



TOR VERGATA
UNIVERSITÀ DEGLI STUDI DI ROMA



**MASTER
IN ECONOMIA
E MANAGEMENT
DELLE ATTIVITÀ
TURISTICHE
E CULTURALI**

“Big Data: Analysis, Challenges, Careers”

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Introduction

In this lesson we will analyze the meaning and the role of big data in tourism, together with the related main challenges and career opportunities.

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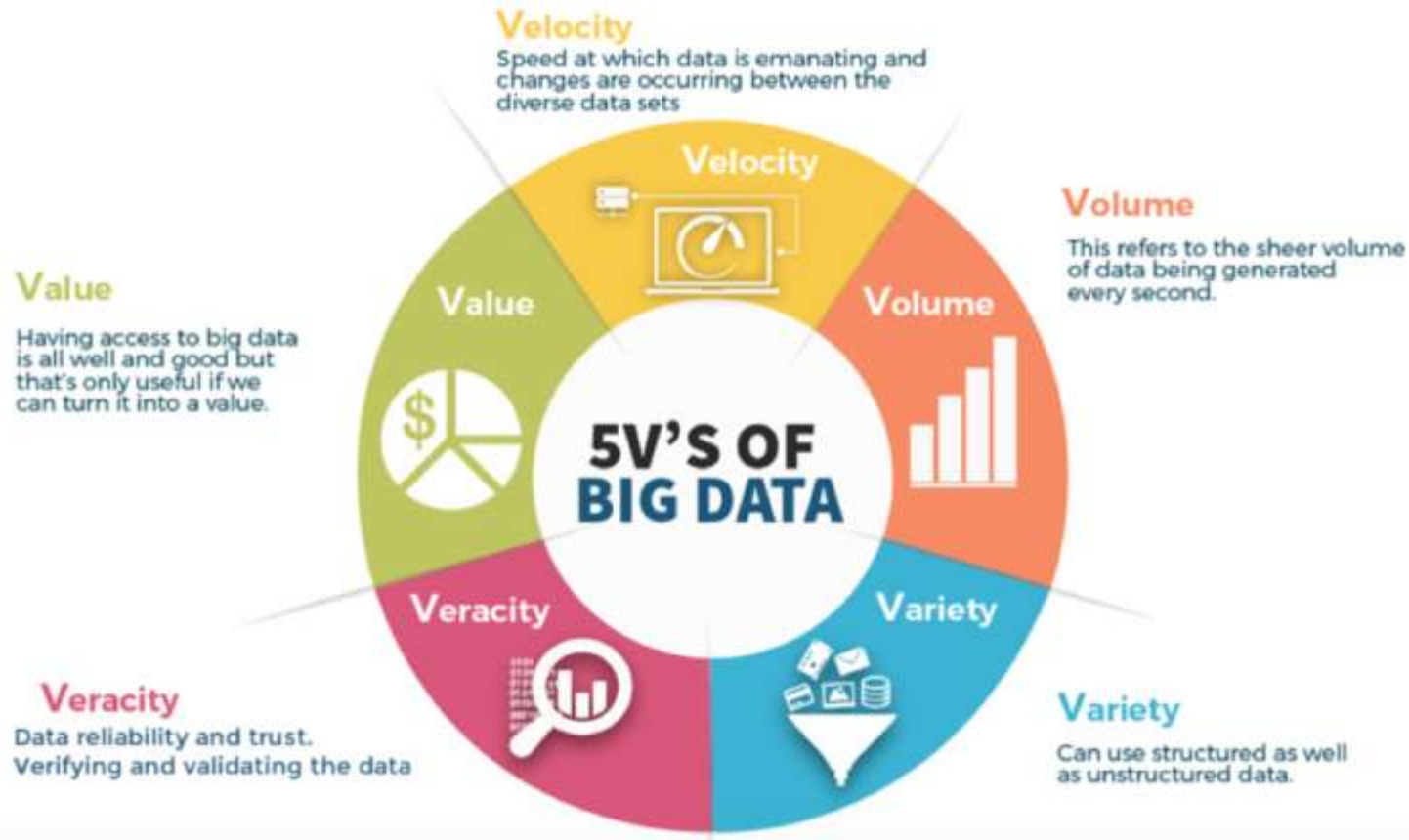
Definition of Big Data

- Big data is data that contains greater variety arriving in increasing volumes and with ever-higher velocity. This is known as the three Vs*.
- Put simply, big data is larger, more complex data sets, especially from new data sources. These data sets are so voluminous that traditional data processing software just can't manage them.



**Gartner's definition*

Big Data, main characteristics



Volume - The amount of data matters. With big data, you'll have to process high volumes of low-density, unstructured data. This can be data of unknown value, such as Twitter data feeds, clickstreams on a webpage or a mobile app, or sensor-enabled equipment. For some organizations, this might be tens of terabytes of data. For others, it may be hundreds of petabytes.

Velocity - Velocity is the fast rate at which data is received and (perhaps) acted on. Normally, the highest velocity of data streams directly into memory versus being written to disk. Some internet-enabled smart products operate in real time or near real time and will require real-time evaluation and action.

Variety - Variety refers to the many types of data that are available. Traditional data types were structured and fit neatly in a relational database. With the rise of big data, data comes in new unstructured data types. Unstructured and semistructured data types, such as text, audio, and video, require additional preprocessing to derive meaning and support metadata.

Source: <https://www.techentice.com/>

Veracity - the most important thing!

Veracity helps to filter through what is important and what is not, and in the end, it generates a deeper understanding of data and how to contextualize it in order to take action.

Data veracity, in general, is how accurate or truthful a data set may be. In the context of big data, however, it takes on a bit more meaning. More specifically, when it comes to the accuracy of big data, it's not just the quality of the data itself but how trustworthy the data source, type, and processing of it is.

