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# Artificial Intelligence Whitepaper/ Guide

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## Introduction

"By far, the greatest danger of Artificial Intelligence is that people conclude too early that they understand it." Eliezer Yudkowsky

Artificial Intelligence is currently the most powerful and exciting emerging technology that is changing the way people work and live. Technology is now part of our everyday lives and research and innovation in AI platforms and solutions has led to the creation of innovative products and services, which is reshaping a companies' relationships with their customers, business partners and employees. This new relationship is established firmly on trust and the sharing of large amounts of personal data.

This new technology and easy availability of big data is changing the marketing game too and working as a catalyst to trigger new ways of reaching and nurturing customer decision making and improving brand relationships. This shift from mere automation to true personalization requires marketers to be informed about AI and how it can be employed well in their business. Through this guide, get to know the essentials of AI and find out what the big fuss is all about. And most importantly, why should you care?

## Artificial Intelligence

Artificial Intelligence involves creating machines with human intelligence and cognitive abilities like self-learning, visual perception, speech recognition, learning, logical problem solving, and decision making. AI is a broad term that encompasses many different types of technology and is huge even in terms of size and complexity. The evolution of Artificial Intelligence has resulted in the creation of more intelligent machines, robots and software programs for increased efficiency. AI involves problem-solving skills and pattern recognition from input data, deep learning for automatic error correction and even predictive capabilities based on available datasets, just to name a few. AI has been adopted in all fields of science and education such as Computer Science, Biology, Engineering, Mathematics, Neuroscience and Psychology.

## Evolution Of Artificial Intelligence

Ever since the first industrial revolution of the late 18th century, we have made massive technological progress.

First Revolution – Steam Power (1784)

Second Revolution – Electricity (1870)

Third Revolution – Information Technology (1969)

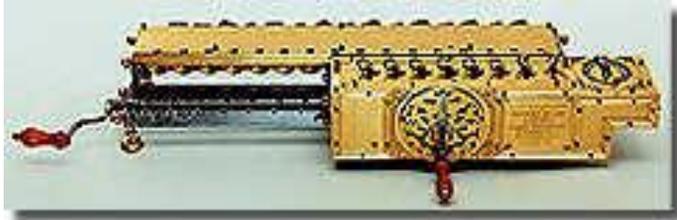
Fourth Revolution – Artificial Intelligence (NOW)

The fourth industrial revolution came about in the 21st century with the advent of AI. Now that we have entered the fourth industrial revolution, this era will be driven by interest, ideation and implementation of AI solutions that enhance operational efficiency and enable ubiquitous connectivity.

## The Roots of Modern Technology

5thc B.C. Aristotelian logic invented

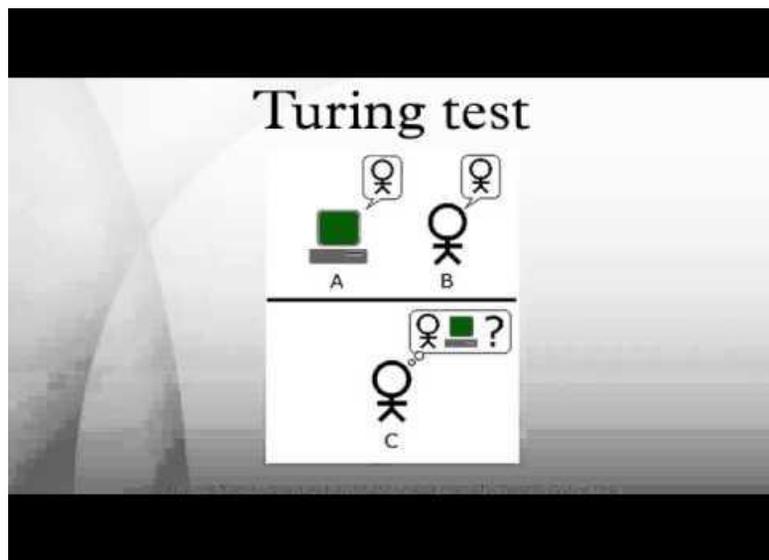
- **1642** Pascal built an adding machine
- **1664** Leibnitz reckoning machine



- **1834** Charles Babbage's Analytical Engine  
A working model was built in 2002.



