additional search options](#)

**Search**

Top Results for Shopping

- Netherlands** > [Scheveningen](#)  
41 properties
- [Spain](#) > [Zandvoort](#)  
132 properties
- [France](#) > [Noordwijk aan Zee](#)  
65 properties
- [Italy](#) > [The Hague](#)  
89 properties
- [United States of America](#) > [De Koog](#)  
56 properties
- [Portugal](#) > [Missingen](#)  
27 properties
- [Belgium](#) > [Bergen](#)  
26 properties
- [Greece](#) > [Domburg](#)  
39 properties
- [Thailand](#) > [Wassenaar](#)  
7 properties
- [Germany](#) > [Egmond aan Zee](#)  
25 properties

Navigation icons: back, forward, home, search, refresh

# Special Thanks



# Special Thanks



Which are the designers?



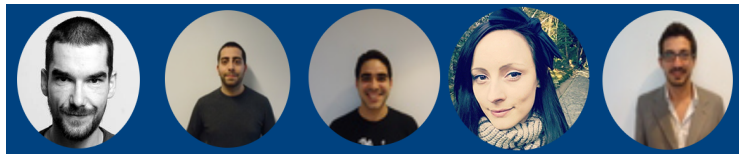
# Special Thanks



Which are the designers?

**Shameless block**

# Special Thanks



Which are the designers?

**Shameless block**

**WE ARE HIRING!!!**

Questions?