

# Data Science Workshop

## Data Science, a Digital Transformation enabler

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# CEOs are asking three critical questions

1 Is my strategy ambitious enough?



Innovate the Experience  
and the Business Model

2 Is my execution fast enough?



Leverage the Ecosystem  
and Digital Technology

3 How do I transform my people and  
their capabilities?



Grow the Digital  
Reinvention Drivers,  
whose the key driver:  
**Data Science**

# Experiences are being transformed by Big Data & Analytics

A coffee house chain delivers design-thinking developed experiences empowered by cognitive analytics that leverage internal and external data

## Retail Example



Loyalty, CRM,  
Weather, News and  
Social Data



Predictive Model



Real-time  
Campaign Tool



Unique Experience  
with targeted offers

### 1. Model Builder

Cognitive analysis reads local news, pulls weather and social data and combines it with loyalty data to build a predictive model



Watson / Presentation Title / Date

### 2. Predictive/Cognitive Model

Josie likes smoothies and frozen coffees on a hot day after a ball game, especially if her favorite barista, Rafe, is working



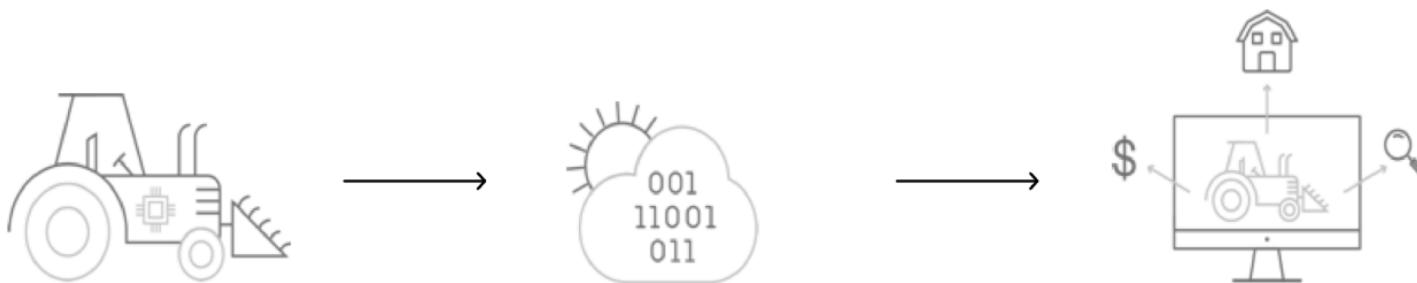
### 3. Real-time Offers

It is 3 PM on a Sunday and Josie is 2 blocks from a coffee outlet. A mobile alert is sent with a discount offer and to let her know Rafe is there

# Internet of Things is altering business models

Analytics, IoT and Cloud transformed a farm equipment manufacturer into an information publisher that enables farmers and suppliers around the world to improve crop yields

Industrial Example



## Sensor data

- Downtime
- Soil conditions
- Crop features

## External Data and analytics

- Local weather
- Market prices
- Retailer needs

## Information sold to

- Farmers
- Agribusiness
- Retailers

## Better Operations

- Reduced equipment down time
- Improved fuel economy
- Higher crop yields

## Better Business

- Optimal harvest timing
- Tuned packaging
- Better price realization

## Better Strategy

- New Business Model
- New Ecosystem
- New Revenue Stream

# The customer Experience FIRST

World's largest  
taxi company...

owns no  
vehicles



World's most  
popular media  
owner...

creates no  
content



World's most  
valuable  
retailer...

has no  
inventory



World's largest  
accommodation  
provider...

owns no real  
estate



World's largest  
<Your Industry  
Here>, ...

has no ??



