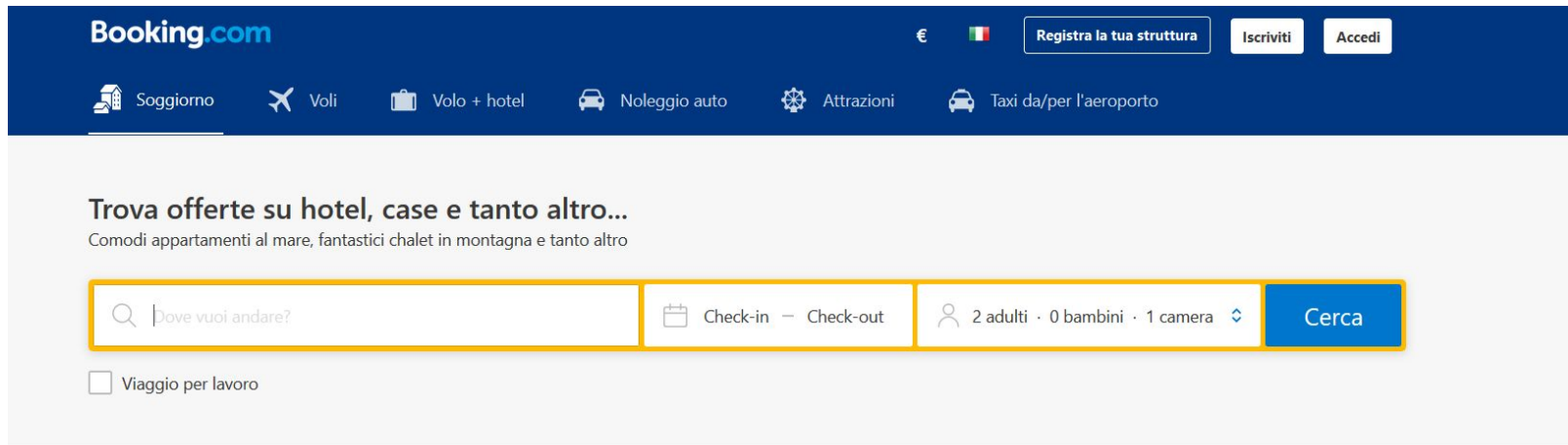

Booking.com

Recommendation system

Fabrizio Mazzone - Philipp Schlieker


The context







Booking.com allows the user to book hotels from everywhere in the world.






The image shows the Booking.com homepage. At the top is a dark blue navigation bar with the Booking.com logo on the left. To the right of the logo are the currency symbol (€), the Italian flag, and three buttons: "Registra la tua struttura", "Iscriviti", and "Accedi". Below the navigation bar is a horizontal menu with icons and labels for "Soggiorno", "Voli", "Volo + hotel", "Noleggio auto", "Attrazioni", and "Taxi da/per l'aeroporto". The main content area has a light gray background. It starts with the heading "Trova offerte su hotel, case e tanto altro..." followed by the subtext "Comodi appartamenti al mare, fantastici chalet in montagna e tanto altro". Below this is a search bar with a yellow border. The search bar is divided into four sections: a text input field with a magnifying glass icon and the placeholder text "Dove vuoi andare?", a date selection field with a calendar icon, "Check-in", a minus sign, "Check-out", a guest selection field with a person icon, "2 adulti · 0 bambini · 1 camera", and a dropdown arrow, and a blue "Cerca" button. Below the search bar is a checkbox labeled "Viaggio per lavoro".

Booking.com

€  [Registra la tua struttura](#) [Iscriviti](#) [Accedi](#)

 Soggiorno  Voli  Volo + hotel  Noleggio auto  Attrazioni  Taxi da/per l'aeroporto

Trova offerte su hotel, case e tanto altro...
Comodi appartamenti al mare, fantastici chalet in montagna e tanto altro

 Check-in — Check-out  2 adulti · 0 bambini · 1 camera  [Cerca](#)

☐ Viaggio per lavoro

The ranking

Typing a city, you can see the results basing on several ranking filters.

