



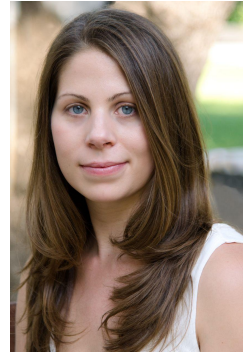
Booking.com

Using data science to empower people to experience the world

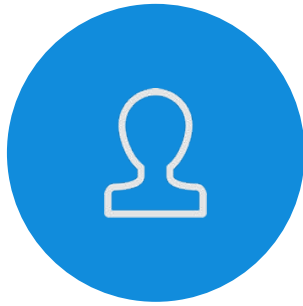
Jennifer Gaskins | 16 March 2018

Who am I?

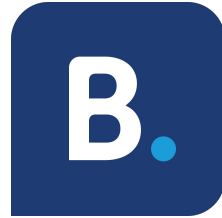
- PhD in Physics from the University of Chicago
- 7.5 years of postdoctoral experience in astro-particle physics (theory and experiment)
- **Data Scientist at Booking.com** for almost 2 years
- [linkedin.com/in/jennifermgaskins](https://www.linkedin.com/in/jennifermgaskins)



Connecting our customers with accommodation and experiences.



Over 1.5M roomnights
booked per day

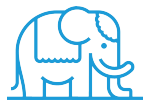


More than 1.6M properties in
228 countries and territories
worldwide

180+ data scientists

Booking.com

Using data to make better decisions in all areas of the business.



Front-end

To help our customers find the right accommodation and the information they need



Partner service

To provide the tools and advice to help our partners succeed on Booking.com



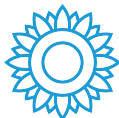
Customer service

To serve our customers efficiently, prevent issues when possible, and for workforce planning



Fraud

To protect our customers, partners, and our business from fraudulent behavior



Marketing

To reach the right customers at the right time in the most cost-effective way



Human resources

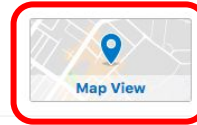
To improve the employee experience and employee effectiveness

Can you spot any data science in this page?

Amsterdam

Visitors Love: Van Gogh Museum, Coffee Shops, Red Light District

Amsterdam's intriguing history spans seven centuries. From humble beginnings as a small village to a world power in the 17th century, Amsterdam today is a fascinating mix of history and commerce. The... [Show more](#)



Personalized elements

Topic modelling

Metrics definition

Automatic detection of high-demand properties

Content selection

Search
Destination/Property Name:
Amsterdam
Check-in Date:
Friday, March 30, 2018
Check-out Date:
Monday, April 2, 2018
3-night stay
2 adults
No children
1 room
I'm traveling for work
Search

Amsterdam is 81% unavailable for your dates on our site. Have you thought about staying nearby?

81% reserved	Schiphol 46% cheaper 11.4 km away, 6 properties	Badhoevedorp 57% cheaper 8.3 km away, 1 property	Hoofddorp 52% cheaper 17.2 km away, 12 properties
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[Show more destinations nearby](#)

Recommendations

Amsterdam

Our Top Picks | Best Price First | Review Score & Price | Stars | Distance From Downtown | Review Score

Ranking

Best Seller

XO Hotels Blue Square ★★★★★
Geuzenveld-Slotermeer, Amsterdam - Show on map (3.8 km from center)
50 people are looking right now
In high demand! Booked 193 times in the last 24 hours
Twin Room
Only 5 rooms left on our site!
Price for All 3 Nights
€ 530
[See our last available rooms >](#)

Filter by:

