# The Future of Artificial Intelligence in Retail

Author, Karthik P.G

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***Data Science Foundation***
Data Science Foundation, Atlantic Business Centre, Atlantic Street, Altrincham, WA14 5NQ
Tel: 0161 926 3641  Email: contact@datascience.foundation  Web: www.datascience.foundation
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# The Future of Artificial Intelligence in Retail

**- How AI can optimize customer engagement**

## EXECUTIVE SUMMARY

### Objective

The objective of this paper is to provide a comprehensive perspective on the advancements in the area of Artificial Intelligence and how the infusion of cognitive customer engagement can positively impact the infamously unpredictable consumer cyclical retail industry.

While the term “Retail Industry” can be broadly classified ranging from departmental stores to E-tailers,each based on a specific business model and their own constraints, the aspects discussed in this paper are applicable to any business entity that directly deals with the end customer and hence susceptible to impact of changes in customer behavior.

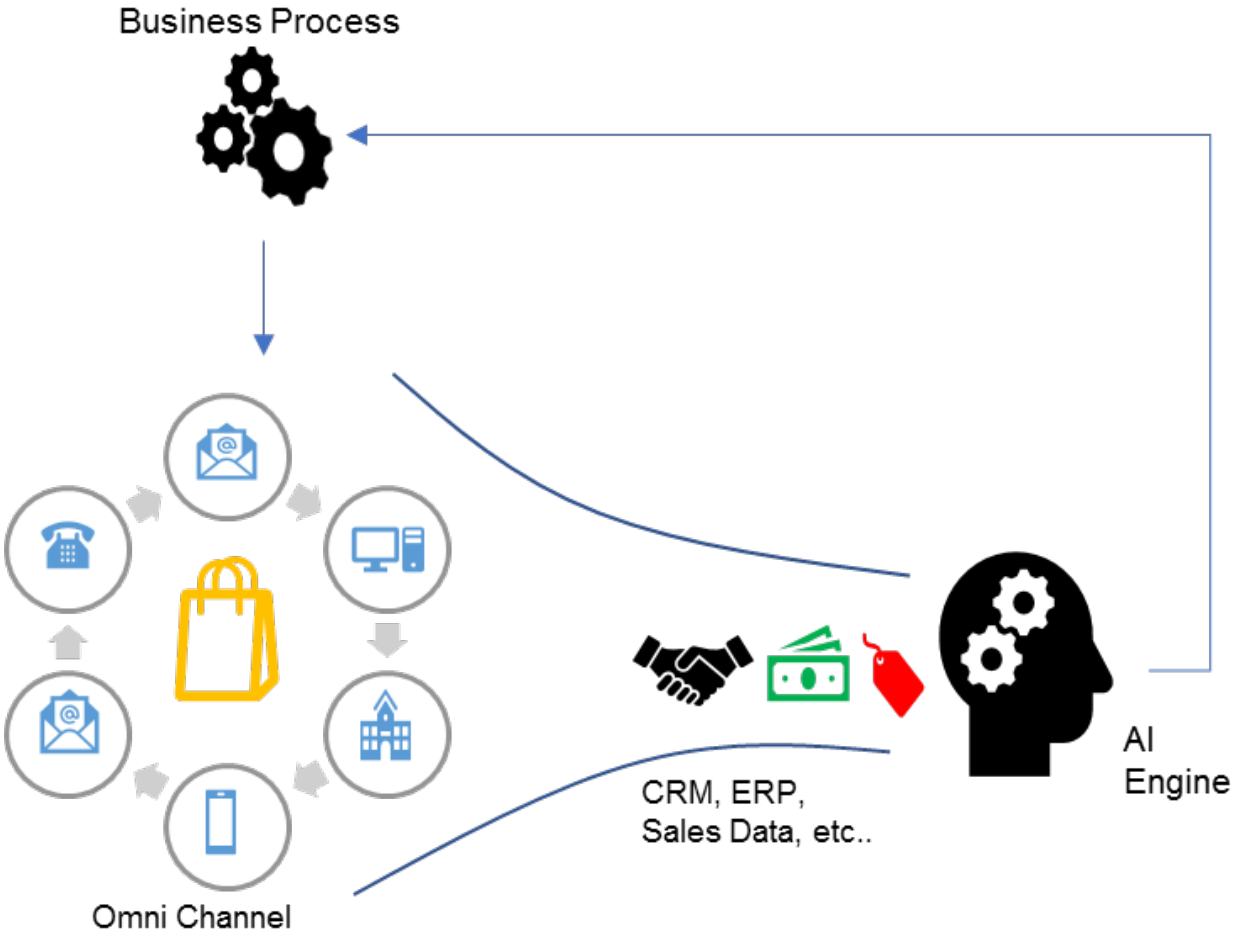
### Goals

Aside from providing a comprehensive overview on where AI and the retail industry are headed in the future, this paper aims to provide the readers an overview of:

- Advantages of AI based techniques over traditional modeling techniques in predicting customer behavior.
- Streams of Artificial Intelligence that can augment customer engagement
- A typical supporting ecosystem needed for a solid AI platform

In a global market place that is fueled by technology and characterized by abundance, physical retail locations are perceived as extensions of the enterprise Omni channel, rather than a vital customer interaction and conversion points.