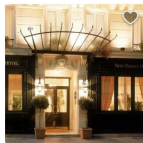
Our top picks	Show homes first	Price (lowest first)	Stars ▼	Star rating and price	Distance from city centre	...
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Top picks


Our top picks

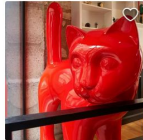
We will focus on what Booking defines *our top picks*.
This ranking is a recommendation system based on many factors:


- Room availability
- Preferred Partners
- Reviews
- Booking earning margin





New Orient Hotel ★★ ★★ 
8^e arrondissement, Parigi - Mostra sulla mappa - 3,5 km dal centro
- Vicino alla metro
Ospitato in un edificio in stile Haussmann dell'VIII arrondissement, l'elegante New Orient Hotel si trova a soli 2 km dall'Opéra Garnier e dall'Arco di Trionfo, e offre una reception aperta 24 ore al...
2 prenotazioni nelle ultime 24 ore sul nostro sito


Favoloso  8,7
558 recensioni
[Visualizza tariffe](#)




Hotel Excelsior Latin ★★ ★★ 
5^e arrondissement, Parigi - Mostra sulla mappa - 1,2 km dal centro
- Vicino alla metro
Situato a 200 metri dai Giardini del Lussemburgo, il 2^o parco pubblico più grande di Parigi, l'Hotel Excelsior Latin dista 400 metri dal famoso Pantheon, e offre una reception aperta 24 ore su 24 ed...
6 prenotazioni nelle ultime 24 ore sul nostro sito

Ottimo  8,2
1.210 recensioni
Posizione 9,3
[Visualizza tariffe](#)



Hôtel Garance ★★ ★★ 
18^e arrondissement, Parigi - Mostra sulla mappa - 9,8 km dal centro

Buono  7,8
1.332 recensioni

Room availability

Booking merges data from internal booking and manual updates to know about rooms availability in every hotel.

Of course, hotels that are full should not be recommended.



ibis Paris Italie Tolbiac ★★

[13th arr., Paris](#) • [Show on map](#) • 3.5 km from centre • Metro access

Good
1,154 reviews

7.6

We have no availability at this property for your dates: Thu 5 Mar 2020 - Sat 28 Mar 2020 (23 nights)

Reviews

The reviews in Booking.com are in the range from 0 to 10, with a decimal digit.

They are usually sided by a very short description.

Superb
1,657 reviews

9.3

Very good
451 reviews

8.4

Good
9,576 reviews

7.9

Preferred partners

The preferred partner program is proposed to the user to provide guests a positive experience thanks to its commendable service and good value.

The hotel could pay Booking.com a bit more to be in that program.



Booking earning margin

Booking.com should make money.

Well, Booking .com actually makes money through charging hotels for selling their inventories. It takes a little commission depending on the city, the hotel, the room.

Of course, it tries to push up the results where it can earn more.



—

Users are important
for booking.com

User preferences

Users decide which hotel to book focusing on:

- Price Sensitivity
- Business vs. Leisure
- Accompaniment
- Rating of the hotel
- Location of the hotel



What we did

We want to simulate Booking.com recommendation system based on what we set in the previous slides.

Our aim is obtaining the lowest regret and thereby maximizing *booking.com* margin.



What we need

→ **Environment**

All the elements that simulates our website (Booking.com)

→ **Some agents**

An agent states the strategy used to suggest a hotel.

→ **Statistics**

We did some comparison in order to know the best agent to choose for our specific environment

Our environment

1. Room Availability

Every hotel has a different room availability.

2. Partner Hotels

Some hotels are featured and they should appear more than the others.

3. Earning Margins

If the user likes the hotel, the margin is different for every hotel.