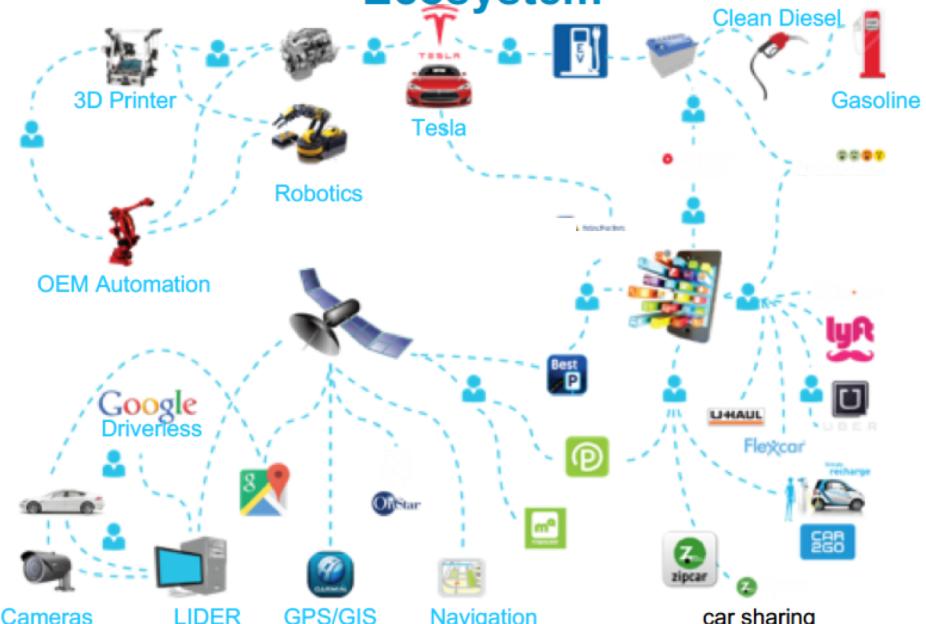
# The automotive industry illustrates the shift to ecosystems

## Automotive Example

### Traditional Automotive Value Chain



### Emerging Mobility Ecosystem



# Data Science – Business Challenges

# Industry Use Cases

 <h3>Banking</h3> <ul style="list-style-type: none"><li>• Optimize Offers and Cross Sell</li><li>• Contact Center Efficiency and Problem Resolution</li><li>• Payment Fraud Detection &amp; Investigation</li><li>• Counterparty Credit Risk Management</li></ul>	 <h3>Insurance</h3> <ul style="list-style-type: none"><li>• Claims Fraud</li><li>• Customer Retention</li><li>• Catastrophe Modeling</li><li>• Telematics</li><li>• Producer Effectiveness</li></ul>	 <h3>Telco</h3> <ul style="list-style-type: none"><li>• Pro-active Call Center</li><li>• Network Analytics</li><li>• Location Based Services</li><li>• IT/Network Infrastructure Transformation</li><li>• Smarter Campaigns</li></ul>	 <h3>Energy &amp; Utilities</h3> <ul style="list-style-type: none"><li>• Smart Meter Analytics</li><li>• Distribution Load Forecasting/Scheduling</li><li>• Condition Based Maintenance</li><li>• Create &amp; Target Customer Offerings</li></ul>	 <h3>Media &amp; Entertainment</h3> <ul style="list-style-type: none"><li>• Business process transformation</li><li>• Audience &amp; Marketing Optimization</li><li>• Multi-Channel Enablement</li><li>• Digital commerce optimization</li></ul>
 <h3>Retail</h3> <ul style="list-style-type: none"><li>• Actionable Customer Insight</li><li>• Merchandise Optimization Playbook</li><li>• Dynamic Pricing</li></ul>	 <h3>Travel &amp; Transport</h3> <ul style="list-style-type: none"><li>• Customer Analytics &amp; Loyalty Marketing</li><li>• Capacity &amp; Pricing Optimization</li><li>• Predictive Maintenance Analytics</li></ul>	 <h3>Consumer Products</h3> <ul style="list-style-type: none"><li>• Optimized Promotions Effectiveness</li><li>• Micro-Market Campaign Management</li><li>• Real Time Demand Forecast</li></ul>	 <h3>Government</h3> <ul style="list-style-type: none"><li>• Threat Prediction and Prevention</li><li>• Health and human services fraud, waste &amp; abuse</li><li>• Tax compliance - fraud and abuse</li><li>• Crime prevention and prediction</li></ul>	 <h3>Healthcare</h3> <ul style="list-style-type: none"><li>• Measure &amp; Act on Population Health</li><li>• Engage Consumers in their Healthcare</li></ul>
 <h3>Automotive</h3> <ul style="list-style-type: none"><li>• Data Warehouse Optimization</li><li>• Predictive Asset Optimization (PAO)</li><li>• Actionable Customer Intelligence</li><li>• Connected vehicle</li></ul>	 <h3>Chemical &amp; Petroleum</h3> <ul style="list-style-type: none"><li>• EDW Smart Consolidation &amp; Augmentation</li><li>• Operational Surveillance, Analysis &amp; Optimization</li><li>• Engineering &amp; Operational Data Exploration &amp; Mining</li></ul>	 <h3>Aerospace &amp; Defense</h3> <ul style="list-style-type: none"><li>• Uniform Information Access Platform</li><li>• Data Warehouse Optimization</li><li>• Predictive Asset Optimization (PAO)</li></ul>	 <h3>Electronics / Industrial Products</h3> <ul style="list-style-type: none"><li>• Channel Driven Customer Analytics (CDCA)</li><li>• Predictive Asset Optimization (PAO)</li></ul>	 <h3>Life Sciences</h3> <ul style="list-style-type: none"><li>• Increase visibility into drug safety and effectiveness</li></ul>

