

# Hotels.com's journey to becoming an Algorithmic Business

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Hotels.com

# Hotels.com

Part of Expedia, Inc. family

>385,000 properties

89 countries

39 languages

>30m Hotels.com Rewards Members

Home of Captain Obvious

Billions of Recommendations, based on real-time Data per day









**Data Science**



**Engineering**



**Front End Development**





Barry Diller  
Chairman & Senior Executive,  
Expedia, Inc.

“Artificial Intelligence Will Be  
Travel’s Next Big Thing”

3M’s are disruptive  
technology

Mobile

Messaging / NLP

Machine Learning





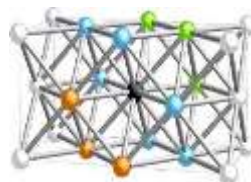
# Core Elements of our Data Science Cloud Platform

Databricks Unified Platform



Maestro – Our Internally Developed Platform on AWS

(EMR, Spark, R-Studio, IntelliJ, SBT, Jupyter, Zeppelin, Unit / QA, Metastore, Apache Airflow, Keras, Tensorflow)



Proof of Concept on Google Cloud, Beam, Spark & Tensorflow





# Databricks Unified Platform

- Key asset to the success of data science at Hotels.com
- Key in driving up data scientist productivity / efficiency / flexibility
- Helps make our data science lifecycle operate much easier and faster driving speed to market
- Reliable / secure + facilitates 'Highly Elastic' workflows exploiting cost effective spot instance on AWS.

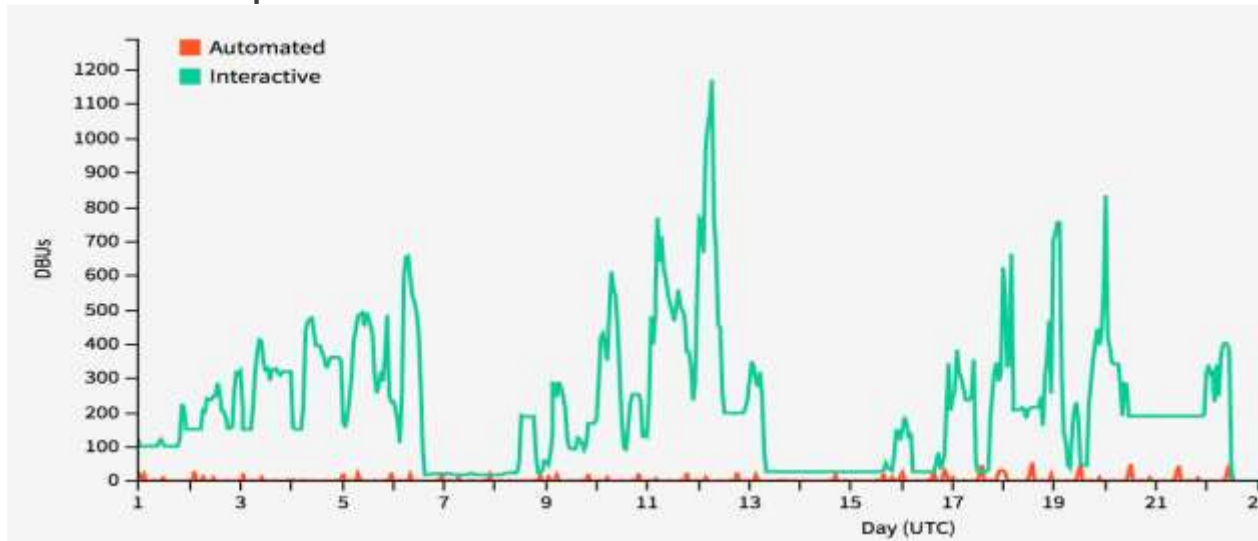


Chart is in 1 hour blocks, y axis = number of 32 core instances

Confidential - do not distribute

# The hidden secret of data science and AI

Typically data scientists are investing large amounts of time in feature / data engineering areas which are ripe for a technology solution

