

# Machine Learning Technologies for The Hospitality Industry



The emergence of new computing technologies has unlocked the gate for hospitality businesses to enter the Machine Learning and Big Data arena.

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## Summary

This white paper presents the current impact of the emerging technologies of Big Data and Machine Learning on the hospitality industry. The paper also highlights where Quanovo believe the main areas are that organisations in the hospitality industry can use these technologies to their advantage if they are not already doing so. Finally, in the conclusion of

this document we discuss where these technologies may take the hospitality industry and the importance of embracing the technology early to gain competitive advantage.

## How Big Data and Machine Learning Impact Hospitality

The way we book our holidays has changed dramatically over the last decade. It used to be the case that the average consumer would either visit their local travel agent in person or simply book their holiday through the travel agent's website. Now however the way we arrange and book our holidays has moved beyond this and customers expect more. Today's customer may end up visiting 20 or 30 different websites on different devices looking for the best rates or features available before making a purchase.

Every day millions of data points are created when customers visit hotel websites and browse around them. Aggregating this data for analysis can highlight the path each customer took before making their purchase. Thus, presenting a hotelier with opportunity and revenue potential if they can access this information. Acquiring and processing all of the data necessary to gain this information is a complex task that would take many man hours to accomplish. This is where the realm of Big Data and Machine Learning can help.

The use of Machine Learning and other Artificial Intelligence technology has the ability to transform the hospitality industry and in many cases this has already begun. Traditional solutions tend to focus on the creation of static models that limit analysis through samples that are frozen in time. Using such an approach to help forecast the correlation between something such as prices and occupancy over time can result in unreliable conclusions. The hospitality industry is constantly moving and moving very

fast. Therefore, any system that can be applied must share these features.

Some hotels are already early adopters of this type of approach with tedious tasks like pricing and demand forecasting already being processed by such systems running in the background and allowing revenue teams the time to focus on other areas of their jobs more effectively.

With the rise of platforms such as TripAdvisor and AirBnb, not only making it easier for consumers to compare competitors against one another but also, providing access to alternative accommodation categories hoteliers need to adopt new techniques to protect market share.

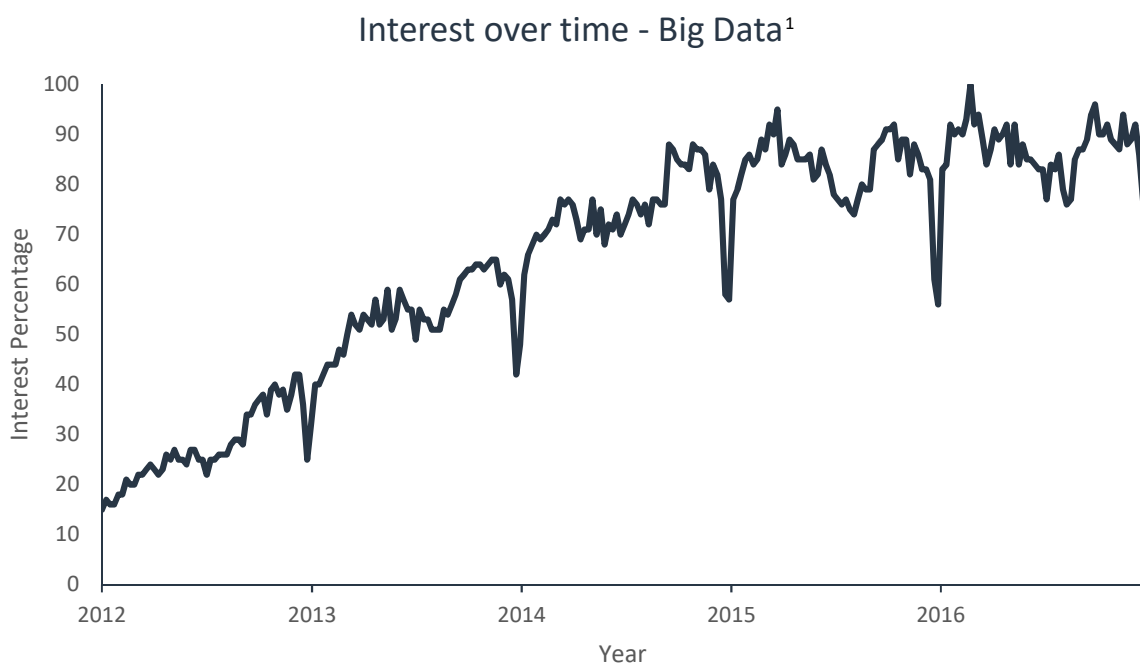
There are not many industries as consumer-centric as the hospitality industry with each type of business trying to create a valuable customer journey from start to finish. Harnessing the power of Artificial Intelligence and Machine Learning through powerful Data Science platforms can help create a more personalised view of each customer that can aid with engaging them on a deeper level than before.