# Examples

Example 1	Predictive Maintenance
Objective	The customer, a multinational company operating worldwide in rail transport markets, wished to introduce Predictive Maintenance in its service contract in order to increase asset availability, reduce maintenance cost and improve customer satisfaction
Solution	<p>Design and Implementation of an Predictive Maintenance solution which answers to the following criteria of success:</p> <ul style="list-style-type: none"><li>- To detect abnormal values for a given train compared to its past behaviour or compared to other trains.</li><li>- To predict and explain with a significant probability a failure on a train the day before with a probability greater than 80%.</li></ul> <p><u>Methodologies:</u></p> <ul style="list-style-type: none"><li>- Data Collection &amp; Integration (Event Data)</li><li>- Data Exploration (technical and functional cleaning, creation of variables, Selections,...)</li><li>- <b>Feature Engineering</b></li><li>- Alert Detection steps:<ul style="list-style-type: none"><li>- The first approach consists in <a href="#">classifying alerts and finding anomalies</a> that helps to understand different behaviours of alerts (or type of alerts)</li><li>- The second approach consists in <a href="#">finding patterns of alerts</a> (or types of alerts)</li></ul></li><li>- Results evaluation</li></ul> 
Example 2	Fraud detection
Objective	The customer, an Insurance Health company, wished to build and operate a unique platform for Fraud & Abuse Management
Solution	<p>Design and Implement a counter fraud management platform, based on demand of reimbursements.</p> <p><u>Methodologies:</u></p> <ul style="list-style-type: none"><li>- <a href="#">Business rules</a> helping to detect suspicious cases, tuned with statistical information (mean, standard deviation, ....)</li><li>- <a href="#">Anomaly detection</a> (from a mathematical point of view) in behavior that could indicate fraud</li><li>- Known business rules and indicators and creates suspicious cases scores / profiles of practitioners</li><li>- Design and Implementation of a <a href="#">meta-score</a> calculation allowing to target the most relevant suspicious cases</li><li>- <a href="#">Operational Reporting</a> for managing the fraud (health practitioner and beneficiaries)</li></ul> 

# Examples

Example 3	Operational efficiency
Objective	The company, a worldwide container transportation and shipping company, wished to find the way to optimize vessels roads and so decisions to take during the navigation of vessels.
Solution	<p>Design and Implementation of an Analytics solution which provides destination harbors prediction at each vessel position, from marine traffic open data (AIS data).</p> <p><u>Methodologies:</u></p> <ul style="list-style-type: none"><li>- Exploration (company's own vessels, competitive vessels, Harbors, Marine Traffic, ...)</li><li>- Design and implementation of the Analytics foundation (business rules, data quality, data creation, ...)</li><li>- Destination harbor prediction by harbors affinity</li><li>- Destination harbor prediction by vessel's path learning (prediction at each maritime position)</li><li>- Map visualization of Destination harbor prediction</li></ul>
Example 4	<p><b>Customer knowledge</b></p> <p>Objectives</p> <p>The company, a worldwide retail company which sells toys, wished to improve marketing campaign ROI and the customer knowledge.</p> <p>Solution</p> <p>Design and Implementation of an Analytics solution which provides consumers profiles and next best action.</p> <p><u>Methodologies:</u></p> <ul style="list-style-type: none"><li>- Business rules</li><li>- Data Exploration (Technical and functional cleaning, creation of variables, Selections,...)</li><li>- Macro segmentation (strategical segmentation)</li><li>- Micro segmentation (consumer profiles)</li></ul>