With the ever-increasing advancements in E(M)-commerce and the devastating proliferation of disruptive forces like Amazon, the customer expectations set on the retail industry has shifted from practical to utopic. Being at the tail end of the supply chain is no more an excuse for not being able to provide attractive product offerings, price point and customer engagement; because customers today have the option to compare similar products, negotiate prices and perform a value analysis on a virtual global marketplace, with a single tap on their mobile device.




**An AI Powered Omni channel is 100% Customer driven**

With the growing need to stay competitive and relevant, the traditional retail industry is headed towards a future where intuitive customer engagement will be the key to drive demand and optimize the pricing & operational management components of the ever-sensitive retail supply chain.

One of the buzzwords in the last decade has been “Omni channel experience”.

While this strategy at large represents an approach to maximizing brand value and market share through a unified customer experience, it also set the stage inadvertently for the need to quantify customer experience and leverage the results to refine the strategy progressively.

As logical precursors for a sound Omni channel strategy, organizations have been actively investing over the past few years in an immersive digital experience and data driven analytics. With those efforts starting to yield the desired benefit and the adoption for big data slowly maturing, a whole new stream of analytics around leveraging the customer data to optimize decision making has gained momentum. What started as a data driven performance management effort has culminated into using machine learning and quantitative methods to build sophisticated mathematical models that aims at predicting certain aspects

of the customer behavior under predefined conditions, which could then be baked into the business strategy. With the exponential growth in technologies related to processing and managing big data, the retail industry is primed to take advantage of the advancements in Artificial Intelligence and augment the return on investments made on the data and analytics front.