Capturing information about customer purchases, location preferences, travel patterns and customer experience inquires can help increase the efficiency of the analytics being utilised and aid companies in the hospitality industry with meeting the increasing customer expectation as well as pivot when presented with new unforeseen issues.

## Big Data

Big Data is not a new phenomenon, in fact the notion has been around for almost half a century. However, it is a topic that has been growing in exposure across every industry in recent years. There are two main reasons that, although the idea of Big Data has been around for some time, it is now gaining traction and rapidly:

- The first of these two reasons are that globally we are producing greater quantities of data than ever before meaning that how we store and process that data to make constructive use of it has become a key issue.
- The second reason is that the advancement of hardware solutions has reached the point where they are capable of running the underlying algorithms on such huge data sets. Meaning that no longer is the field of Big Data confined to a corner of academia or indeed gigantic organisations as the hardware required has become more affordable and practical to obtain and use.



<sup>1</sup> Data from Google Trends - <https://www.google.com/trends/explore?q=big%20data>

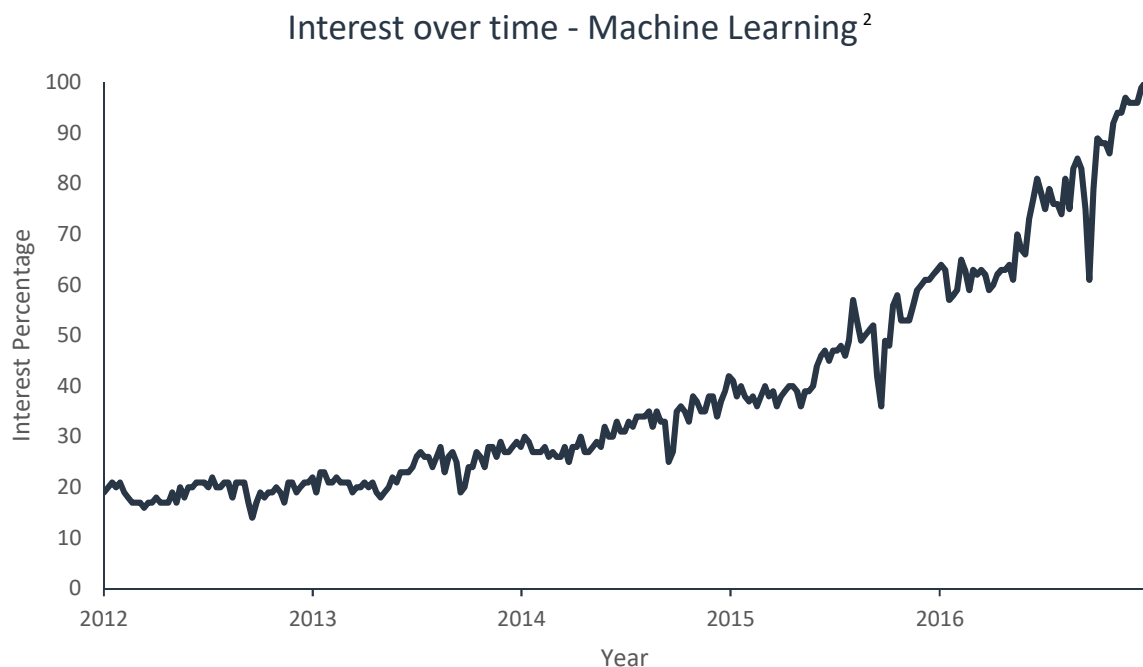
# Machine Learning

Machine Learning is similar to the process of Data Mining and in many ways, can be considered a subset of the field. Both share the concept of looking through data with the goal of identifying patterns and establishing connections.

The algorithms that Machine Learning is built upon can be very useful for extracting qualitative data from datasets that are simply too large for people to sort through. These algorithms are generally split into two main categories, supervised and unsupervised. Supervised Machine Learning algorithms take what has already been learned and apply that knowledge to new data, whereas Unsupervised Machine Learning is the process of sifting through data with the aim of discovering some, as yet unknown meaning, from it.