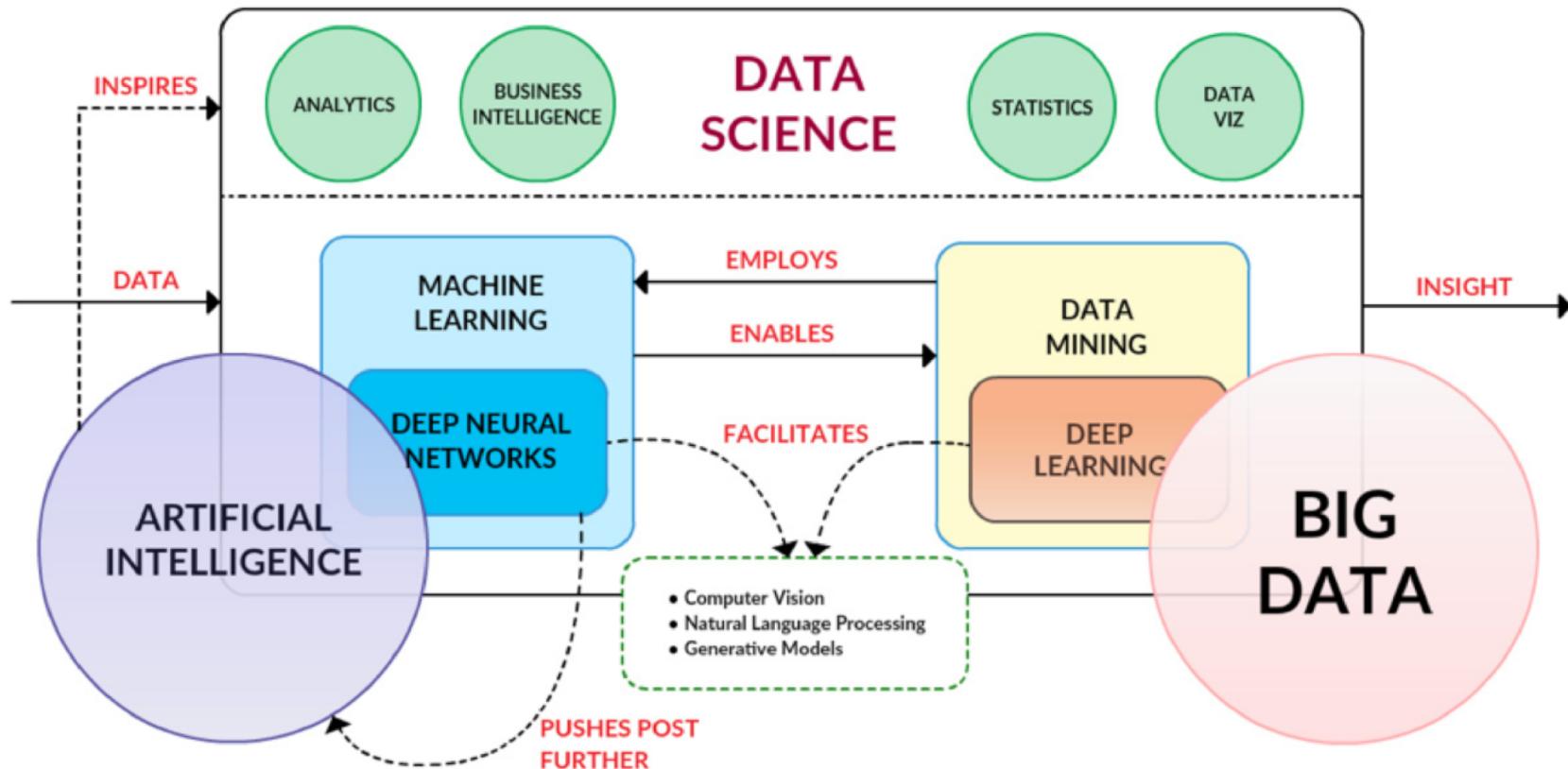


# Data Science – What does it mean?

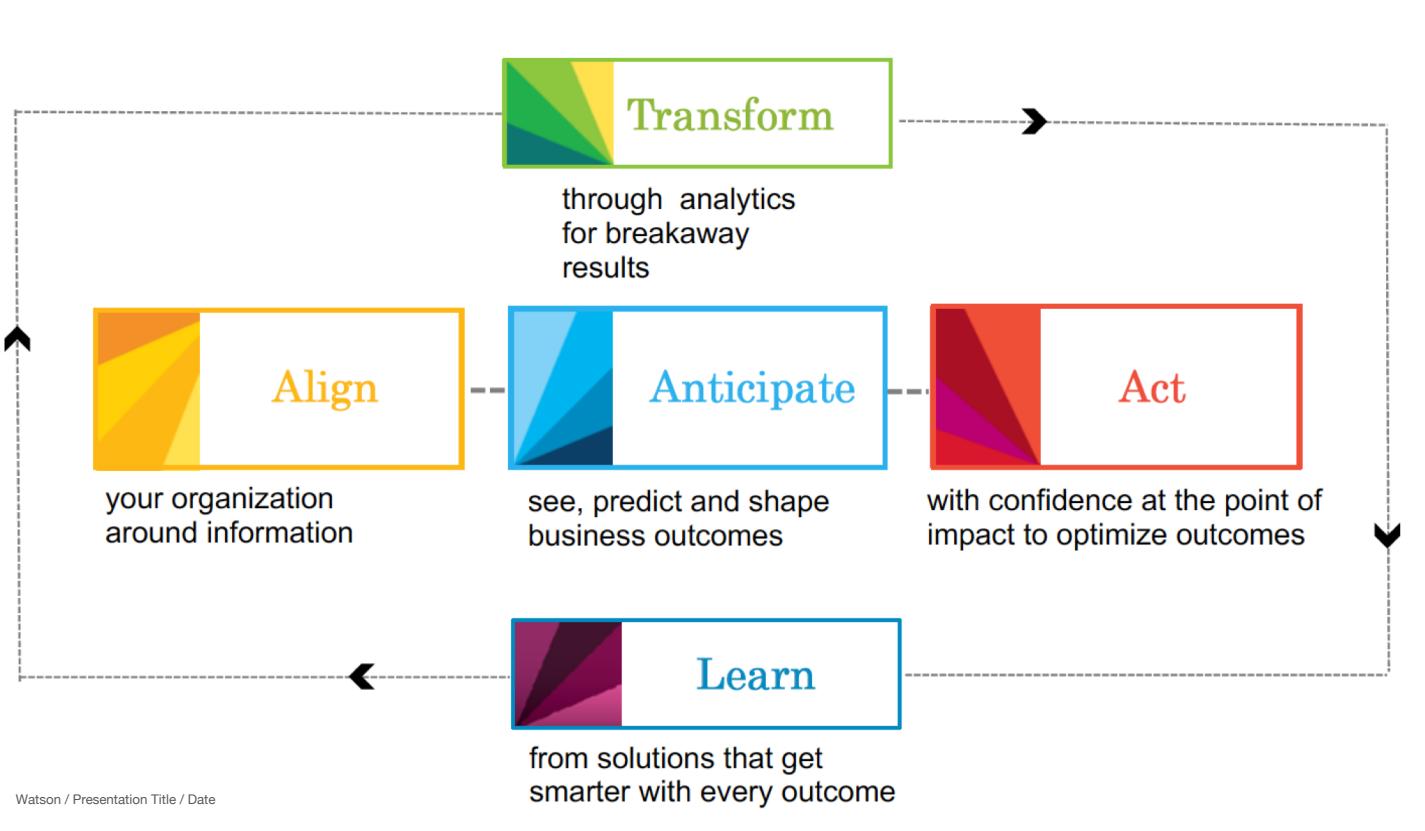
## Definition

**Data Science** is  
the practice of various **scientific fields**,  
their **algorithms, approaches and processes**,  
through the use of **programming languages and software** frameworks,  
that aims to **extract knowledge, insights and recommendations** from data,  
and deliver them to business users and consumers in consumable  
**applications**.

# Augmented Intelligence



# Analytics is a holistic approach that turns information into insight and insight into business outcomes



# Analytics Capabilities



## Transform

### Business Analytics and Optimization Consulting Services

BAO Strategy | Customer Analytics | Regulatory and Risk | Fraud Analytics | Financial Performance Management  
Information Management Foundation | IBM Research First-of-a-kind Projects | Application Management

### IBM Smarter Analytics Signature Solutions

Customer | Finance | Anti-Fraud, Waste & Abuse

### IBM Solution Accelerators

Portfolio aligned to Industry Imperatives



### Align

- Big Data Platform
- Data Warehousing
- Information Integration and Governance
- Data Management
- Enterprise Content Management
- Defensible Disposal