Still one to go... VALUE

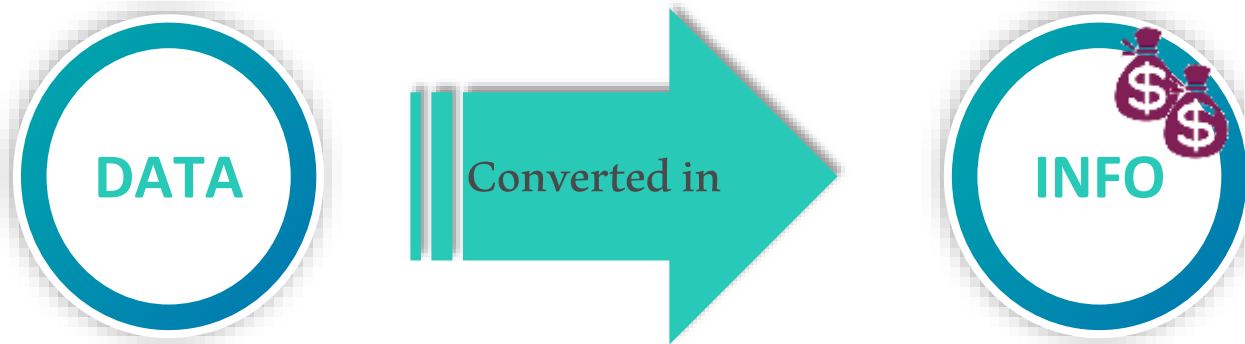
VALUE

Big Data has been defined in recent years as the new gold, or as an invaluable source of *value*.

It is exactly like that.

But simply collecting data, while exploiting the best technologies available on the market, does not guarantee having information and, above all, extracting knowledge.

From “data” to “information”



Through the use of methodologies of Big Data Analytics a company can extract **value** or make more informed, timely and aware decisions from the ENORMOUS world of Big Data

Big data Analytics: methodologies

DESCRIPTIVE - This can be termed as the simplest form of analytics, so arithmetic operations, mean, median, max, percentage, etc on existing data. It is said that 80% of business analytics mainly involves descriptions based on aggregations of past performance. It is an important step to make raw data understandable to investors, shareholders and managers.

DIAGNOSTIC - analytics is used to determine why something happened in the past. It is characterized by techniques such as drill-down, data discovery, data mining and correlations. Diagnostic analytics takes a deeper look at data to understand the root causes of the events. It is helpful in determining what factors and events contributed to the outcome. It mostly uses probabilities, likelihoods, and the distribution of outcomes for the analysis.

PREDICTIVE - analytics is used to predict future outcomes. However, it is important to note that it cannot predict if an event will occur in the future; it merely forecasts what are the probabilities of the occurrence of the event. A predictive model builds on the preliminary descriptive analytics stage to derive the possibility of the outcomes.

PRESCRIPTIVE - The basis of this analytics is predictive analytics but it goes beyond the three mentioned above to suggest the future solutions. It can suggest all favorable outcomes according to a specified course of action and also suggest various course of actions to get to a particular outcome. Hence, it uses a strong feedback system that constantly learns and updates the relationship between the action and the outcome.

Source: <https://www.analyticsinsight.net/>



Data Science - Origins, development



We started to talk about “Data Science” in the early 1970s and the first definition referred to the science of manipulating data, while little emphasis was placed on the ability to extract useful information in business contexts.

The advent of Big Data has given new life to this term and Data Science has acquired a leading role in the business context.

This is an interdisciplinary science, at the intersection of Computer Science, Statistics, Mathematics, Data Visualization and understanding of variables and management language. It is possible to summarize the skills related to Data Science in five areas:



Data science: 5 areas of expertise

TECNOLOGY

Ability to manage structured and non-structured data, to extract data from external sources through specialized methodologies and tools and to manipulate and distribute large amounts of data;

ANALYTICS/MACHINE LEARNING

knowledge of mathematical-statistical models and techniques, ability to develop and implement machine learning algorithms and knowledge of tools for carrying out analyzes;

KNOWLEDGE DEPLOYMENT

ability to create representation of data interesting and intuitive. Not only soft communication skills, but also technical skills such as the ability to use data visualization software and dashboard design

PROGRAMMING programming skills in the main languages;

BUSINESS ANALYSIS - knowledge of business aspects (effects of micro and macro-economics, functional processes, language and management objectives) and governance of variables related to the sector in which the company operates.

Data Science & Big Data



*“Every
problem is a
data
problem”*

Data Management



What does it mean to have to manage much larger and heterogeneous databases in the company, with more sophisticated analysis methods and increasingly efficient and faster information processing systems?



A mature approach to Analytics does not lie in an indiscriminate and disordered use of unreliable information, but in the ability to manage large amounts of data with technological processes and tools that reduce infrastructure flexibility and agility as little as possible.

Main challenges:



Guarantee quality on extremely heterogeneous data

Build a flexible and open infrastructure ensuring a unique view of the data

Increase data users ensuring information security and privacy

Managing data in a Company: new careers, new skills



DATA SCIENTIST MUST-HAVE SKILLS

MATH & STATISTICS

- Machine Learning
- Statistical Modeling
- Exploratory Analysis
- Clustering
- Regression Analysis

PROGRAMMING & DATABASE

- Computer Science Fundamentals
- Database Management System
- Data Visualization
- Python
- Big Data

DOMAIN KNOWLEDGE & SOFT SKILLS

- Inclination towards business operations
- Keen on working with data
- Problem solver
- Strategic, proactive, and cooperative
- Interested in hacking

COMMUNICATION & VISUALIZATION

- Storytelling skills
- Convert data-based insights into decisions
- Collaborative with Sr. Management
- Knowledge of tools like Tableau
- Visual art design

The Data Scientist is in all respects a professional figure being defined.

Certainly he/she must have:

Strong interdisciplinary skills

Ability to "read the data" in order to identify patterns with statistical and mathematical skills but with a "wide view".

Managing data in a Company: new careers, new skills

The growing & evolving Chief Data Officer role

The growing importance of data & analytics has led to the evolution of the Chief Data Officer (CDO) role



Everest Group® Enterprise Digital Adoption in Retail | Pinnacle Model™ Assessment 2018

The Chief data officer (CDO) has the task of defining, presenting and implementing the strategies of Data Driven Innovation, Data Analytics and Big Data.



Specifically, the CDO is the person who has to manage the acquisition, analysis, intelligence and action on corporate data. In terms of skills it is a figure that must combine technical, managerial and business skills, but also possess a series of soft skills to dialogue, know and interpret the "Data Driven" needs of all business areas.