In the real world, what this means is that we can utilise Machine Learning technology to carry out tasks such as extract sentiment from bodies of text like product reviews and use that information to derive the reasons for negative or positive feedback.

The real power of Machine Learning comes from the fact that it is a technology that can enable the prediction of future events even when certain datasets are absent.



<sup>2</sup> Data from Google Trends - <https://trends.google.com/trends/explore?q=machine%20learning>

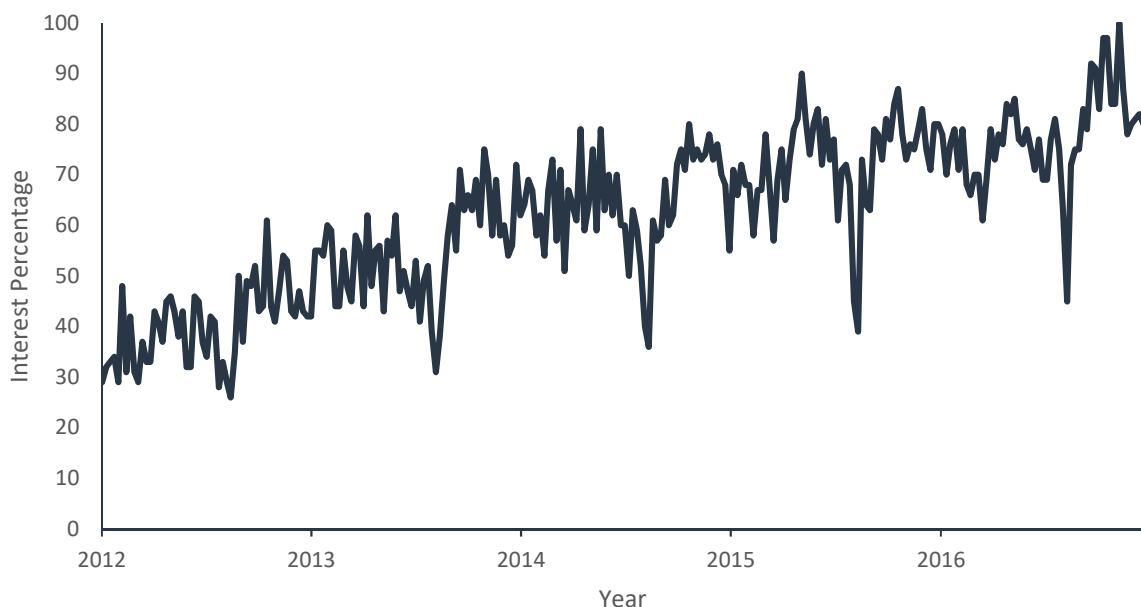
## Predictive Analytics

When applied in the realm of Machine Learning the term Predictive Analytics refers to the ability to predict future outcomes using trends and indications that can be derived from the underlying data. By predicting what is likely to occur in the future, Predictive Analytics provide the opportunity for an organisation to gain advantage surrounding any action that should be taken and in doing so transitions that business from reactive to proactive.

The direct applications of Predictive Analytics to the hospitality industry may take the form of answering questions such as what are the top geographical markets searching for your hotel for future arrival dates? Or Is the market demand over the next month able to support your current prices? That last one could also lead to Prescriptive Analytical insight in helping to answer the question of What price should we set for a specific package that will maximise our return but also has the demand to be attractive to customers?

A customer browsing the hospitality industry today has an unprecedented number of choices all aided by sophisticated online tools to help get the best price possible. With that reality competition in the industry is ferocious meaning any and all advantages need to be exploited. Understanding the past is clearly essential, however the ability to predict the future is fast becoming a necessary part of the business when aiming to acquire market share from competitors.

Interest over time - Predictive Analytics





## The Main Areas That Can Receive the Greatest Machine Learning Impact.

“Make predictions for guest arrivals and calculate the optimum prices as the market changes.”

A huge misconception when it comes to Machine Learning is that, in order to produce any useful insights, an organisation must have huge amounts of data. It is not quite as black and white as this and in fact many hotels and hotel groups use small scale data to manage revenues, improve profitability and engage with customers. In this section, you can see how Machine Learning can be applied in these ways.