### Anticipate

- Business Intelligence
- Performance Management
- Predictive and Advanced Analytics
- Risk Analytics
- Sentiment Analytics
- Big Data Analytics
- Content Analytics
- Web and Digital Analytics
- Online Benchmark
- Spend Analytics



### Act

- Decision Management
- Advanced Case Management
- Digital Marketing Optimization
- Cross-channel Selling and Marketing
- Pricing, Promotion, and Assortment Optimization
- Marketing Performance Optimization
- Supply Chain Optimization
- Organization and Workforce Transformation



### Learn

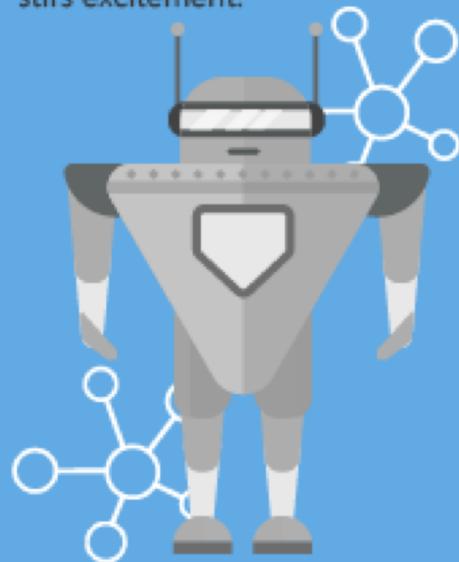
#### Systems that learn and reason

Watson | Watson for Healthcare | Watson for Financial Services | Ready for

**Smarter Computing - Systems that are tuned to the task, designed for data, managed with cloud technologies**

# ARTIFICIAL INTELLIGENCE

Early artificial intelligence  
stirs excitement.



1950's

1960's

1970's

1980's

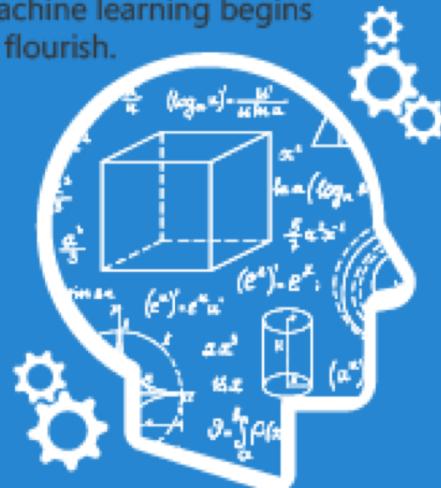
1990's

2000's

2010's

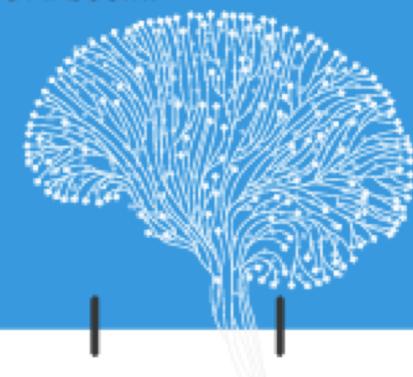
# MACHINE LEARNING

Machine learning begins  
to flourish.



# DEEP LEARNING

Deep learning breakthroughs  
drive AI boom.