Managing data in a Company: new careers, new skills

A good Data Science team need to include additional figures within it:

➤ the **Data Engineer**. Its job is to make the data available for analysis. In complex contexts, the presence of a Data Engineer is essential to make timely analyzes and make the entire infrastructure work. The Data Engineer is therefore an extremely technical role, focused on the ability to manage relational and non-relational databases, on the knowledge of Big Data technologies (e.g. Hadoop or Spark) or stream processing (e.g. Kafka) and more generally on construction and maintenance of the architecture that makes the data available for analysis.

➤ the **Data Analyst**. He is required to carry out mainly descriptive or exploratory analysis, less complex than those carried out by the Data Scientist, and to play the role of conjunction between analysts and business figures. The Data Analyst has basic skills in mathematics, statistics and database operation. Generally it uses more traditional tools - in many cases only Microsoft Excel - and, if it knows programming languages, it is more likely that it knows SQL than Python

Data Scientist also known as Data Managers, statisticians.	Data Engineers also known as database administrators and data architects.	Data Analysts also known as business Analysts.
		
A data scientist will be able to take data science projects from end to end. They can help store large amounts of data, create predictive modelling processes and present the findings.	They are versatile generalists who use computer science to help process large datasets. They typically focus on coding, cleaning up data sets, and implementing requests that come from data scientists.	They typically help people from across the company understand specific queries with charts.
<i>Skills:</i> Mathematics, Programming, Communication	<i>Skills:</i> Programming, Mathematics, Big data	<i>Skills:</i> Statistics, Communication, Business knowledge
		
Will use programmes such as: SQL, Python, R	Will use programmes such as: Hadoop, NoSQL, and Python	Will use programmes such as: Excel, Tableau, SQL

Real Time Analytics: A velocity challenge

Real-time analytics is the use of data and related resources for analysis as soon as it enters the system. The adjective real-time refers to a level of computer responsiveness that a user senses as immediate or nearly immediate. The term is often associated with streaming data architectures and real-time operational decisions that can be made automatically through robotic process automation and policy enforcement.



Real-Time Analytics involve the entire Analytics value chain and can have important impacts on an organization's business model

New architectural borders: with Hadoop, beyond Hadoop



Hadoop is an open-source software framework for storing data and running applications on clusters of commodity hardware. It provides massive storage for any kind of data, enormous processing power and the ability to handle virtually limitless concurrent tasks or jobs.

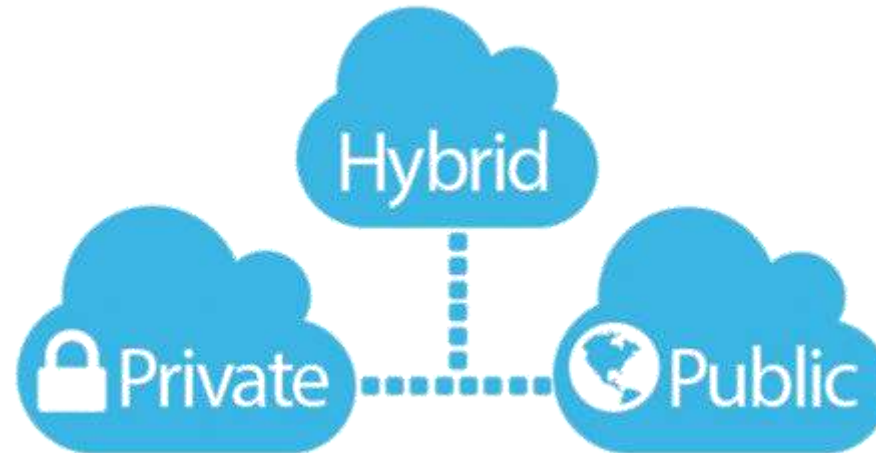


Apache Spark™ is a unified analytics engine for large-scale data processing



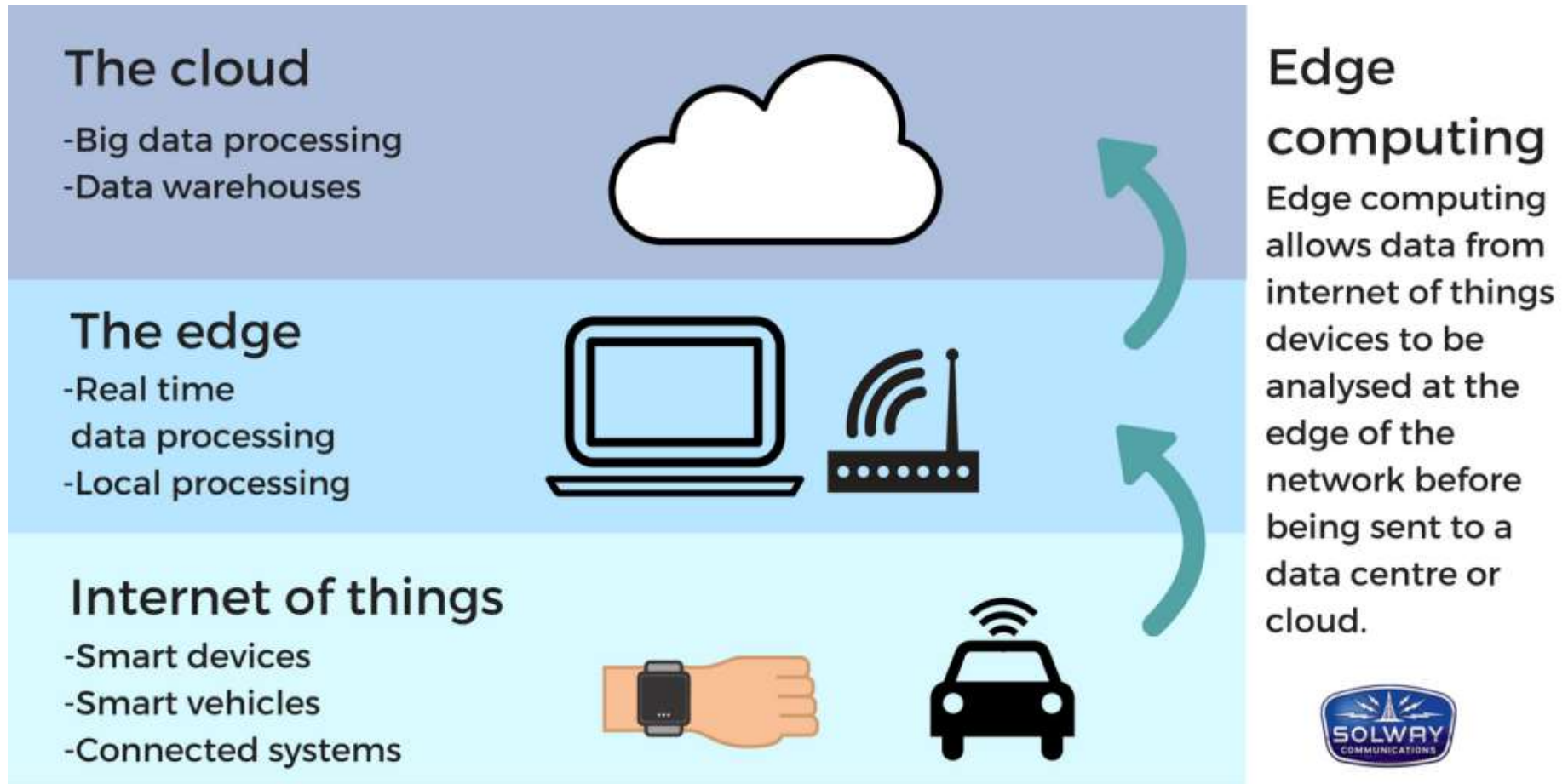
Apache Kafka is an open-source stream-processing software platform developed by the Apache Software Foundation, written in Scala and Java. The project aims to provide a unified, high-throughput, low-latency platform for handling real-time data feeds.