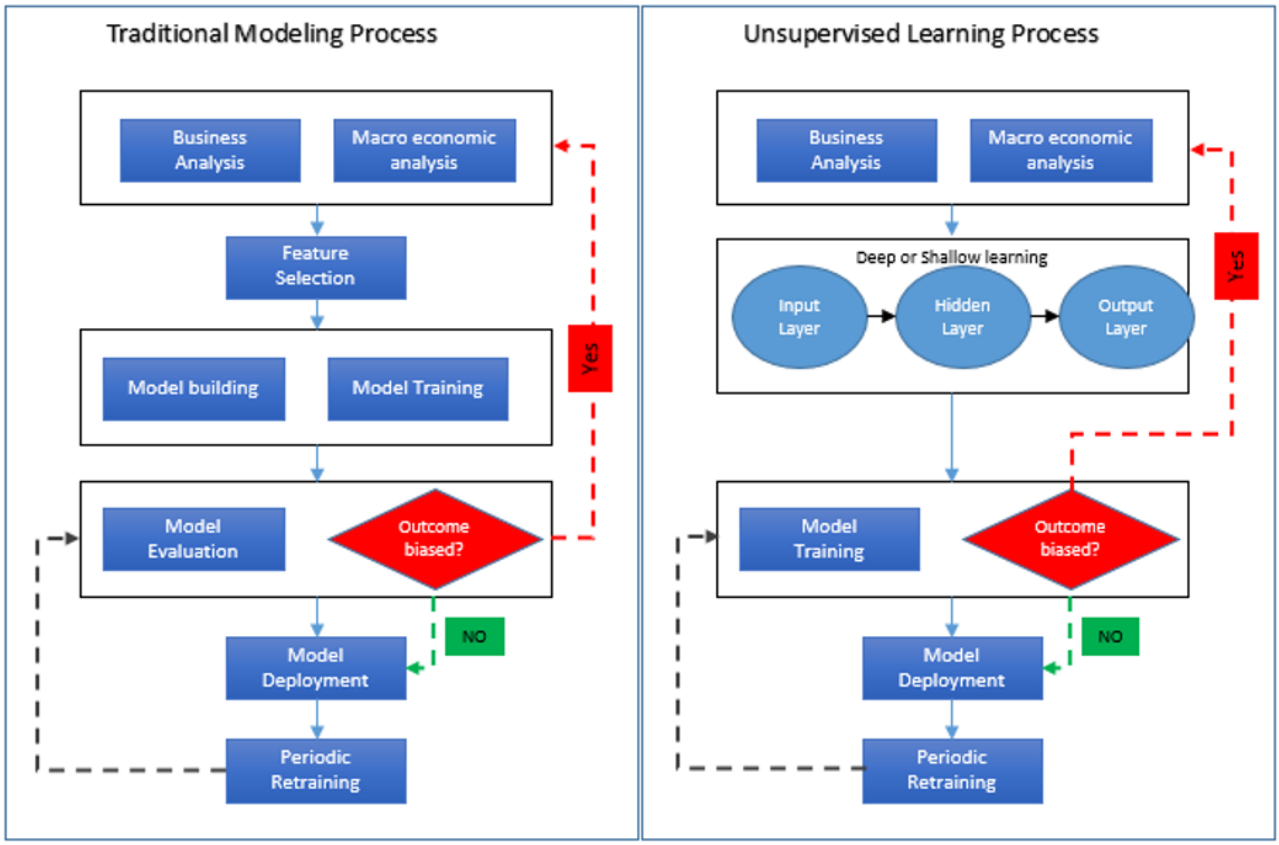
There are 2 channels through with AI adoption make a significant difference in the retail industry:

Artificial Neural networks, the foundational element of Artificial intelligence can effectively eliminate the complex process of feature selection leading to stable models with better accuracy

**Infusion of Deep Learning and Neural Networks-** With deep learning gaining popularity and GPU processing becoming increasingly cheaper, it is now possible to overcome the limitations of feature selection posed by traditional modeling techniques without sacrificing performance.
**Leveraging Vision, Speech and Natural language processing-** Including vision, voice and NLP related technologies to engage and manage customers will enable companies to drive demand through unchartered territories and more importantly be able to forecast demand with reduced variability.

To complement the core modeling component of a retail data science platform, AI can be leveraged in areas of the customer journey, where capturing and quantifying an appropriate sensory input from customers can serve as a valuable input to model customer behavior. More importantly, the inclusion of appropriate AI streams as part of the technology platform will enable retailers to tap into the customer's clock 24/7 and simplify critical business processes.

With most sub pisions of retail being highly sensitive to macro-economic conditions, engineering the right set of features that defines a realistic model is one of the most common challenges that practitioners face today.




**The above diagram depicts the difference in the workflow between a traditional Modeling process and a typical Unsupervised Learning process (Redundant Process)**

Engaging Customers is more of a complicated art than science

Traditionally, modelers tend to favor the approach of focusing more on variance reduction than bias reduction since the former is theoretically attainable (and very much in the control of the modeler) and the latter is heavily dependent on the understanding of broader market conditions. Eventually, they combine such inpidual models using boosting methods to provide an outcome. Despite the granular control this method offers, the problem with this approach is that this is still statistical learning at its core and is only as intelligent as the assumptions made and features selected. As new data accumulates, the distribution of the underlying data inherently changes and will not be accounted for in the model. As a result, if retraining the model results in reduced accuracy, the foundational assumptions that were made on the features selected must be revisited.