Free Cancellation & More

- Free cancellation
- Book without credit card
- No prepayment

Popular Filters

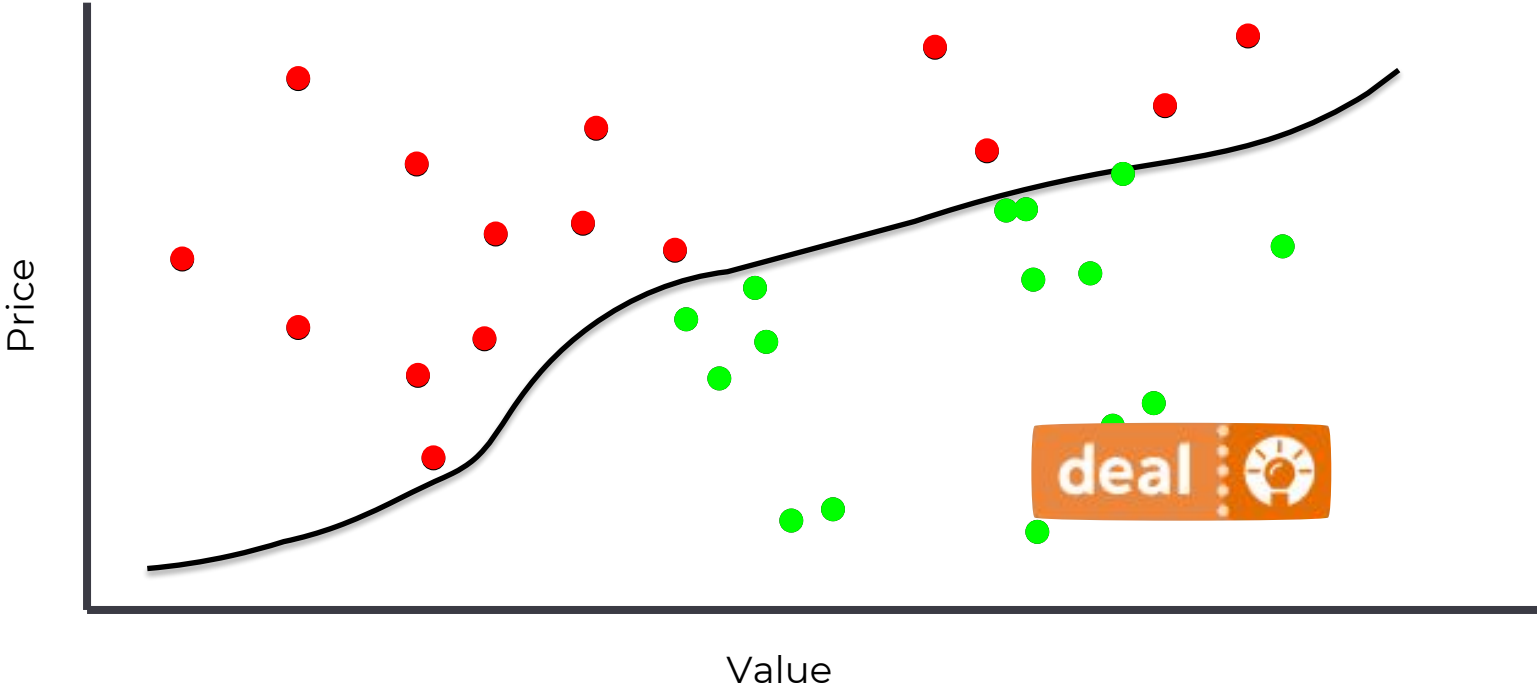
- Amsterdam City Center
- Breakfast included
- Hotels

Ozo Hotel ★★★★★
Zuidoost, Amsterdam - Show on map (6 km from center) - Subway Access
7 people are looking right now
Good 7.4
3,110 reviews

A few business questions.

- How can we identify a “good value” for our customers?
- How can we anticipate and get availability on high-demand dates?
- How should we translate content for millions of properties?
- How should we prioritize incoming messages from our customers?
- How can we identify fraudulent properties? Fraudulent bookers?
- Does product X help our partners to perform better on Booking.com?
- How should we spend our marketing budget to make it most cost-effective?
- How can we test changes in Customer Service procedures?
- Where should we open our next local office?
- How can we make our teams at Booking.com more effective?

Automatic deal detection.



Machine translation.

2/3 of bookings made on Booking.com are made in a language other than English. Currently hotel descriptions are translated by humans in 43 languages based on visitor demand.