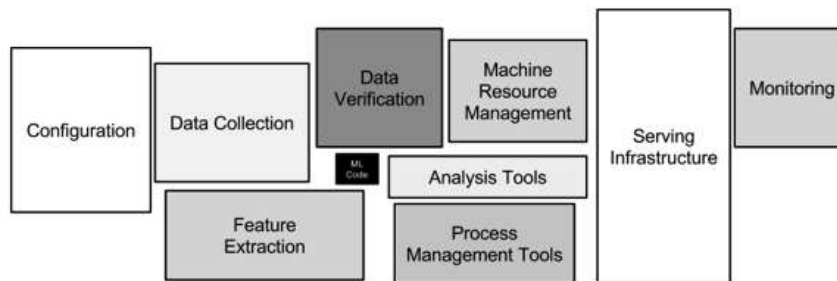
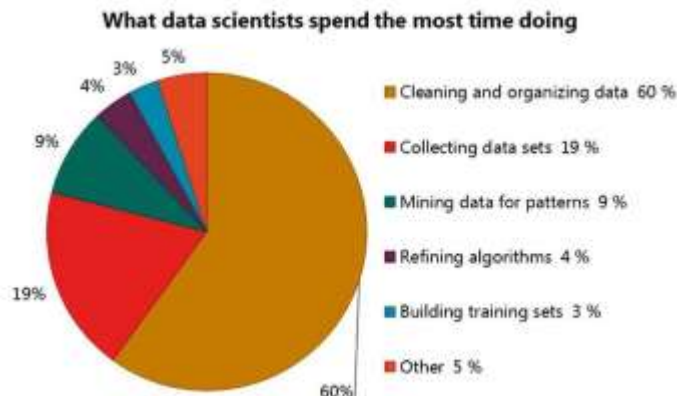


Figure 1: Only a small fraction of real-world ML systems is composed of the ML code, as shown by the small black box in the middle. The required surrounding infrastructure is vast and complex.