**Evaluating with a common example:**

While a sound Omni channel strategy spear headed by careful user experience design can play the critical role of ‘art’ on the surface, an AI powered decision support platform under the hood is required to handle the ‘science’ part of the equation. It is easier to understand the aforementioned abstract statement with a common business use case like predicting customer behavior.

Predicting a customer's purchase behavior is a common machine learning problem that never goes out of fashion due to its myriad of applications and ease of incorporating into business decisions. Although the expected outcome is simple and binary, (whether the customer will make the purchase or not) building a model for this particular problem, is not. Aside from understanding the customer demographics and other supporting data elements, it also requires educated assumptions pertaining to the product or service the model is built for.

Traditionally, linear discriminant analysis (LDA) is one of the typical models used to predict customer behavior for a binary outcome. In LDA, the target variable (Customer behavior) is approximated with the independent variables (selected features) in a linear combination and the coefficients are then generated from a regression analysis.

Despite the simplicity in the methodology, subtle nuances like seasonality, non-significant relationships (that could be powerful predictors when used in combination with other non-significant relationships), macro-economic conditions that could be brewing, and more importantly customer sentiment are not factored in the model.

As an alternative to the above approach, training a vast amount of data using a simple deep learning method such as Restricted Boltzmann machine (RBM) will result in a much more versatile model which is more intuitive, requires no feature selection and can self-learn the changes in the underlying data distribution.

Artificial intelligence can be leveraged to transform a traditional machine learning platform into a true complex system.

Besides the core modeling aspect, there are a few notable areas where AI has made significant advancements over the last few years. If the present is any sign of the future, these streams of AI and their related applications will see advancements that can positively impact the way customers perceive the retail industry.

**Virtual Assistants-** With voice enabled virtual assistants like Alexa, Siri and Cortana gaining popularity, including a technology layer to process voice enabled searches and requests will enable businesses to stay in touch with the customers and also pave the way for gathering interesting data on search patterns.
**Virtual and Augmented reality-** This is an emerging market which when included as part of a sound mobile strategy can engage customers to customize and personify products that will in turn promote sales and minimize returns.
**Natural Language processing-** This is a fairly matured stream of AI which has a variety of use cases ranging from sentiment analysis to recommendation engines. With a lot of advancements in the area unstructured data storage and processing, inclusion of NLP as part of the data science platform is easier than ever.
**Drones-** Including drones as part of the overall logistics strategy to autonomously deliver small goods, can drastically reduce delivery costs. Although, it is a tangible and hard benefit, the cool factor associated with it will engage the millennials at the least to try out the fancy delivery method.
**Dynamic Pricing-** With the advancements in AI and IOT, retailers are poised to leverage AI powered

pricing engines and location analytics already in place, to customize promotions and pricing based on an identified customer profile.

**Personalized shopping assistants-** Providing a true boundary free shopping experience,

- By 2020, 85% of customer interactions will be managed without a human. By the end of 2018, “Customer digital assistants” will recognize customers by face and voice across channels and partners (Source: Gartner)
- In the immediate future, execs are looking for AI to alleviate repetitive, menial tasks, such as paperwork (82%), scheduling (79%), and time sheets (78%). (Source: PwC)
- 32% of executives say voice recognition is the most-widely used AI technology in their business. (Source: Narrative Science)
- Out of the 717 retail and e-commerce decision makers surveyed, 42% of them are presently piloting, implementing or expanding their AI programs. (Source: Forrester)
- The mobile ad market alone will surpass $100 billion by next year. Some projections put augmented and virtual reality investment in retail at close to $30 billion by 2020. (Source: WSJ; Harvard Business Review)
- Companies with strong cross channel customer engagement see a 9.5% year-over-year increase in annual revenue. (Source: Aberdeen Group)
- AI will drive 95 percent of all customer interactions by 2025, with consumers unable to differentiate bots from human workers via online chats and over the phone. (Source: Servion)
- By 2020, 100 million consumers will shop in augmented reality. (Source: Gartner)

personalized shopping assistants can shop across multiple online stores based on a picture through an AI powered engine. Innovative startups like GoFind.AI, are already making a splash in the fashion side of the retail, setting a new bar in shopping experience. In the future, virtual mirrors and personalized shopping assistants will be an integral part of the customer experience.