The screenshot shows the Booking.com interface with a language selection dropdown menu open. The menu lists various languages, with 'English (UK)' highlighted. The background shows the main navigation bar with the Booking.com logo, user profile 'Nishikant Dhanuka', and search filters for destination, check-in, and rooms.

Booking.com

Choose your preferred language. We speak English (UK) and 42 other languages.

Most often used by people in the Netherlands

Nederlands	English (US)	Русский
English (UK)	Deutsch	简体中文

All languages

Bahasa Indonesia	Italiano	Svenska
Bahasa Malaysia	Íslenska	Slovenščina
Català	Latviski	Türkçe
Čeština	Lietuvių	Tiếng Việt
Deutsch	Magyar	Български
Dansk	Nederlands	Українська
Eesti	Norsk	ភាសាខ្មែរ
Español	Polski	עברית
Español (AR)	Português (PT)	العربية
English (UK)	Português (BR)	한국어
English (US)	Русский	日本語
Ελληνικά	Română	繁體中文
Français	Srpski	简体中文
Filipino	Suomi	
Hrvatski	Slovenščina	

Travelled recently?

Where to...
From snowy ski lodges

Destination, pro...
More places than...

Check-in
Check-in date

Business trip?

Arriving by: Airplane

Rooms

genius Show

Yes, take the survey No, thanks

Open your guide

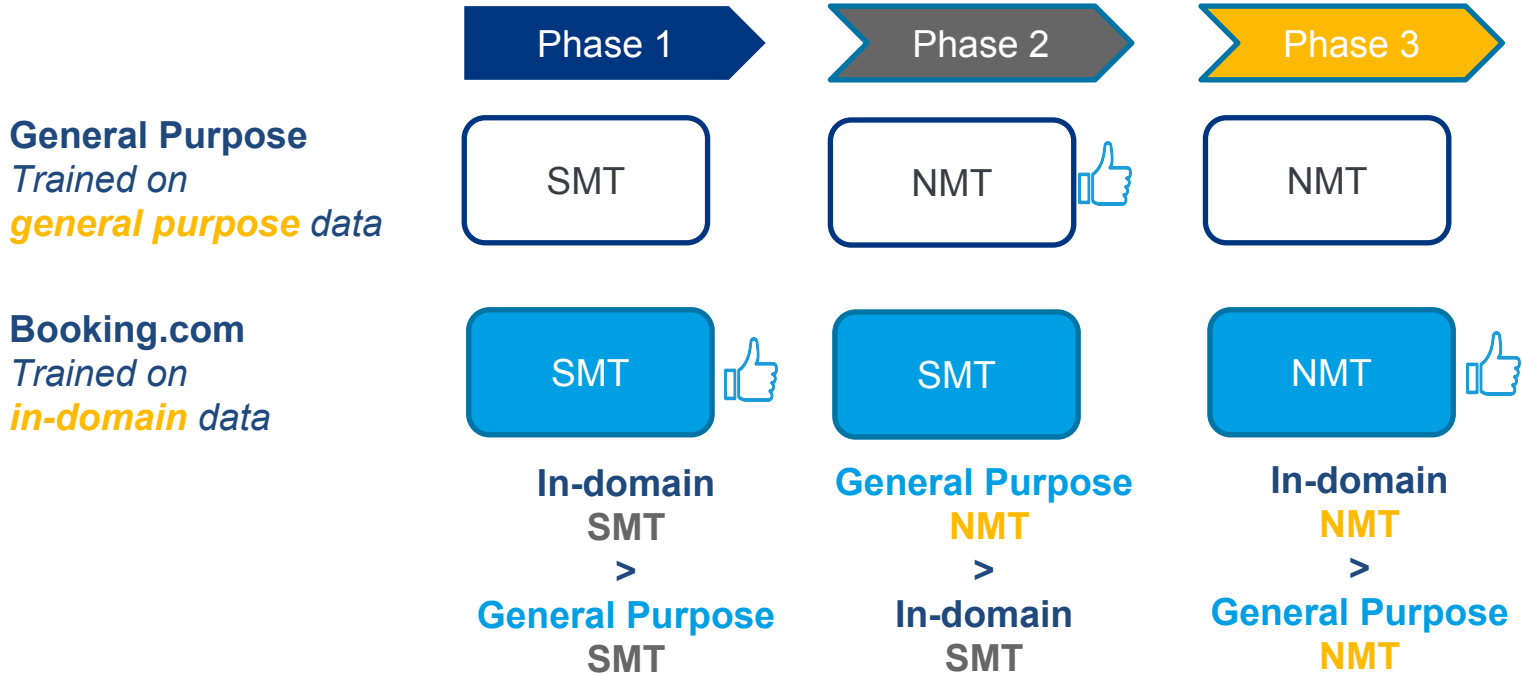
Prices may rise, check deals now!