### Revenue Management Systems (RMS)

Revenue managers are responsible for determining the best room rate at a given time in order to maximise bookings and revenue. Until recently this task was a tedious one, with revenue managers required to manually collect, review and analyse numerous data sets each time the rate needed to be updated and then calculate the correct rate based on those variables. With new online travel agencies and websites this task has become impossible to do manually with unparalleled levels of data being produced daily. However, recent advancements in computing hardware and cloud technologies have opened up the world of Machine Learning to the problem.

Revenue Management Systems (RMS) automatically collect and compute large amounts of complex data and run it through models to output easily understood insight along with the best possible room rate and all in real time.

A properly trained system is able to effectively sift through the signals detected from market variables, discover patterns and anomalies and then use that information to make predictions for guest arrivals and calculate the optimum prices as the market changes.

Without such a system revenue managers would receive too much unfiltered data that would result in either inaccurate estimations or predictions that are simply too delayed to hold any real advantage.

## Recommendation Engines

Recommendation engines are not a new tool for the hospitality industry. In fact, online companies such as Expedia and TripAdvisor have been utilising them for over a decade. The sophisticated mechanisms that sites like that use allow them to figure out what a customer's likely budget and needs are and then suggest items that are rated as a good fit for that customer. For example, it is not just enough for a service to offer rental cars because you have booked a flight. A more tailored experience would offer specific brands or types of vehicle based on the customer's individual profile. These suggestions are obtained by the system through analysis of other customer's preferences who share a similar customer profile. This is a recommendation engine and is a very valuable tool to have in an industry that prides itself on anticipation of customer needs.

For an industry such as the hospitality industry the benefits of recommendation engines are not limited to websites at the time of booking. In a hotel setting it is possible for staff to view an individualised preference sheet for each customer that has been compiled using a mix of data collected direct from the customer's past visits but also from recommendations mined from similar customers using Machine Learning. In this way, a hotel is able to better anticipate a guest's needs and create a better customer experience.

"Able to better anticipate a guest's needs and create a better customer experience."

## Market Segmentation

“Highlight not only sub-segments but also whole new segments that organisations may not have realised even existed.”

As we stated earlier in the hospitality industry it is important that customers feel like individuals and not just a number on a spreadsheet. Market segmentation is not a revolutionary idea and it has been used in the past with good results. However, with the power of new technologies we can now do more than simply categorising guests into large segments such as family holiday or business travellers.

Using market segmentation techniques Machine Learning can be used to compute dynamic clusters of guest types that are fluid and change in real time. As the guest goes about their stay they will inevitably create more data when making on site purchases or using the resort facilities. This new information can automatically be processed by a Machine Learning system to update things in real time so your segments are always valid and up to date.

Even better still is the unsupervised nature of the creation of these segments that can highlight not only sub-segments but also whole new segments that organisations may not have realised even existed.

Understanding what matters to guests at the individual level means an improved level of customer engagement. Also, these techniques can allow hotels to understand the characteristics of their most profitable customers so that they can instantly recognise another one when they use their services.

## Demand Forecasting

The hospitality and leisure industries are extremely fluid ones due not only to the cyclical nature of holidays but also unforeseen events that can have huge impacts. Having the ability to forecast when demand may pick up or die down allows for the appropriate actions to be taken at the appropriate times to enjoy the best efficiency possible.

Demand forecasting with Machine Learning using Big Data means creating models that are based on seasonality, hotel history, local events, your own promotions, and external real time events. This is all possible by a member of staff but for the greatest impact the calculations need to be constantly run so that the forecast can be kept up to date and is able to take into account any new factors that have only just occurred. Only a Machine Learning solution can accomplish this.

Being able to forecast demand in such a dynamic way means that a hotel can optimise room offerings and prices to suit changing levels of market demand patterns to always maximise their profit while maintaining a competitive rate. Furthermore, having a robust demand forecasting system in place means that maintenance and renovation work can be scheduled to be carried out in a way that will have a minimal impact on overall profit.

“A hotel can optimise room offerings and prices to suit changing levels of market demand patterns to always maximise their profit.”

## Automation Advantage

“Automation through Artificial Intelligence can help free up time for staff to focus more on the guests.”

Most of the news and hype surrounding Machine Learning and Artificial Intelligence in the hospitality industry focuses on the larger brands but smaller players make up a huge and very important segment that can take advantage of the benefits these technologies have to offer too.