Hybrid Cloud ed Edge Computing



The main Big Data trend of the moment is that of the Hybrid Cloud, or the possibility of connecting your private environment with one or more Public Cloud systems. A hybrid Cloud environment enables even greater flexibility, limits the movement of data and allows the execution of Analytics where the data is stored. Costs optimization, therefore, but also greater agility and better management of legal requirements in terms of data privacy and confidentiality.

Hybrid Cloud & Edge Computing



5 ways Big Data can help the travel industry



1: Revenue Management

One of the most effective uses of big data within the travel industry is linked to revenue management. To maximise financial results, hotels and other tourism companies need to be able to sell the right product, to the right customer, at the right moment, for the right price, via the right channel, and big data can be invaluable for this.

In particular, internal data like past occupancy rates, room revenue and current bookings can be combined with external data, such as information about local events, flights and school holidays, in order to more accurately predict and anticipate demand. As a result of this, hotels are then better able to manage prices and room rates, increasing them at times of high demand, in order to maximise the revenue that is generated.



2: Reputation Management

Another important use for big data within the tourism industry is in connection with reputation management. In the internet age, customers can leave reviews on a wide range of different platforms, including social media sites, search engines and dedicated review websites, sharing their opinions and experiences. Moreover, customers are increasingly checking these reviews and comparing different hotels before they make a booking.

This data, combined with feedback acquired internally, can be used to spot the most significant strengths and weaknesses, and where customers are impressed or disappointed. Once this information has been gathered, hotels can use it to inform their training efforts, in order to make improvements and ensure future reviews are positive.



3: Strategic Marketing

Within the travel industry, marketing can be difficult to get right, because potential customers are so varied in who they are, where they come from, and what they are looking for. However, big data can help tourism companies to adopt a more strategic approach to their marketing efforts, targeting the right people in the right way.

More specifically, big data can help businesses to identify the main trends that exist among their customers, where the similarities are, and what the best marketing opportunities are. It can also help businesses to understand where those people are and when marketing is most relevant to them. This can enable marketing messages to be sent, based on time, location and other data, allowing more targeted promotional content to be delivered.



4: Customer Experience

Hotels and other businesses in the travel and tourism industry have a vast array of interactions with customers, and each of these interactions can provide valuable data, which can be used to improve the overall customer experience. This data can include everything from social media conversations and online reviews, to service usage data.

Used effectively, this information can reveal which services customers use most, which they do not use at all, and which they are most likely to request or talk about. Through this data, companies can make more informed, data-driven decisions about the services they currently provide, the services they no longer need to provide, the services they want to introduce, and the new technology they choose to invest in.



5: Market Research


Finally, those in the travel and tourism industry can also use big data to compile and analyse information about their main competitors, in order to gain a clearer understanding of what other hotels or businesses are offering customers. Again, this data can be acquired from a variety of sources, as there is no shortage of places where customers go to share their opinions on hotels and travel companies, especially online.

Ultimately, the data can be used to pinpoint the strengths, weaknesses and overall reputation of rival companies. This can be extremely valuable, as it can help business leaders to spot potential gaps in the market, or opportunities to deliver in ways that rivals are failing to. This can, in turn, lead to greater demand and higher revenue.

Big data can benefit those in the travel industry in a number of important ways, allowing them to make more evidence-driven decisions. These include the ability to anticipate future demand more accurately, optimise pricing strategies, target marketing more precisely and improve the customer experience.



4 use cases for predictive analytics in travel



In reality, big data is all about finding meaningful patterns from vast data-sets. Statistical models are applied to bring out those insights from the data-sets we have at our disposal. These patterns allow us to make predictions for future based on existing trends. This is what is called predictive analysis. In layman's language, it's the study of present and past trends in data-sets to make predictions for the future. This is how the travel industry makes predictions of a customer's travel plans for a season. It studies if s/he has been booking flights and hotels on mountains every winter. Here are a few ways of how predictive analytics is being used in the travel industry.

1. Alerting and Monitoring Systems

The amount of data generated and recorded by businesses are huge. It's not humanly possible to keep a track of these data and their anomalies. Businesses are making use of supervised machine learning techniques to find defects in their systems. It studies a number of factors and alerts when something abrupt or rare happens in the system. These algorithms are making it possible for businesses to take immediate action before an accident starts to show up.



2. Sentiment analysis and profiling

The whole world is functioning on social media today, be it an individual or a business. The crowd on social media platforms is demanding and getting larger by the day. This results in more volumes of data coming from those platforms. It's not possible to monitor your social media manually anymore. Modern travelers share their photos and sentiments on social media when they are traveling. Most travelers like to review locations and hotels on social media for others to follow. Sentiment analysis enables businesses to read and analyze these data in fractions of seconds. Predictive analysis checks the sentiment for your business and responds immediately. That's how businesses respond to you within minutes after seeing your bad review on the web.