Bridge

Begin earning!

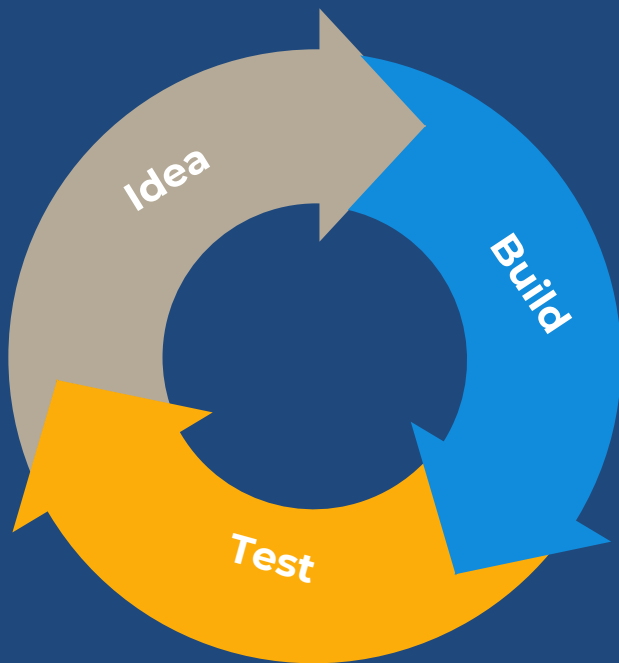
Machine translation.

Statistical vs Neural Machine translation



How we work.

Fail fast (and learn from failures)



Idea

Data scientists work with the business to develop ideas



Build

Development cycle is typically fast, focusing on small, concrete steps



Test

Products and approaches are evaluated through experimentation

Experimentation.

- **Experimentation is fundamental** at Booking.com to make decisions and demonstrate their value
- Our go-to experimentation setup is **A/B testing**



Booking.com

Search

Destination/Property Name: Lisbon
Check-in Date: Friday, March 9, 2018
Check-out Date: Sunday, March 11, 2018
2-night stay
2 adults
No children 1 room
I'm traveling for work?
Show me properties that meet my mobility needs
Search

Filter by:

- Your Budget: € 0 - € 50 per night, € 50 - € 100 per night, etc.
Popular Filters: Hotels, Breakfast included, Parking, etc.
Star Rating: 1 star, 2 stars, etc.

76% reserved
Lisbon is a top choice on our site with travelers for your selected dates (76% reserved).
Tip: Prices might be higher than usual for the dates you've selected. Why not try again with these alternatives?

Lisbon: 990 properties found - including 110 value deals!

Visitors Love: Pastéis De Belém, Barrio Alto, Miradourous
Food, Old Town, City View

Our Top Picks, Lowest Price First, Review Score & Price, Quality, Distance From Downtown

LikeLisboa
Apartments, Arroios, Lisbon - Show on map
Very Good 8.2
4 people are looking at this apartment right now
Booked 4 times in the last 6 hours
Great Value Today
Price for 2 Nights € 89
Last-minute price drop!
See all 4 available apartments

Star inn Lisbon Airport
Best Seller
Apartments, Olivais, Lisbon - Show on map
Excellent 8.7
4,348 reviews
Price for 2 Nights € 187
FREE cancellation
See our last available rooms

Casa Da Lucia Alfama
Apartments, Alfama, Lisbon - Show on map
Excellent 8.9
134 reviews

Search

Destination/Property Name: Lisbon
Check-in Date: Friday, March 9, 2018
Check-out Date: Sunday, March 11, 2018
2-night stay
2 adults
No children 1 room
I'm traveling for work?
Search

Filter by:

- Your Budget: € 0 - € 50 per night, € 50 - € 100 per night, etc.
Popular Filters: Hotels, Breakfast included, Parking, etc.
Star Rating: 1 star, 2 stars, etc.