Some agents

1. Random

It performs a completely **random** choice, respecting the constraints, though.

2. Adaptive Greedy

At first it randomly chooses, then it takes the hotel that had the **average** greatest reward.

3. Epsilon Greedy

With a **eps** probability, it picks randomly, than exploits the learned **feature** to choose the best hotel.

Some agents

4. Thompson Sampling

It calculates and updates the estimated reward based on **probability** distribution.

5. Upper Confidence Bound

It samples very quickly to reduce the **uncertainty** of the unknowns before **locking** onto the most profitable hotel..

Some agents

6. Embedding Agent Offline

It trains embeddings based on **historical data** and learns expected payouts.

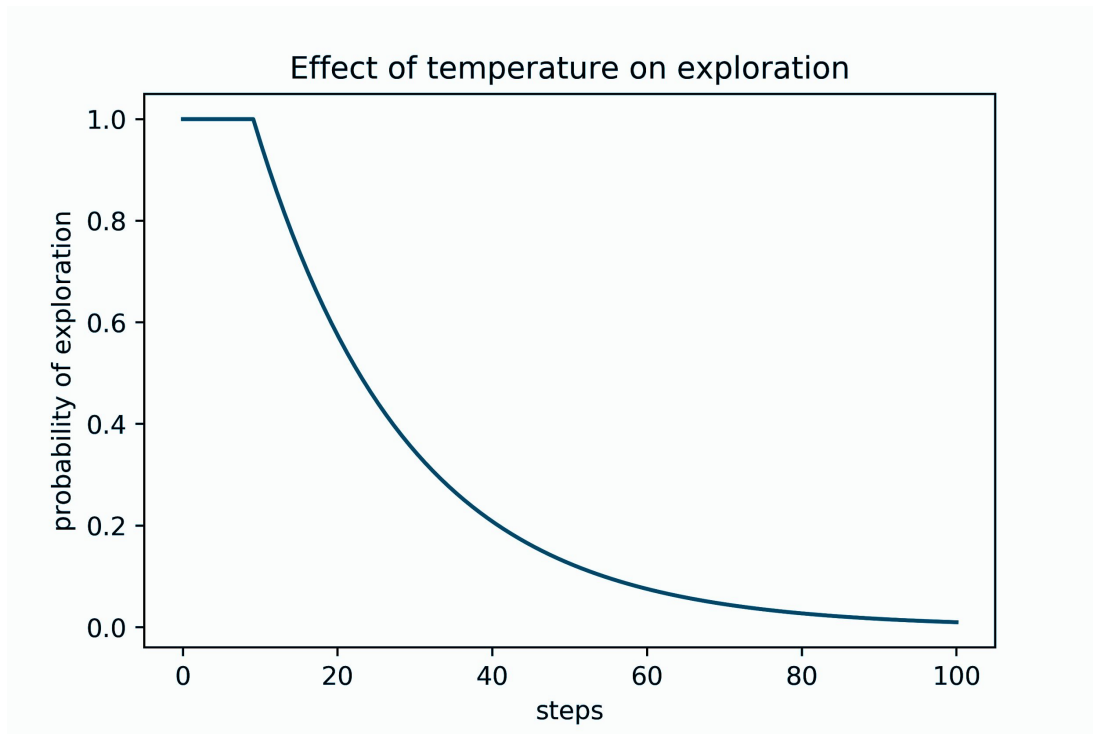
7. Embedding Agent Offline / Online

Embedding model that retraines when 30% new data is available.

8. Epsilon Embedding Agent

It performs a **weighted pick** between random exploration and exploitation of learned embeddings.