3. Click and conversion optimization



Conversion Rate Formula

How to work out how likely a click is to convert

$$\text{CR (Conversion Rate)} = \left(\frac{\text{Total Attributed Conversions}}{\text{Total Measured Clicks}} \right) \times 100$$

*Conversion Rate is expressed as a percentage, so for easy of use x 100 is added to the above equation.

What does it mean?

Conversion: An action you want people to complete (for example buying something or signing up to something).

Total Attributed Conversions: The total amount of conversions recorded which have been caused by *these* clicks.

Whether a click is responsible for a conversion is usually decided on by the advertiser (a user may have clicked on an ad on two different sites before making a purchase, so the advertiser decides which actually caused the sale).

Total Clicks: Number of times an ad was clicked on (and counted by a server).

theonlineadvertisingguide.com

TO
AG

Online marketing is all about making a sale without having to do a lot of product exposure. Luring customers to an advertisement is never enough if it doesn't convince them to take the next course of action.

Predictive algorithms estimate conversion rate, positioning of the advert and optimize them. They understand passenger needs based on the various factors that seem to affect the traveler's preferences. This creates a new platform for online advertising.

4. Recommendations and recommender systems

Customers Who Bought This Item Also Bought



Recommendations rule the travel industry. Imagine you are browsing through different locations of Iceland and checking flight rates. Wouldn't you be convinced if a pop up for a cheap & attractive Airbnb comes up? You might not do the booking immediately, but it will certainly persuade you to make an Icelandic trip. It all happens based on what searches you have done in the past. Predictive analytics can create efficient recommendation algorithms based on the data we have at hand.

There are also a hundred different flights that connect two different countries today. There are a thousand more when one counts the possible services between these points. So why, and how, do one exact solution and just a few services make sense to an individual traveler? Recommender services provide mutually beneficial plans for both travelers and travel providers. The solution is suited to their preferences and is monetarily sensible for both parties too. Predictive analysis studies user behavior and makes meaningful suggestions.

3 Big Data pain points the travel industry shares



1. Integrating more non-traditional data and human demographics

For many professionals focused on the traveler journey, there is a desire for data that isn't focused on an aircraft. These professionals—whether in strategy, design or delivery roles—want to better understand the people traveling, and their experience during travel.

For example, they want more information on weather and current affairs, such as strikes or political unrest, that might have an impact on travel. Additionally, they want to know more about the human beings involved. Who is the person traveling, what type of person are they and where are they in their journey?

Profile information that comes directly from the consumer can be combined with traditional travel data sets to create actionable derived information. Weave what you know about a traveler with monitored behaviors, and feedback from actual trip experience—this can produce deeper intelligence on how travelers feel about the travel experience and opens a door for predictive insights.

When considering what data sets you need, keep this in mind: Just because data is available, doesn't mean it's worth the time spent to analyze.

Non-traditional data was a recurring theme from all parts of the travel ecosystem. However, the meaning of non-traditional data depends on which vertical of the industry you're in. Airlines, airports and vendors all have different needs. Some traditional data within the industry might seem non-traditional because it's siloed, and everyone wants to peek into what everyone else has.

Focus on looking for data that fits your problems. Start with smaller pieces of a problem and think about what you need to solve that piece. When starting with just one area of the traveler journey—everything that happens before getting to the airport, everything that happens at the airport, or everything that happens in-flight—the data points needed to create the first experience may differ than the data points needed for the next experience.

2. Targeting the customer and consumer in different ways

When developing new products and capabilities, are you designing for the customers you have, or the customers you want? If you want to design for both, then you're going to need a pathway to collecting data about each one.

Airlines in particular are making a distinction between organizations that have signed contracts for services—their customers—and the individuals that make their own travel choices—general consumers. Customers are people you are already getting information from, while consumers are an aggregation of people in the market you need to learn more about.

Experience-based metrics like a Net Promoter Score help you understand customers, and compare actual customer needs against what customers say they desire. Rich, useful data about consumers is more elusive and connected to the behavior of individuals you can't easily reach.

The biggest challenge that exists for travel professionals who want to distinguish between the customer experience and the consumer experience is the accessibility of data. You want to turn more consumers into customers, but you have no data about those consumers. How do you learn about the consumer want when no one is sharing data with you?

Although the technology and processes for customer data capture already exist, many organizations still struggle to get a firm handle on their own customer information. The path to obtaining customer data is a matter of getting organized, while the path to accumulating consumer data requires you to determine how to capture it or negotiate with whomever already owns it.

A common pitfall is wanting more data before you even know if what you have is useful or not. Knowing what customers are buying from everyone else in the market is naturally the dream. Yet, before you can try to tackle learning about the open market, it's best to study your customers first. Then, determine what you need to learn from consumers and build a plan for how you will capture those insights.

If you aren't confident you have your customer data under control, there's no use increasing the problem. Consider postponing your desire for more data and take the time to get more clarity around what you have. Identifying the behaviors and characteristics that paint the picture of your current customers is worth the wait.

3. Increasing focus on segmentation

More travel service providers are taking a step back from trying to address the market as a whole in an effort to understand the different segments within the market. Once customers and consumers are parsed around common characteristics and behavior, providers can determine how to cater to each segment.

For example, you can determine what kind of person a traveler is based on linking information like their occupation and age with their purchasing decisions. This will help glean insight into the likelihood that a person with the same profile will buy the same product.

The travel industry in general is behind the curve when it comes to achieving sophisticated data segmentation. Most players currently segment by routes or capacity at the aggregate level, but fail to segment at a more specific, individual traveler level. Right now, it's difficult to even clearly see the routes people take and the place they generally live. The desire to segment by behavior, consumer attributes and scores exists, but the mathematics and data needed to accomplish segmentation has not been harnessed.

Going back to the concept of using non-traditional data to get answers you wouldn't typically have, consider leveraging data that has already segmented your travelers in other industries or working with a third-party provider with experience in melding consumer data to industry data.

While behavioral segmentation based on a customer's attitudes, use, and responses toward your product or service isn't something you can get from other industries or providers, you can seek out other categories of segmentation data. For example, consider leveraging the psychographic data—lifestyle, values, personalities—other companies already have because the same people who are traveling are also making other purchasing decisions out in the world, which you can learn from. Additionally, get advice from experts who have done this type of data blending before because they know the challenges and how to solve them.