76% reserved
Lisbon is a top choice on our site with travelers for your selected dates (76% reserved).
Tip: Prices might be higher than usual for the dates you've selected. Why not try again with these alternatives?

Lisbon: 990 properties found - including 119 value deals!

Visitors Love: Pastéis De Belém, Bairro Alto, Tile Museum
Food, Restaurants, Fine Art Museums

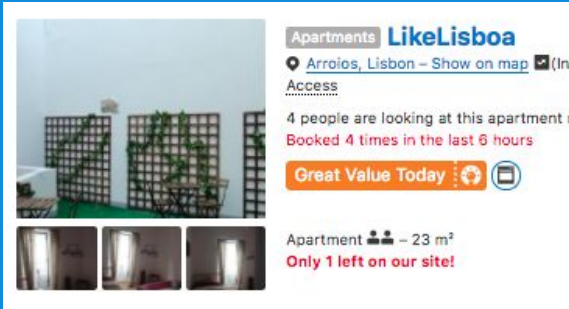
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Excellent 8.7
4,348 reviews
Price for All 2 Nights € 187
FREE cancellation
See our last available rooms

Junqueira Charming Apartment
Apartments, Junqueira, Lisbon - Show on map
Wonderful 9.0
21 reviews

Hypothetical example



Apartment **LikeLisboa**
Arroios, Lisbon – Show on map (In Access)
4 people are looking at this apartment r
Booked 4 times in the last 6 hours
Great Value Today 🏠 📄
Apartment 🧑🧑 – 23 m²
Only 1 left on our site!

1M users in A
40k bookers

4 %



Apartment **LikeLisboa**
Arroios, Lisbon – Show on map (In Access)
4 people are looking at this apartment r
Booked 4 times in the last 6 hours
Great Value Today 🏠 📄
Apartment 🧑🧑 – 23 m²
Only 1 left on our site!

1M users in B
44k bookers

4.4 %

Experimentation.

- But **A/B testing isn't practical for everything** we want to test, and then we need to be more creative



Booking.com



Big Data.

Scale is often a challenge both for manipulating data and designing analyses

- How to use destination as a model feature when we have 100k+ destinations?
- In just 1 hour, we collect something like 100+ million rows of data from the front-end... how to efficiently analyze this data?

Data Science Technologies.

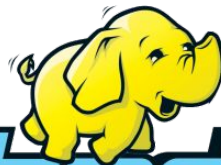
Data Access

SQL, Hadoop, ...

Analysis Tools

Up to the analyst. Most of us use Python and/or R. Parallel computing tools like Spark help deal with analysis of large data sets. Several machine-learning libraries are widely used at Booking.com.