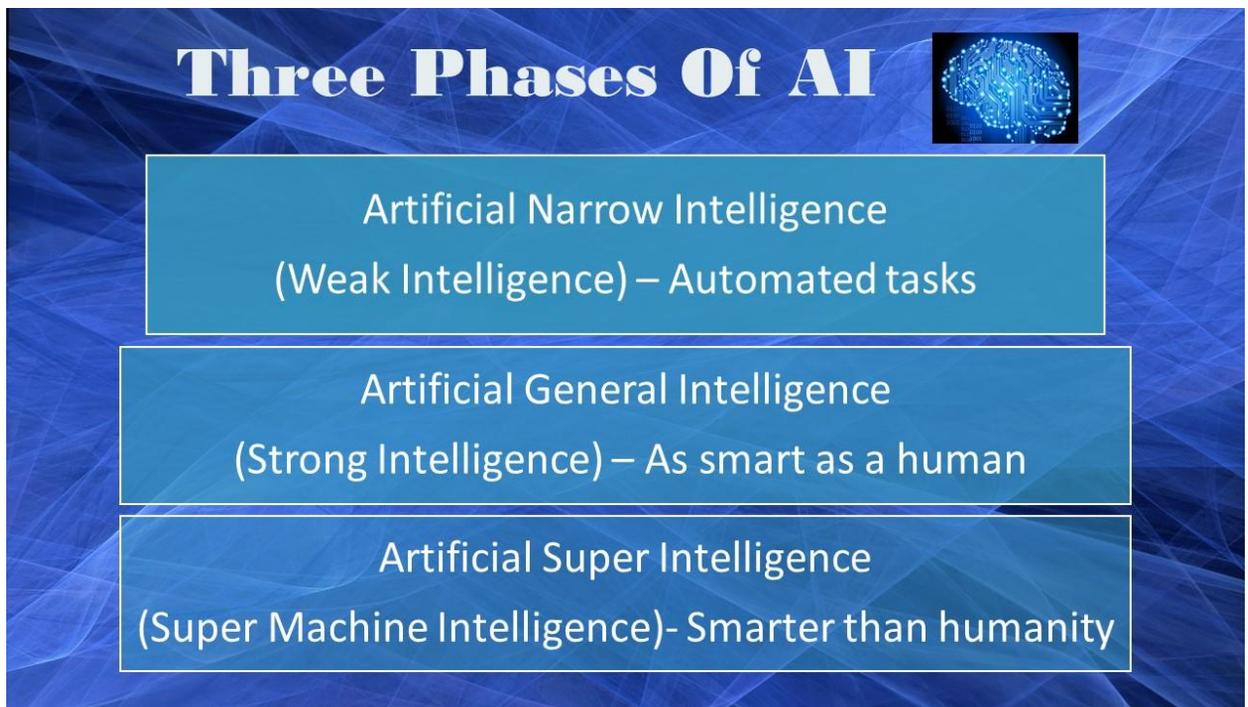
- **1848** George Boole -The Calculus of Logic
- **1900** Hilbert's program and the effort to formalize mathematics  
Bertrand Russell and Alfred North Whitehead published [Principia Mathematica](#), which revolutionized formal logic
- **1931** Kurt Gödel's paper, On Formally Undecidable Propositions
- **1936** Alan Turing's paper, On Computable Numbers with an application to the Entscheidungs problem.
- **1950** A.M. Turing published "[Computing Machinery and Intelligence](#)". Introduction of Turing Test as a way of operationalizing a test of intelligent behavior.