# ALPs – Algorithm Lifecycle Pipeline Service

## The end to end ML Platform





## Data capture

Accessible data

 databricks™



## Data pipelines

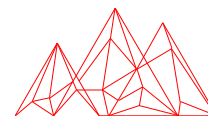
Develop and maintain ML/ AI pipelines

 databricks™



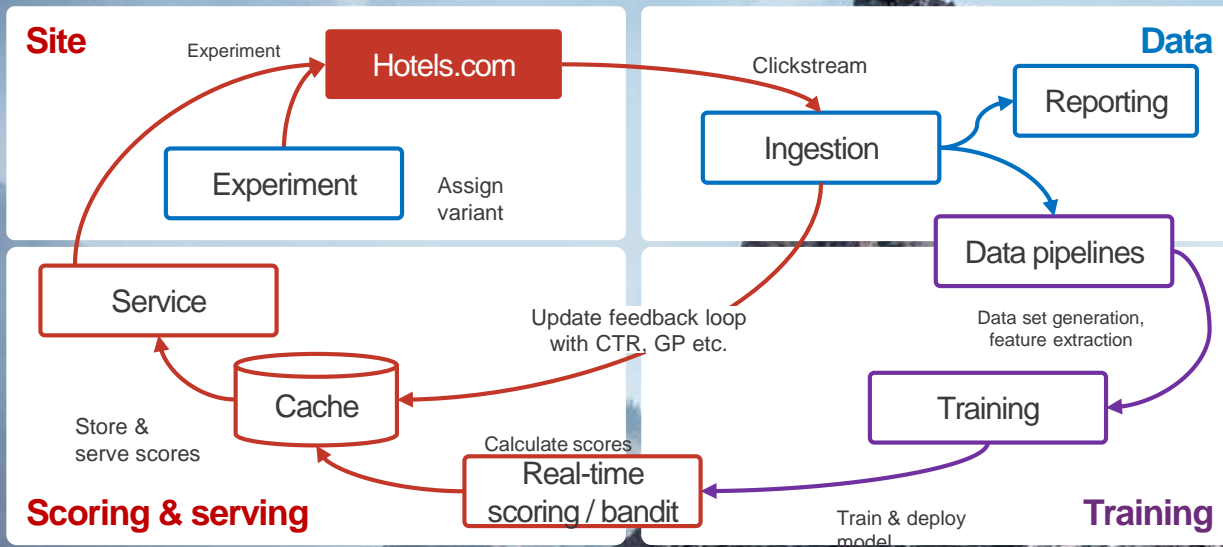
## Frameworks & Platforms

Methods to research & exploit ML & AI innovation



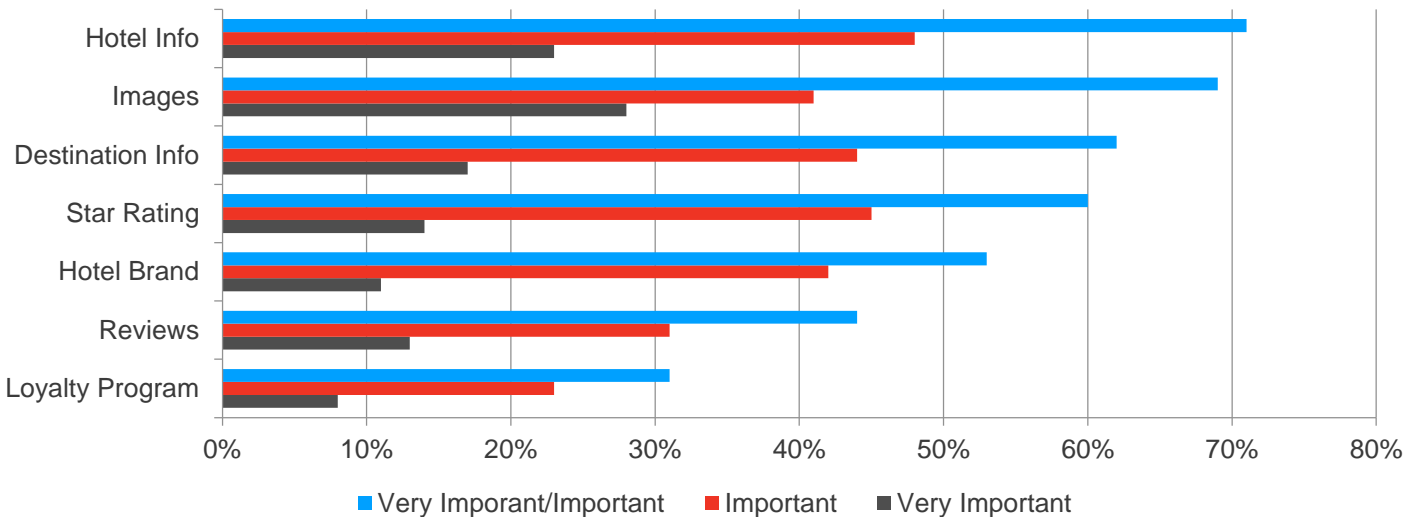
## Lifecycle / Deploy

Implement ML / AI in production



# Images are an important factor while choosing a hotel

## Factors other than price/location



Reference: [The Influence of Visuals in Online Hotel Research and Booking Behaviour](#)

# Computer Vision problems we try to tackle



**Near Duplicate Detection**



**Scene Classification**





**Image Ranking**



**The Cove Atlantis, Autograph Collection** 5 stars  
 Paradise Beach Drive, Paradise Island, New Providence, B. Bahamas, 0001 027 6776  
 Upscale beachfront resort with free water park, near Fort Fincastle  
 ✓ Free WiFi

Jump to: [Overview](#) | [Room choices](#) | [Hotel information](#)