8 travel brands using data and AI to improve customer experience



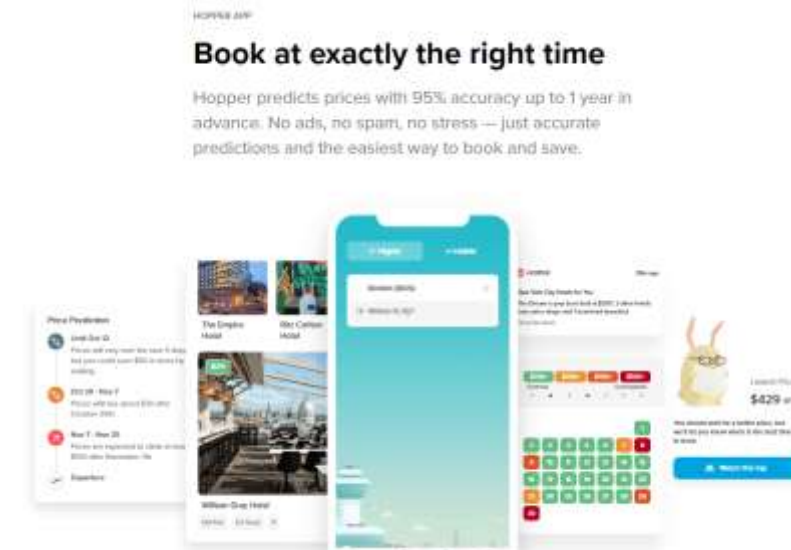
1. Hopper

No article about predictive analytics in travel would be complete without mentioning Hopper, the rapidly-growing fare prediction app.


According to Travelport’s 2018 Digital Traveler Survey, 50% of US travelers and 51% of Canadian travelers identified the time spent trying to find the best price as a top pain point for searching and booking leisure trips.

Hopper saves users time, money, and anxiety in their quest to book the perfect trip by offering travelers recommendations and alerts based on highly accurate pricing predictions. The innovative app accesses bookable travel options using Travelport’s next-generation APIs, then uses powerful machine learning to uncover price drops and exclusive deals for a personalized search and booking experience on mobile devices.

Hopper is one of the biggest success stories to hit the travel tech space and is currently on-track to process over \$1 billion in sales this year, according to recent reports from the company.



2. Booking.com



Off-Peak Deals ✕

School holidays are over but yours are not. Enjoy 20% off stays September-October.

[View deals](#)

Millions of homes, big or small... and you thought we only did hotels



Apartments
750,782 apartments



Resorts
20,501 resorts



Villas
384,101 villas



Cabins
12,863 cabins



Cottages
115,668 cottages

Booking.com uses predictive analytics not only in product development, but also across multiple departments, including customer service. Lukas Vermeer, Data Scientist at Booking.com, describes the importance of predictive analytics to the company in an interview with Predictive Analytics World:

“Booking uses predictive analytics for lots of different things! In web marketing, attribution models and ROI predictions help bring customers to our site. On the product side, recommendation systems help us show more relevant destinations, hotels and content to our users. In customer service, call volume predictions and scheduling algorithms help staff our call centers and connect customers to the right agent as quickly as possible. I could go on. In fact, I honestly struggle to think of a single department that is not using predictive analytics in one way or another.”

3. United Airlines



Airlines have a vast amount of customer information at their disposal. United Airlines has seen the benefits of using individual data to improve customer experience over the last few years, which has resulted in an increase in year-over-year revenue by more than 15%.

Its 'collect, detect, act' system analyses 150 variables in a customer's profile, like previous purchases to customer priorities, and presents an offer tailored to the individual. Its terms, on-screen layout, copy, and other elements will vary based on an individual's collected data.

4. IBM and Travelport



When it comes to corporate travel management, controlling the budget is one of the biggest challenges facing travel managers. In August 2018, IBM introduced its AI platform, the IBM Travel Manager, to help businesses manage corporate travel spend.

The platform allows organizations to track, manage, predict and analyze travel costs in one place, so they can optimize their travel program, control spend and enhance the traveler experience.

The IBM Travel Manager gives users complete access to previously siloed information from travel agencies, cards, expense systems and suppliers. When combined with travel data from the Travelport GDS, this information is then used to create real-time predictive analytics recommending how adjustments in travel booking behavior patterns can positively impact a company's travel budget.

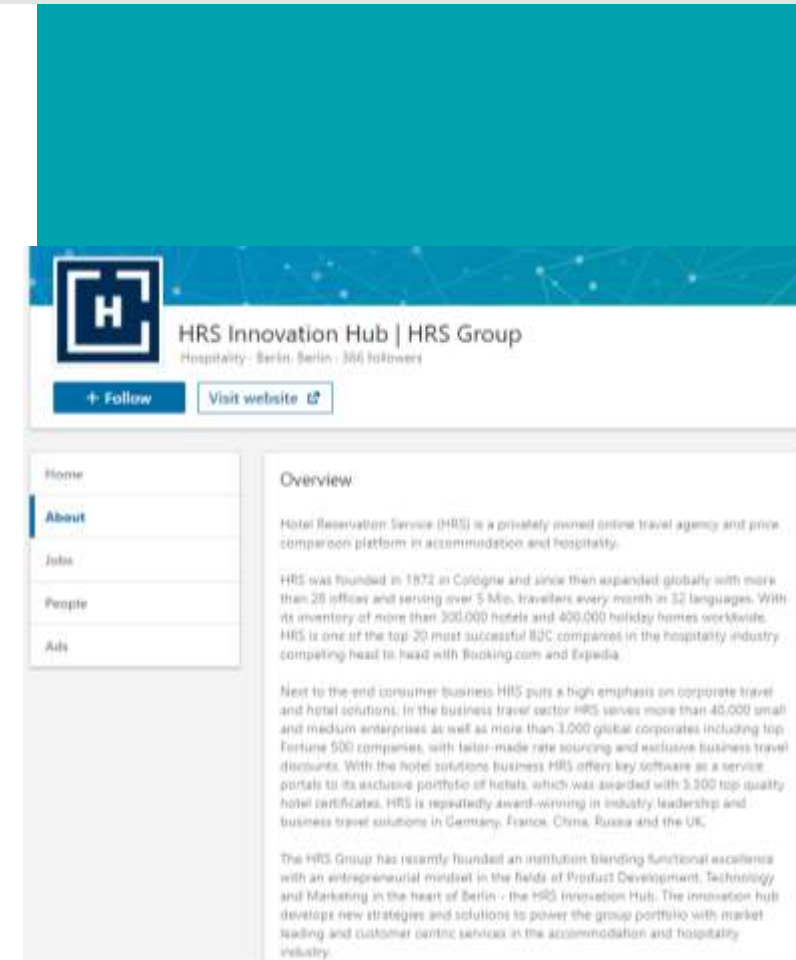
The platform features advanced AI and provides cognitive computing, predictive data analytics using "what-if" type scenarios, and integrated travel and expense data to help travel management teams optimize their travel program, control spend and enhance the end-traveler experience.