Effect of Temperature on Exploration

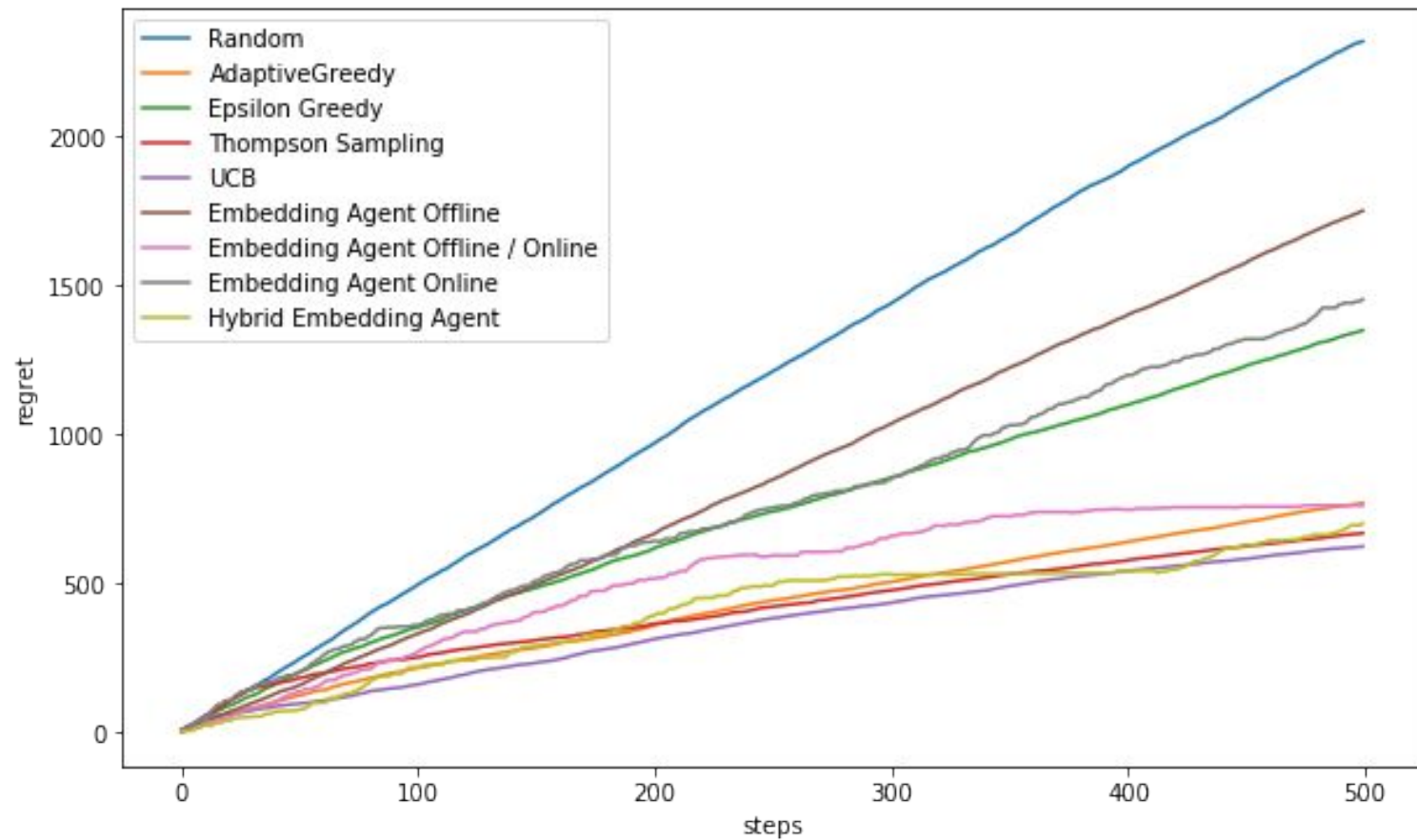


Some agents

9. Hybrid Agent

Uses Embeddings but also takes Meta-Data into account

Our results



Further improvements

- Implement Linear Stochastic bandits (LinUCB, LinTS)
- Perform Grid Search on Parameter Space
- Experiment with different ways to reduce temperature