A strong supporting eco system of technology and processes, is essential for maximizing the ROI on Artificial Intelligence.

**Intelligent Chat bots-** A long way from where it all started, chat bots of the future are well positioned to take advantage of the advancements in natural language processing, database technologies, CRM and ERP systems. For carefully constructed use cases, an intelligent chatbot of the future can provide answers to questions that require factual details by mimicking the functionality of traditional BI platform with an NLP feature.

**3D Printing-** Over the last few years the cost of 3D printing has drastically reduced and is poised to be leveraged in the retail industry. Niche companies like Shapeways, are already offering customers to conceptualize and design personal fashion accessories. Plotting the growth curve of mobile technology against the rising needs of the retail industry, it is just a matter of time that this becomes a viable strategy to drive customer oriented design and can very well disrupt the fashion retail segment.

**Conclusion**

The effective operationalizing of an Artificial Intelligence initiative is heavily, dependent on the effectiveness of the supporting eco system. Albeit being a data and mathematics driven discipline at its core, the actual success of an AI initiative has a lot to do with the adoption rate, which in turn is a factor of how easily external customers can engage or stay engaged and how prevalently the internal customers trust the outcome to make business decisions.

Among other factors, the following constitute a solid eco system:

**A Robust Data Engineering Platform-** Whether it be the rate at which customer interactions are tracked for a cross selling/up selling decision made by the AI engine or personal virtual assistants and chat bots taking on peak traffic, or, facial recognition applications scanning customer traffic to feed customer traits to a segmenting algorithm that runs under the hood, the most important factor for optimal customer engagement is the response time, which ideally should be in sub seconds.
With a plethora of options available in big data platforms & distributions, processing technologies, and software architecture, it is imperative to choose the right combination of technologies to create a customized data engineering platform that the AI engine can feed out of. There has been a lot of advancements on the data engineering side over the last decade and new data formats, compression techniques, data types and innovative processing methods will continue to evolve in the future.

**An Intelligent Customer Hub-** AI or not, there is no argument that creating a 360-degree view of the customers is the first step towards creating any data driven analytic initiative in the retail segment. With every major data engineering vendor already offering customized Master data management packages to assist the cause, a new breed of vendors proposing to offer AI powered data management as a service are starting to evolve and will mature into a dominant main stream force in the future.

**A Smart Application Development Platform-** With location analytics and IOT already in mainstream usage, it is imperative to have a smart application development platform that can complement a retailer's Omni channel strategy with innovative API mash ups. With visual and voice search expected to drive more than 30% of e-commerce revenue by 2021(Source: Gartner), mobile APIs will evolve to include voice and visual interfaces as essential customer interfacing components.

**A Strong Synergy between Business and Technology-** Effective cross functional teams, where the business architects and data scientists work together, in building AI applications will be the norm of the future. This will lead to innovative processes and techniques to operationalize models and promote an AI driven intelligent retail supply chain.

## About the Data Science Foundation

The Data Science Foundation is a professional body representing the interests of the Data Science Industry. Its membership consists of suppliers who offer a range of big data analytical and technical services and companies and individuals with an interest in the commercial advantages that can be gained from big data. The organisation aims to raise the profile of this developing industry, to educate people about the benefits of knowledge based decision making and to encourage firms to start using big data techniques.

## Contact Data Science Foundation

Email:contact@datascience.foundation
Telephone: 0161 926 3641
Atlantic Business Centre
Atlantic Street
Altrincham
WA14 5NQ
web: www.datascience.foundation