5. HRS Innovation Hub

HRS established an Innovation Hub to gather data and develop tools that understand traveler preferences, so it can optimize recommendations for those travelers and offer enhanced sourcing of hotel content for corporates. This means that travelers are being presented with the hotels that are most likely to hit their preferences, making subsequent searching unnecessary. It also enables organizations to ensure that their travelers book hotels within policy.

Martin Biermann, vice president of product development and chief technology officer for HRS, predicts that this type of technology will negate the need for business travelers to search at all: “You will just make the appointment in your calendar and you’ll get the hotel recommendation right into it, maybe even the reservation if the system is confident this is exactly what you want.”

Mike Mulligan, Product Director at Travelport, is one of the expert contributors to our Mobile Travel Trends 2019 report and forecasts that AI predictive technologies such as the HRS Innovation Hub and IBM Travel Manager could spell the end of search for business travelers. Find out more by downloading the Mobile Travel Trends 2019 report.



6. JetBlue



JetBlue uses AI to improve and de-stress the day of travel experience for customers. By live streaming security camera footage, the airline tracks people on the TSA line to determine how quickly its moving. It then combines this information with traffic data to predict how long it will take a traveler to get from their house to the gate.

“If I can tell you before you leave your house that your flight is two hours delayed, you can spend those two extra hours with your family... or at the bar,” says Ramki Ramaswamy, the airline’s VP of IT, Technology and Integrations. “It’s the same with how long you’ll have to wait at the airport.”

7. TUI Group

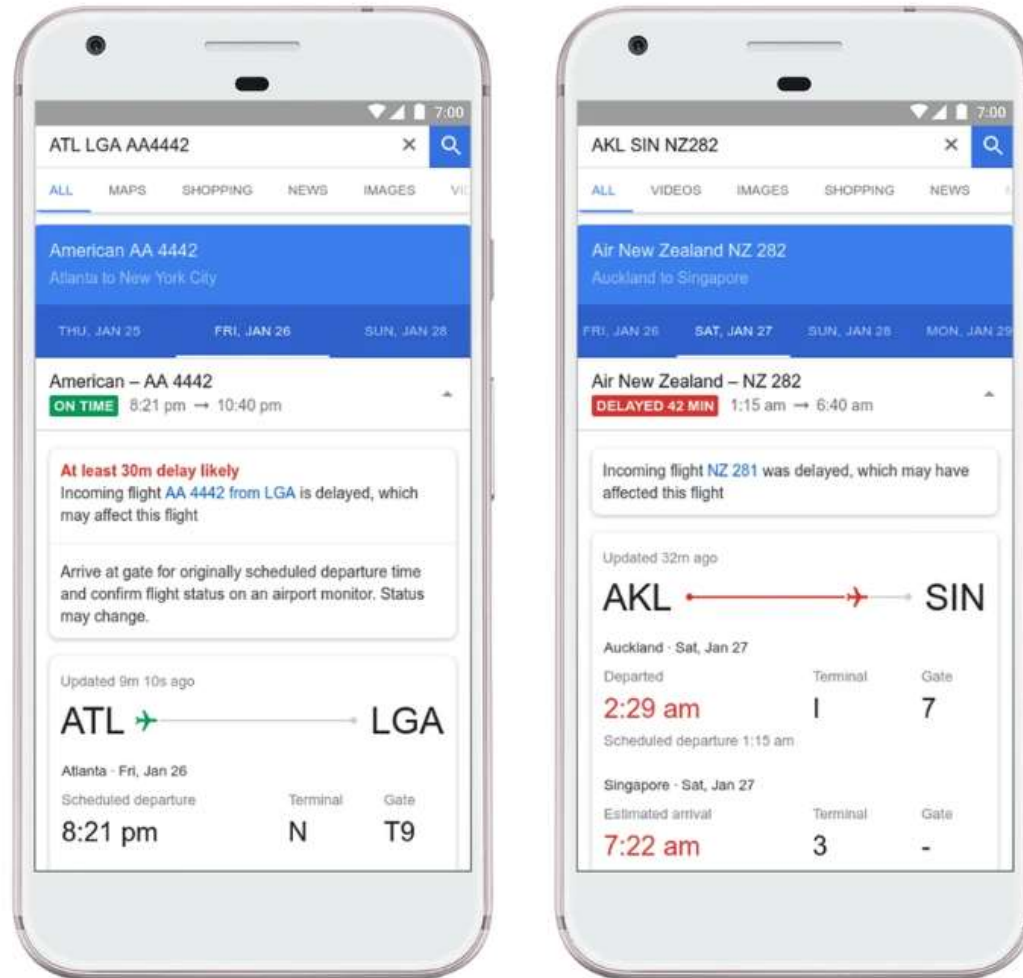


The screenshot shows a news article on the TUI Group website. At the top, there is a large image of a red smiley face. Below it, a blue bar contains the word 'Story'. A breadcrumb trail reads 'Home > Media > TUI Stories > TUI continues digitalisatio...'. Social media sharing buttons for Twitter, Facebook, and LinkedIn are visible. The article is dated '18 January 2018' and is categorized under 'Press releases'. A sidebar on the left lists other news items: 'TUI Stories', 'Annual General Meeting 2019 and Q1', 'Key financial information', and 'Interviews, speeches & presentations'. The main headline is 'TUI continues digitalisation campaign – Cooperation with start-up Utrip'. The text below the headline states: 'TUI Group considers digitalisation as a key driver for further growth and the creation of unique holiday experiences for its customers. Cooperation with the US start-up Utrip is a further building block in this process.' To the right of the text is a 'MORE INFORMATION' section with a link: '> Plug and Play visit: TUI cooperates with...'