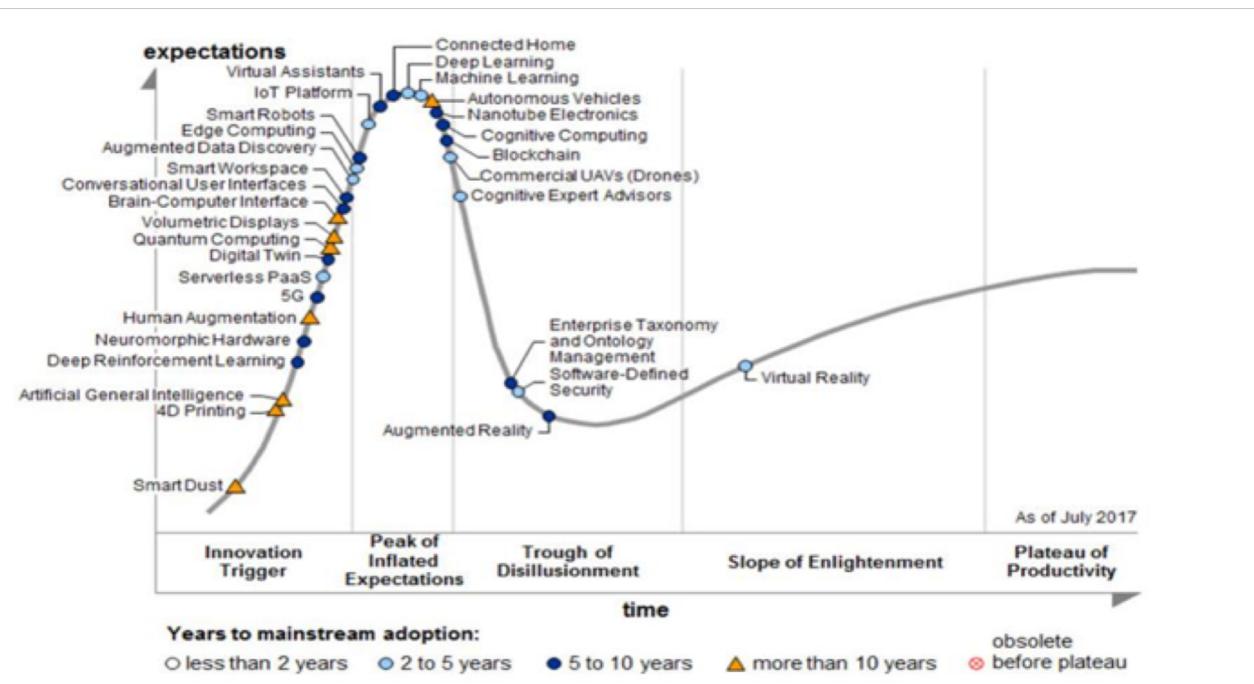


# Artificial Intelligence is Exponentially Taking Off

“Intelligent software applications will become commonplace. And **machine learning will touch every industry.**”

According to the father of Artificial Intelligence, John McCarthy, it is “**The science and engineering of making intelligent machines, especially intelligent Computer programs**”.

Cognitive computing, artificial intelligence, and machine learning will become the fastest growing segments of software development by the end of 2018; **by 2021, 90% of organizations will be incorporating cognitive/AI and machine learning into new enterprise apps**



# Machine Learning

Machine Learning: Algorithms to parse data, learn from it, and then make a determination or prediction about something in the world

- **Supervised Learning**

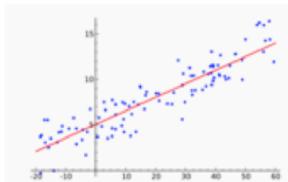
- Learning with a labelled training set
- Example: email spam detector with training sets of already labelled emails

- **Unsupervised learning**

- Discovering patterns in unlabeled data
- Example: cluster similar documents based on text content

- **Reinforcement Learning**

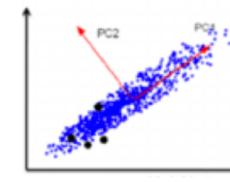
- Learning based on feedback or reward
- Example: learn to play chess by winning or losing



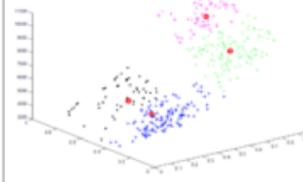
**Regression**  
*Linear regression  
Logistic regression*



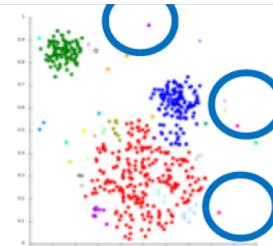
**Decision Tree**  
*Random Forest  
Markov Chain ...*



**Dimensionality reduction**  
*Principal Component Analysis ...*



**Clustering**  
*k-Means  
Hierarchical clustering ...*



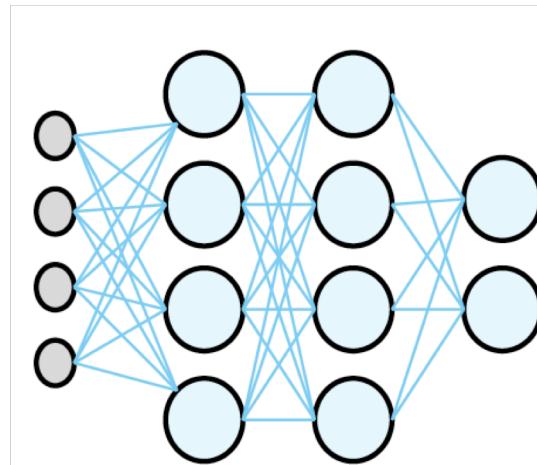
**Anomaly Detection**

# Deep Learning

**Deep Learning = Artificial Neural Networks** are inspired by our understanding of the biology of our brains – all those interconnections between the neurons