**Waterslide** [25/1]



**La Tinassara**  
 Lazise  
 0.51 mi from Bardolino  
 020 3564 4852 (Call cost)

**Superb! 4.5/5**  
 (6 reviews)  
 2 nights from  
**1 left at**  
**£201**



**Hotel Remât** ★★  
 Garda (Garda)  
 0.64 mi from Bardolino  
 020 3564 4852 (Call cost)  
 ✓ Free Cancellation

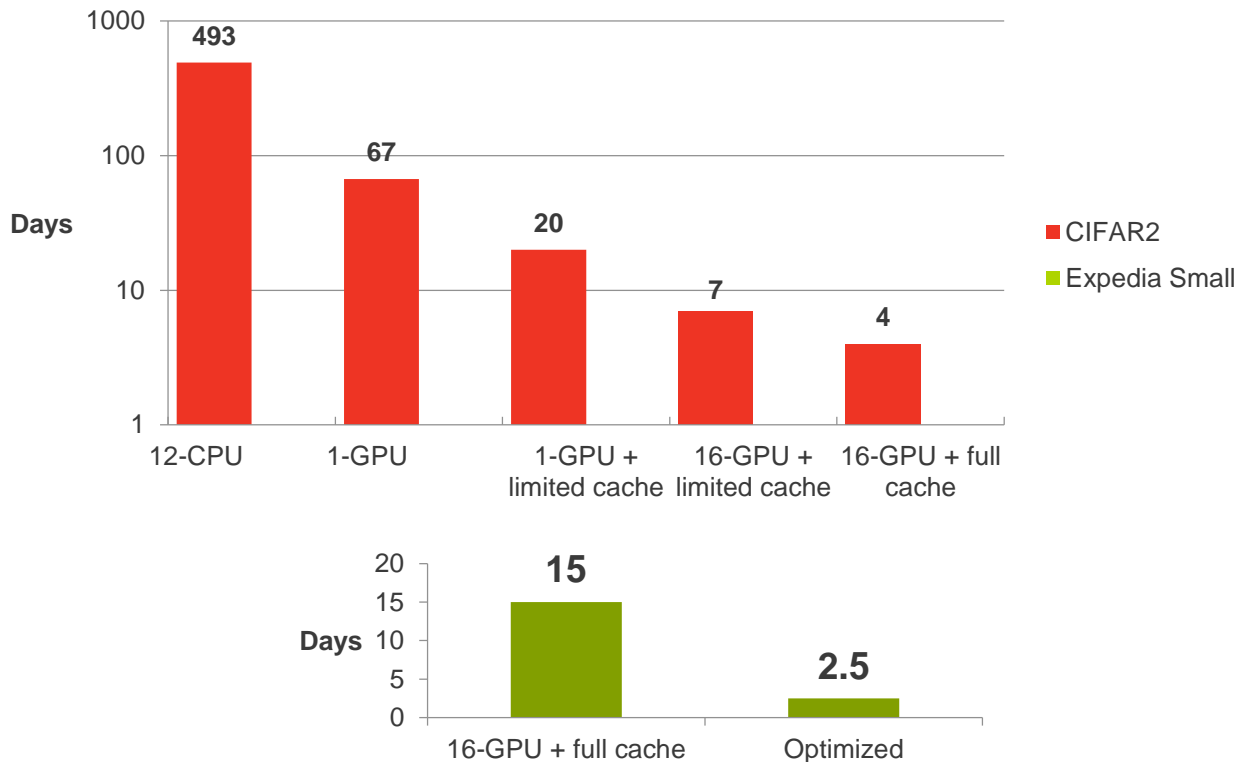
**Superb! 4.5/5**  
 (51 reviews)  
 2 nights from  
**3 left at**  
**£202**  
 +2.00 EUR due at hotel



**Tagged as Bathroom**



## GPU's quickly became key, took a large effort to optimize using Keras + Tensorflow (Inception v3 + ResNet)



# Near Duplicate Detection: Real world examples



**Non-Duplicates – probability 100%**



**Duplicates – probability 97.98%**



**Non-Duplicates – probability 95.91%**



**Duplicates – probability 98.43%**

# Using the model: Real world examples



EXTERIOR/HOTEL



INTERIOR/SEATING\_LO



INTERIOR/SEATING\_LOBBY



ROOM/GUESTROOM



ROOM/BATHROOM



ROOM/LIVING\_ROOM

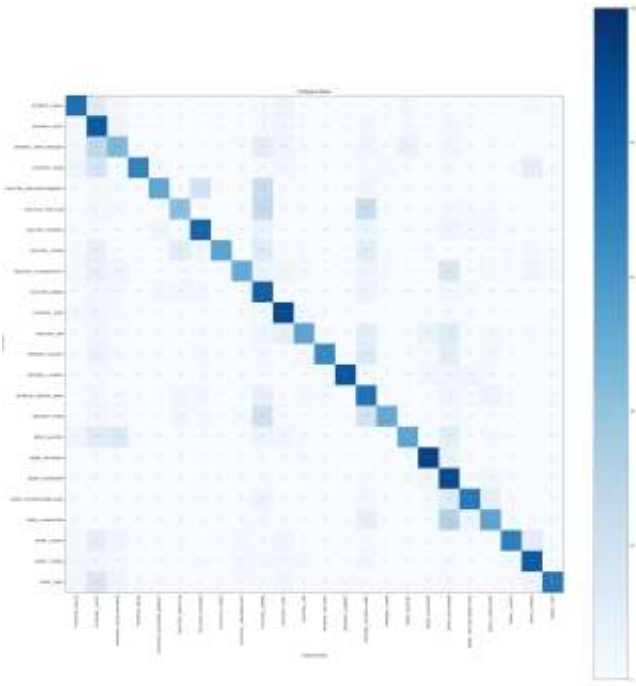


FACILITIES/DINING



FACILITIES/POOL

# Accuracy & Confusion Matrix



- After many manual / long winded iterations and regularization processes tuning hyperparameters
- We achieved good accuracy and low confusion matrix