- **1956** John McCarthy coined the term "artificial intelligence" as the topic of the Dartmouth Conference.  
"The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it."
- **1958** Lisp – a functional programming language with a simple syntax.
- **1967** Dendral – a rule-based system that inferred molecular structure from mass spectral and NMR data
- **1972** PROLOG - a logic programming language whose primary control structure is depth-first search. The same year Kenneth Colby invented one of the first devices of emotional AI: a computer system called PARRY that simulated a conversation with a human paranoiac.
- **1975** Mycin – a rule-based system to recommend antibiotic therapy
- **1975** Meta-Dendral learned new rules of mass spectrometry, the first discoveries by a computer to appear in a refereed scientific journal
- **1979** EMycin – the first expert system shell
- **1980's** The Age of Expert Systems. RI, the first commercial expert system began operation at the Digital Equipment Corporation helping configure orders for new computer systems.
- **1981** Japanese Fifth Generation project launched as the Expert Systems age blossoms in the US.
- **1988** CLOS (Common Lisp Object Standard) published based on ideas from Smalltalk and semantic nets. AI revenues peak at \$1 billion. AI Winter begins
- **1990** AI scientist Rodney Brooks published a new paper: Elephants Don't Play Chess. Brooks looked at a bottom-up approach to AI, including the field of neural networks
- **1997** IBM built machine, Deep Blue took on world chess champion Garry Kasparov and won. the contest, dubbed 'the brain's last stand.'
- **2002** Rodney Brook's spin-off company, iRobot, created the first commercially successful robot for the home, Roomba, which was an autonomous vacuum cleaner. Amazon bring cloud storage to the masses
- **2004** With Web 2.0, new era of user generated data begins

- **2005** iRobot created PackBot, a bomb disposal robot, which combined user control with intelligent capabilities such as explosives sniffing.
- **2009** American computer scientist Andrew Ng and his team at Stanford University uses GPUs to train Deep Learning models more efficiently
- **2010** At Shanghai's World Expo, 20 NAO robots went on display to dance in perfect harmony for eight minutes.
- **2011** Watson, IBM's question answering system, defeats the great Jeopardy champions, Brad Rutter and Ken Jennings
- **2012** Deep-learning system wins ImageNet's image-classification contest, by an error rate of 15.3% versus the second-best error rate of 26.2%
- **2014** GSMA reports the number of mobile devices at around 7.22 billion, which exceeds the number of humans
- **2017** Electronic device users generate 2.5 quintillion bytes of data every day.

## What Are The Three Phases Of AI?



Artificial Narrow Intelligence (ANI)- Intelligence is restricted only to one functional area.

Artificial General Intelligence (AGI)- Intelligence is more advanced and covers more than one area like problem solving, reasoning and abstract thinking, which is on par with adult humans.

Artificial Super Intelligence (ASI)- This is the final stage of super intelligence, wherein AI will surpass human intelligence in all fields.

Currently we are on the verge of completing the transition to the second stage- AGI.

## 4. Machine Learning

Machine Learning is a branch of narrow Artificial Intelligence that most brands can easily implement today. It is a form of data analysis that automates analytical model building so that systems can learn from data, identify patterns and take informed decisions with minimal human intervention. With growing volumes of available data, cheap processing power and powerful data storage capabilities, data mining and Bayesian analysis is more popular than ever. More so because machine learning allows software to think more like humans—get performance feedback and make future decisions based on them, without any human programmer intervening. Machine learning has made it possible to automatically produce precise models that can analyze bigger, more complex data for faster and more accurate results, thereby avoiding risks and identifying profitable opportunities for business.

### Stages Of Analytics

Machine Learning can provide analysis and insights in order of increasing complexity-

Descriptive- Describe what happened

Predictive – Anticipates what will happen (probabilistic)

Prescriptive- Provide recommendations on what to do to achieve goals.