Large hotel chains have the ability to hire a dedicated suite of specialists with the sole responsibility of creating, managing and reporting important business intelligence and many smaller brands often lack a large enough budget for additional staffing. Therefore, revenue management tends to be a task that an existing member of staff will take on in addition to their other tasks. This solution is inefficient and can be overwhelming for the staff member who takes this on. Not having a revenue management solution in place means that you are missing out on potential profits.

Revenue management has traditionally only been accessible by big brands with big budgets but with the cost of computing hardware coming down and the emergence of cloud computing smaller organisations are often pleasantly surprised by the level of initial investment needed to get such a system set up and running. RMS are just one example of where Machine Learning and Big Data can help smaller organisations maintain their competitiveness. Automation through Artificial Intelligence can help free up time for staff to focus more on the guests and free up cash to improve the hotel facilities themselves.

## Customer Experience

A good customer experience has to be one of the top priorities of any business but it could be argued that in no other industry is it more prevalent than the hospitality one.

A comprehensive knowledge base can help tailor a guest's experience to them in a way that cannot be achieved without the support of Machine Learning. A good Machine Learning solution can help detect unexpected relationships or patterns that would have been missed by human analysis.

In addition to the customer experience enhancements mentioned elsewhere in this document one of the main ways that Machine Learning and Artificial Intelligence solutions can help create a more unique and appealing customer experience is in combination with the appearance of the Internet of Things (IoT). It no longer makes sense to manually gather guest information through outdated means like questionnaires or simple observation. The IoT helps to further develop the personalised guest experience. The connection of room control, motion sensors, integrated TV and voice control systems such as Amazon's Alexa as well as Apple and Microsoft's personal assistant offerings are enhancements that can affect the hotel industry and boost customer experience.

The underlying technologies behind voice controlled assistants rely on Machine Learning systems. Many large businesses are already developing services that run on this hardware to serve their customers in a better way and many hotel businesses believe that Artificial Intelligence is a tool that can help their companies. However, some are unsure if their business has the necessary level of technology to integrate voice controlled assistants effectively. The reality is that the barrier to entry is actually lower than many believe. Such services would be extremely useful for hoteliers as voice activated assistants can help guests with elementary questions and requests while freeing up hotel staff to more complicated tasks that require a human touch. In addition, voice activated assistants are able to speak to guests in different languages making it easier for guests speaking a foreign language to communicate their needs.

Other uses of sensors connected through The IoT include setting up a room to the guests' remembered configuration if they have visited before in relation to temperature, lighting and television preferences such as language.

“A good Machine Learning solution can help detect unexpected relationships or patterns that would have been missed by human analysis.”

## Conclusion

Machine Learning may seem intimidating, especially if you assume that you need Big Data and massive computing power to yield any investment. It is actually the case that the majority of hospitality businesses already possess enough core guest information to get started and that augmenting that with fresh data does not need to be expensive. The reality is that the whole hospitality industry is moving towards the use of this type of technology and with the cost of computer hardware and cloud computing coming down in recent years then Machine Learning and other cognitive technologies are accessible for almost everyone in the industry.

For an industry that focuses so much on the needs and experience of the customer Machine Learning is the perfect fit. Only a machine is capable of processing all the necessary points of data and analysing that data to provide insight quick enough for it to have any real-time value. The adoption of AI in hotels is a topic that is rising quickly in popularity with major brands such as Hilton partnering with IBM to introduce robot concierges that can learn what individual guest's preferences are and then cater to their needs regarding information about the hotel and its local area.

The growth in Machine Learning utilised in the hotel industry is set to explode in the coming years, with Hospitality Technology reporting that the the number of people helped by hospitality robots will double by the end of 2017<sup>3</sup>. Machine Learning presents a massive opportunity to hoteliers and in the near they will be able to harness these new abilities to reach higher levels of efficiency; business intelligence, pricing and demand forecasting will run in the background, automatically sending alerts for exceptional conditions that require a human to intercede. All the time freeing up hotel resources to concentrate on delivering the highest level of hospitality at the right price, based on the best data insights.

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<sup>3</sup> H. Technology, "Robots in Hospitality: Five Trends on the Horizon," Hospitality Technology, 04 April 2017. [Online]. Available: <http://hospitalitytechnology.edgl.com/news/Robots-in-Hospitality--Five-Trends-on-the-Horizon109345>. [Accessed 16 May 2017].