# Optimizing the photo order for improved customer experiences

Original



Model



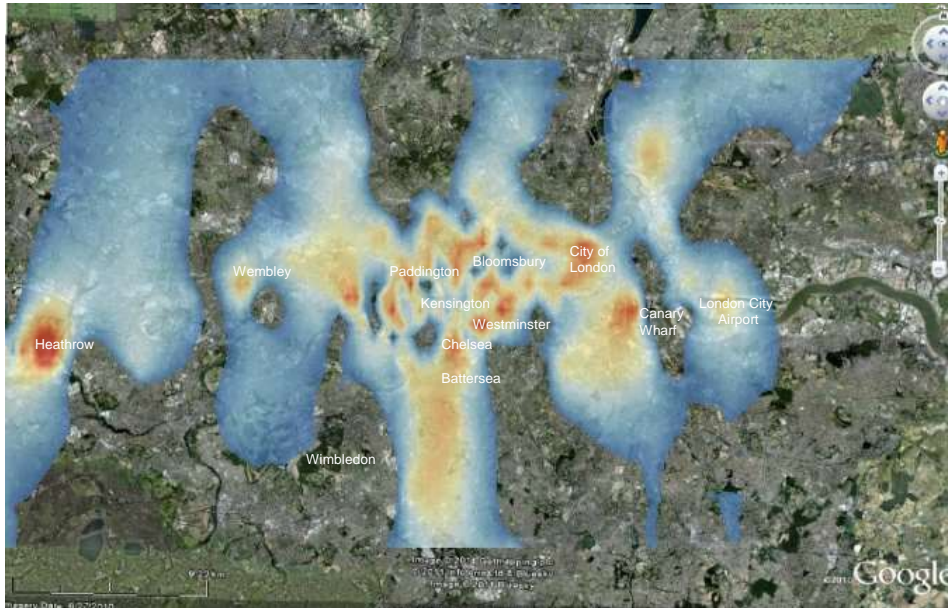
Reference: [Radisson Blu Edwardian Berkshire Hotel, London](#)

# Finding the right hotel in our marketplace is core to our customers needs.

The screenshot shows the Hotels.com website interface. At the top, the header includes the Hotels.com logo, a phone number (0008 234 6370 or 0203 864 6246), and a user profile. The main search bar displays the destination 'The Convention Centre Dublin, International Financial Services Centre, Dublin, Ireland' and the dates 'Wed 25 - Fri 27 October 2017, 2 nights, 1 room, 1 adult'. Below the search bar, there are filters for 'Narrow results', 'Name contains', 'Price (for 2 nights)', 'Star rating', 'Guest rating', and 'Hotels.com Rewards'. The search results are displayed in a grid format, showing three hotel listings: 'The Spencer', 'IFSC Dublin City Apartments by The Key Collection', and 'Dockland Apartments Dublin City by The Key Collection'. Each listing includes a photo, a brief description, a rating, and a 'Choose Room' button. The bottom of the page features a banner for the Hotels.com app and a link to download the app.

The screenshot shows the Hotels.com mobile app interface. The header displays the Vodafone logo, the time '15:59', and the battery level '58%'. The search bar shows the destination 'The Convention Centre Dublin, International Financial Services Centre, Dublin, Ireland' and the dates 'Wed 25 Oct to Fri 27 Oct'. Below the search bar, there are filters for '207 hotels available', 'Hotel Name...', 'Price (for 2 nights)', 'Star rating', 'Guest rating', and 'Hotels.com Rewards'. The search results are displayed in a grid format, showing three hotel listings: 'The Spencer', 'IFSC Dublin City Apartments by The Key Collection', and 'Dockland Apartments Dublin City by The Key Collection'. Each listing includes a photo, a brief description, a rating, and a 'Choose Room' button. The bottom of the page features a banner for the Hotels.com app and a link to download the app.

## As an example different user segments like to stay in different locations





just browsing!

Utility



Intent  
(click)

Utility



BOOK!

Utility



# Thank you

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@mattfryer

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