SQL



Google Cloud



hadoop



cassandra



H₂O.ai

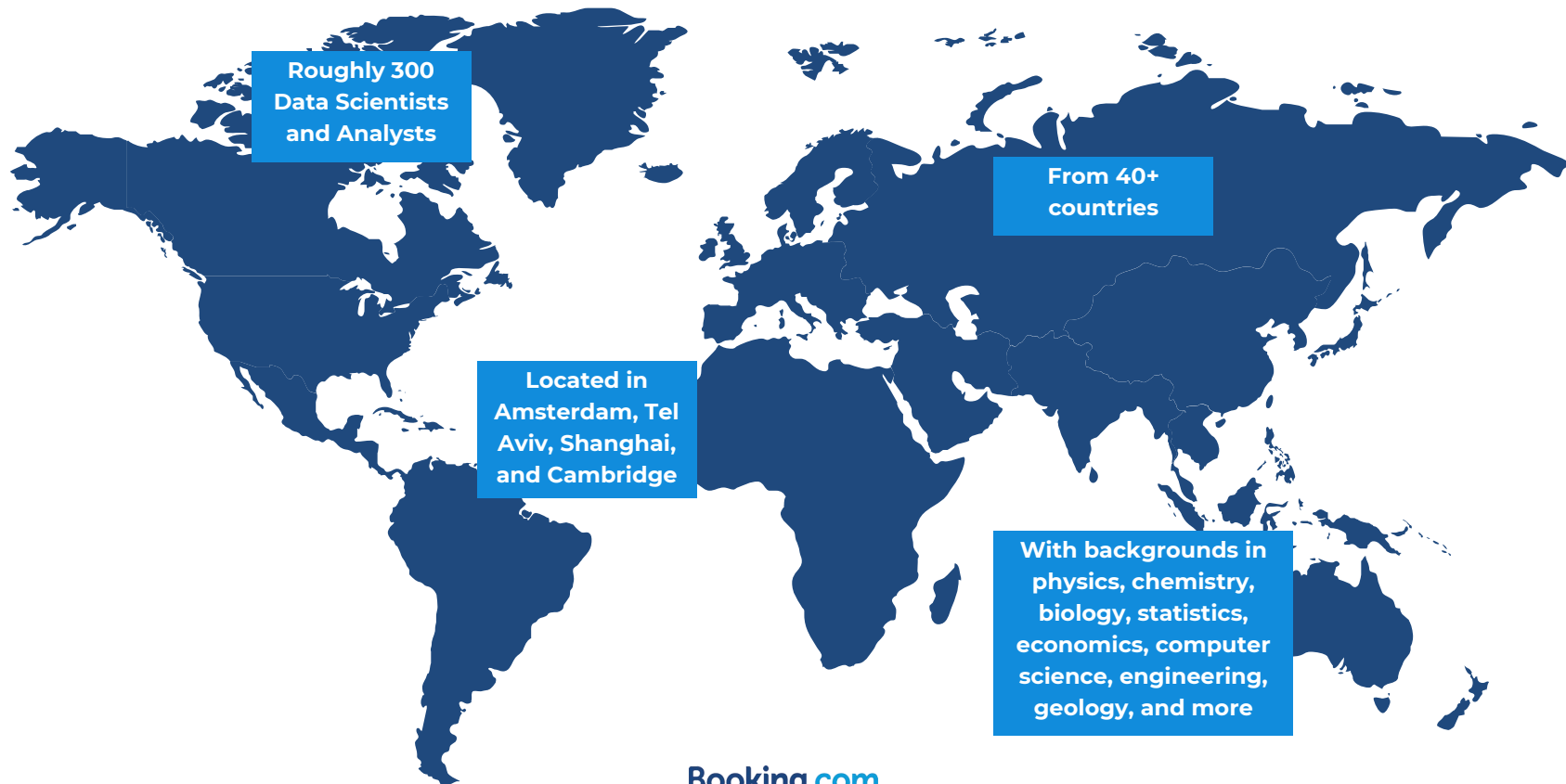


Booking.com

What skills do (astro)particle physicists bring to data science?

- **Scientific thinking**
 - ▶ Statistical thinking
 - ▶ Experiment design
 - ▶ Ability to spot biases / define comparable groups
 - ▶ Creative problem solving
- **Algorithmic thinking / programming skills**
- **Familiarity with data**
 - ▶ Which data to use
 - ▶ Data transformations
 - ▶ Dealing with edge cases, outliers
 - ▶ Modeling
- **Communication**

The analytics community at Booking.com.




Roughly 300
Data Scientists
and Analysts

From 40+
countries

Located in
Amsterdam, Tel
Aviv, Shanghai,
and Cambridge

With backgrounds in
physics, chemistry,
biology, statistics,
economics, computer
science, engineering,
geology, and more



We're hiring!

<https://workingatbooking.com/>

Booking.com

Jennifer Gaskins from **Booking.com**

[linkedin.com/in/jennifermgaskins](https://www.linkedin.com/in/jennifermgaskins)