Some well-known machine learning applications are -

Self-driving Google car

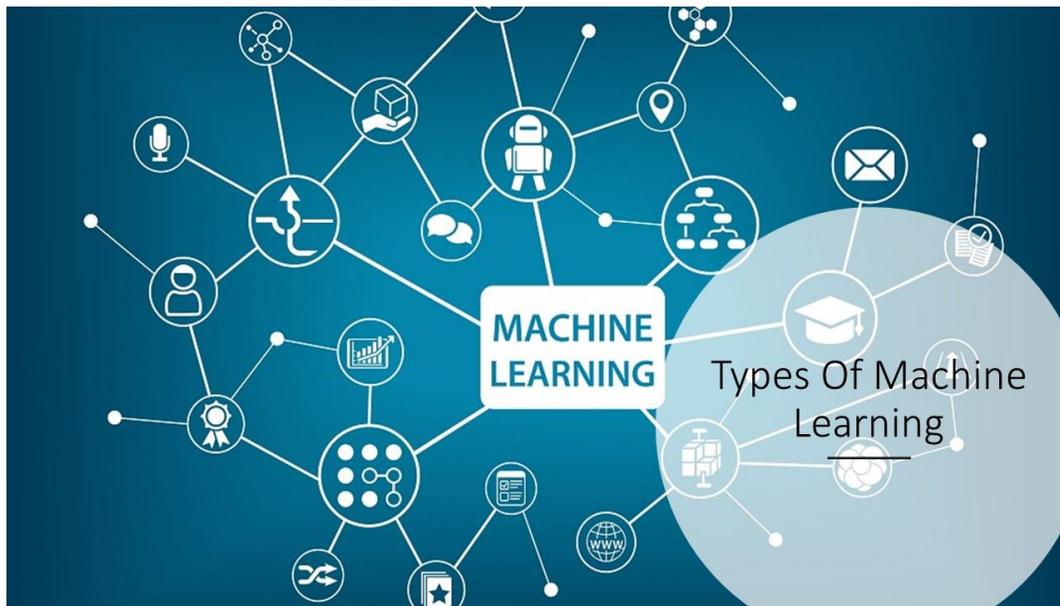
Search optimization, recommendation offers from online retail sites, such as those from Amazon and Netflix

Programmatic ads and automated narratives for customers

Credit checks and fraud detection

## 5. Major Types Of Machine Learning

Now that we have covered the basics of machine learning, know that there are three major types of machine learning that exists. Within each type, there can be hundreds of different techniques for machine learning based on a statistical or mathematical principle, which makes them highly effective in certain circumstances.



### 1. SUPERVISED

#### TASK DRIVEN

- Regression
- Classification

### 2. UNSUPERVISED

#### DATA DRIVEN

- Clustering

### 3. REINFORCEMENT

#### FEEDBACK DRIVEN

- Algorithm learns to react to an environment

## Supervised Machine Learning

Supervised machine learning algorithms and software are trained to recognize something using labeled examples. It uses patterns through methods like classification, regression, prediction and gradient boosting, to predict the values of unlabeled data. It receives a known training library of inputs along with the corresponding correct outputs and the algorithm modifies the model by comparing its actual output with correct outputs to find errors.

For example, machine learning algorithms help sift messages as spam in your inbox through training received from users who have marked an email as spam. Over time, if we keep marking messages as spam or not correctly, the algorithm can pick up what is or isn't spam.

## Supervised Learning algorithms:

- Linear and logistic regression
- Support vector machine
- Naive Bayes
- Neural network
- Gradient boosting
- Classification trees and random forest

Supervised Learning is used for expert systems in image recognition and speech recognition, forecasting and in specific businesses for targeting and financial analysis.

## Supervised Learning In Marketing Context

Supervised learning method can be used in marketing situations where you need to recognize or find something, including:

- Logo identification
- Social media mentions
- Sentiment analysis
- Influencer identification

## Unsupervised Machine Learning

Unsupervised learning is used against data without any given outcomes. The system is not given any historical labels, but the algorithm must group different objects based on the similar attributes. The idea is to explore the data and find some structure within through sorting and classification.

For example, it is only with unsupervised machine learning that it is possible to go through content being produced every day to analyze it. It is possible to collect blog posts written about your company and use natural language processing to transform them into a list of topics to find the messaging being associated with the company.