In January 2018, TUI Group partnered with discovery platform Utrip to help personalize the traveler planning experience through AI.

TUI customers can enter their preferences in various categories like arts and culture, food or shopping in Utrip's platform. They then receive a personalized itinerary for their trip, including excursions and tips for restaurants or attractions. To create this customized travel program, Utrip's AI algorithm sorts through millions of potential combinations within a matter of seconds. The platform enables customers to save time in planning their trip and offers them more relevant recommendations.

8. Google



The Google Flights search engine is using predictive analytics not only for fare predictions, but also to make judgments on the likelihood of flight delays—even before the delay has been flagged by the airlines themselves.

By using historical data and machine learning algorithms, Google Flights can predict delays, and provide reasons for the delay, like weather or the late arrival of an aircraft. As the predictions are not confirmed by the airlines themselves, it won't flag these in the app unless it's 80% confident in the prediction.

Future predictions



There is no one technology enabling predictive analytics and personalization; it is a range of technologies, but at its heart is data. Using the wealth of data now available will allow travel brands to know so much about individuals that they can present offers based on their preferences. In addition, analyzing big data like historical flight itinerary data and weather patterns enables brands to make more general predictions on areas like flight delays and fares.

Our end traveler research found that 65% of travelers would provide personal details if it resulted in a more personalized travel experience. This shows how customers are increasingly looking to technology to take the stress out of travel and enhance the journey—whether that’s being presented with more relevant offers at the booking stage, being able to track fare patterns to ensure the best deal or being informed as early as possible how long it will take to get to the airport.

Of course as an industry, we need to ensure we use personal data ethically, with integrity and responsibility and this is where a big focus is likely to lie in 2019 and beyond.

Big Data: focus on the airline industry



- Airline industry – due to how technology-intensive and investment-intensive it’s always been – has traditionally led the way to technological innovation for the whole sector. I’m not so sure things are exactly the same today, however I think that – even only because of the historical role of airlines in travel technology advancement – it makes sense run quickly a short overview specifically focused on Big Data utilization in the airline industry.
- After all, analyzing vast swathes of data is not new for the sector. For instance, engine manufacturers have utilized trend monitoring and operating parameters for decades. This meticulous approach to performance has translated into huge savings for airlines, providing them with up-to-the-minute operational data. Moreover, a Boeing 787 creates half a terabyte of data on every flight. Combined with weather forecasts, customer service data, ticketing information, and airport communications, this vast ocean of data offers a wealth of business intelligence.
- However, many airlines are not taking full advantage of the data they have. With an enormous reservoir of data at their disposal, big data technology can transform the way airlines do business. By prioritizing data collection and analysis, even small airlines can respond to customer demands and market trends with precision and agility. So how are major airlines benefiting from big data? Here, we introduce how data can enhance airline operations and discuss five inspiring case studies.

Smarter maintenance



Big data helps airlines to better maintain their aircraft. Take fuel for example; fuel accounts for 17% of all airline operating costs, making it the most significant overhead after labor. Therefore, fuel efficiency is a critical metric. With big data, airlines can identify new efficiencies. Greater computational power has allowed airlines to gather and process huge volumes of data that enable them to analyze fuel consumption on a per-trip basis. For instance, Southwest Airlines collects data from sensors embedded in aircraft that measure wind speed, temperature, and plane weight alongside fuel consumption.

However, these advantages do not end at fuel efficiency. For example, Boeing analyzes 2 million conditions daily across 4,000 aircraft as a part of its Airplane Health Management system. This intelligence – which includes mechanical analysis, in-flight metrics, and shop findings – helps Boeing to plan maintenance and distribution. To illustrate, this system can predict failures and facilitate preemptive action. In practice, this approach saves the company \$300,000 annually in service delays and repair costs.

Safer flights



By capturing flight incident data, regulators can improve safety across the aviation industry. Recently, the European Aviation Safety Agency launched the Data4Safety program, which collects and analyzes in-flight telemetry data, air traffic control information, and weather forecasts to detect risk. The program will allow regulators to determine safety risks and advise stakeholders. By combining big data analytics and computational power, this program aims to strengthen weak links in the aviation chain.

Improve service



While there are significant operational gains, big data can also help airlines to enhance customer service. Instead of simply identifying successful products, airlines can use big data to drill down into customers' buying habits. By analyzing variables and aggregating historic information, airlines can predict and model customer behavior to generate personalized offers. This smart approach not only drives ticket sales, it also enhances opportunities for upselling, such as baggage fees and onboard refreshments.

Big data in aviation: 4 case studies



Get to know the customer: British Airways



British Airways uses an intelligent 'Know Me' feature to provide personalized search results to customers. In this impressive big data case study, BA identified that their customer base largely consists of busy, time-pressed professionals who require fast, concise results. Therefore, 'Know Me' uses in-depth data analysis to provide relevant and targeted offers for their consideration. BA received a huge amount of positive feedback from clients who loved the fact that the company understood their travel needs.

Deploy artificial intelligence: EasyJet



Many airlines go a step further than basic data collection. With new technology, it is possible for companies to analyze big data accumulated from purchase activity to demand patterns. For instance, if an airline sees the demand for a certain route increasing, they can adjust prices accordingly. From this information, the airline can also identify which customer segments are price sensitive, and determine a segment's price range for a given route.

A related big data case study comes from EasyJet. EasyJet invested in an artificially intelligent algorithm that determines seat pricing automatically, depending on demand. Furthermore, the system can also analyze historical data to predict demand patterns up to a year in advance. These analytics can also impact future decision-making about new routes, schedules, and codeshare alliances.

In-flight intelligence: Southwest Airlines



Inflight, vast amounts of data are generated throughout the journey – pilot reports, warning reports, control positions, and air traffic control communications. When this data is closely monitored and analyzed it can streamline operations and improve safety. For example, Southwest Airlines have teamed up with NASA to continually improve airline safety. By using intelligent algorithms, Southwest and NASA have created an automated system that can crunch an enormous amount of data to flag anomalies and prevent accidents.

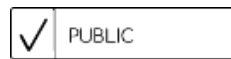
Making lost bags a thing of the past: Delta



American airline Delta has developed an app which allows customers to track their bags on their smartphones. The concept is simple – the app uses exactly the same technology that the Delta ground staff use. So far, the app has been downloaded over 11 million times by Delta customers globally.

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