## Unsupervised Learning algorithms:

Unsupervised algorithms can be split into different categories:

- Clustering algorithm -K-means, hierarchical clustering or mixture models
- Dimensionality reduction algorithms- PCA, ICA or autoencoder
- Anomaly detections- detect data outliers

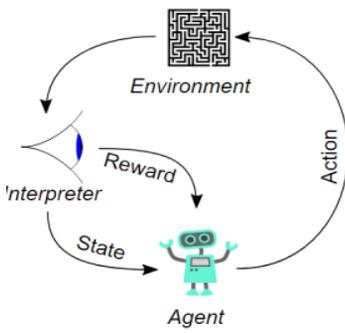
Unsupervised learning algorithms are preferred for pre-processing the data, for exploratory analysis or also for pre-training supervised learning algorithms.

# Unsupervised Learning In Marketing Context

Unsupervised machine learning can be used in marketing situations for-

- Sorting images
- Making sense of social media conversations about your company, competitors, or a particular industry
- Identifying your best customers
- Recommending items
- Finding trending topics to write about

## Reinforcement Machine Learning



Source: Wikipedia – Reinforcement Learning

Reinforcement Learning is based on the interaction of the agent (decision maker) with the environment. The algorithm is written in such a way that the machine learns through trial and error method to take action that yields the greatest reward. By repeating this action loop many times, the machine will improve its behavior and outcomes. Rewards can be anything from winning a game, to making more money or winning against other opponents. Reinforcement Learning is used in decision making processes and on 'small' dynamic system.

## Reinforcement Learning algorithms:

- Q-Learning
- Sarsa
- Real-Time Dynamic Programming
- Dyna
- Prioritized Sweeping
- Policy Search Algorithm
- Hierarchical Reinforcement Learning Algorithms

Reinforcement Learning algorithms are used in game theory, robotics, computer networking. Industrial logistic or even in vehicular navigation.

# Reinforcement Learning In Marketing Context

The Reinforcement Learning framework is used marketing, for –

- Cross-channel marketing optimization
- Integrating marketing measurement and media buying systems
- Buying ads with different attributes to be shown to the home page, social media and other partner sites

But the most advanced implementation of machine learning and artificial intelligence are never restricted to one type or technique, rather many techniques are used together.

## Deep Learning

Deep learning is a subset of machine learning. Following the hierarchy of analytics, the most promising stage is 'Proactive analytics,' when systems can trawl the data, perform analysis based on deep learning and neural networks to learn complicated patterns and anticipate what will happen. Deep learning is like higher cognitive function (abstraction, creativity) in a human being. In Deep Learning techniques, neurons form a neural network to identify objects in images or words in sounds. Pattern recognition is used for performing complex tasks such as automatic language translation, medical diagnoses and solving other business problems. The most famous deep learning implementation currently is Google's DeepMind, which has managed to beat many world Go champions.

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## Deep Learning In Marketing Context

There are currently no marketing tools sufficiently developed enough to use deep learning yet. But the ability for a machine to help find "patterns inside of patterns" through deep learning is very promising for marketing in the future. As programs develop the capability to handle and interpret more data, marketers can learn more complex data relationships from it. A sufficiently advanced deep learning machine may be proficient in natural language generation. It will be able to reactively generate content- compose an email for your customers or write a blog post or even an e-book. Deep learning algorithms will be able to understand customer brand perception, analyze unstructured data for social media insights and to identify marketing opportunities, power advanced chatbots with personality and more nuanced inquiries and so much more.

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## Conclusion

Artificial Intelligence solutions are here to change the traditional marketing standards, and mindsets still holding it back. AI can give businesses better insight into patterns and trends hidden in large data sets that they already have access to but cannot properly analyze. Artificial Intelligence and Machine Learning is all about inspiring groundbreaking marketing to fully realize the transfer of power from automation to personalization and probably even prediction, in the not-so-distant future. Brands should meanwhile look to make full use of the intelligence that current AI platforms brings to marketing to provide better and more experiences to their users.