- Universal function estimator, without feature engineering
- Requires lots of training data
- Black box approach

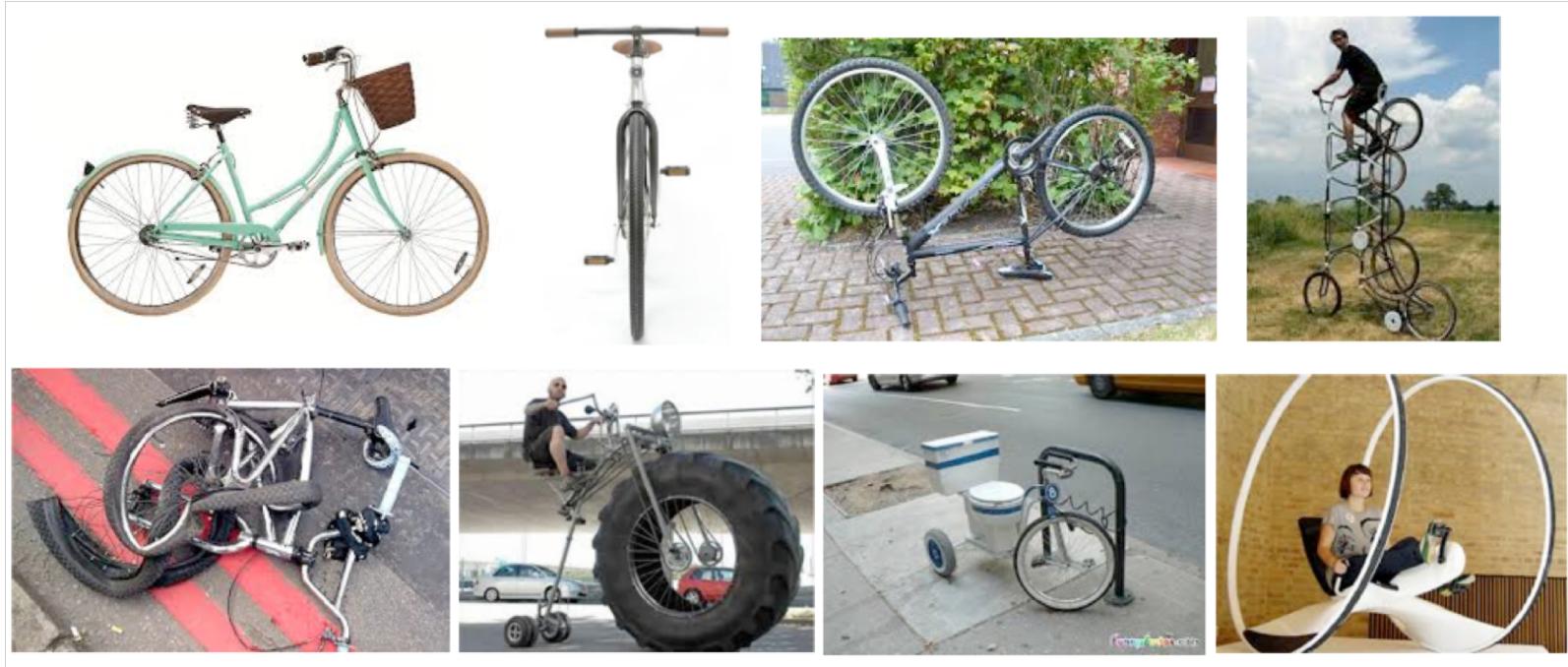
- Speech recognition
  - Speech to text
  - Sentiment analysis
- Computer vision
  - Object recognition
  - Image tagging
  - Image classification
- Natural Language Processing
  - Sentiment analysis
  - Legal requirements analysis
  - Chatbots



**Watson Services**

Deep Learning Framework  
(Caffe, Torch, Theano, TensorFlow, etc.)

Through experience, exposure, and repetition, we learn to perceive the world around us

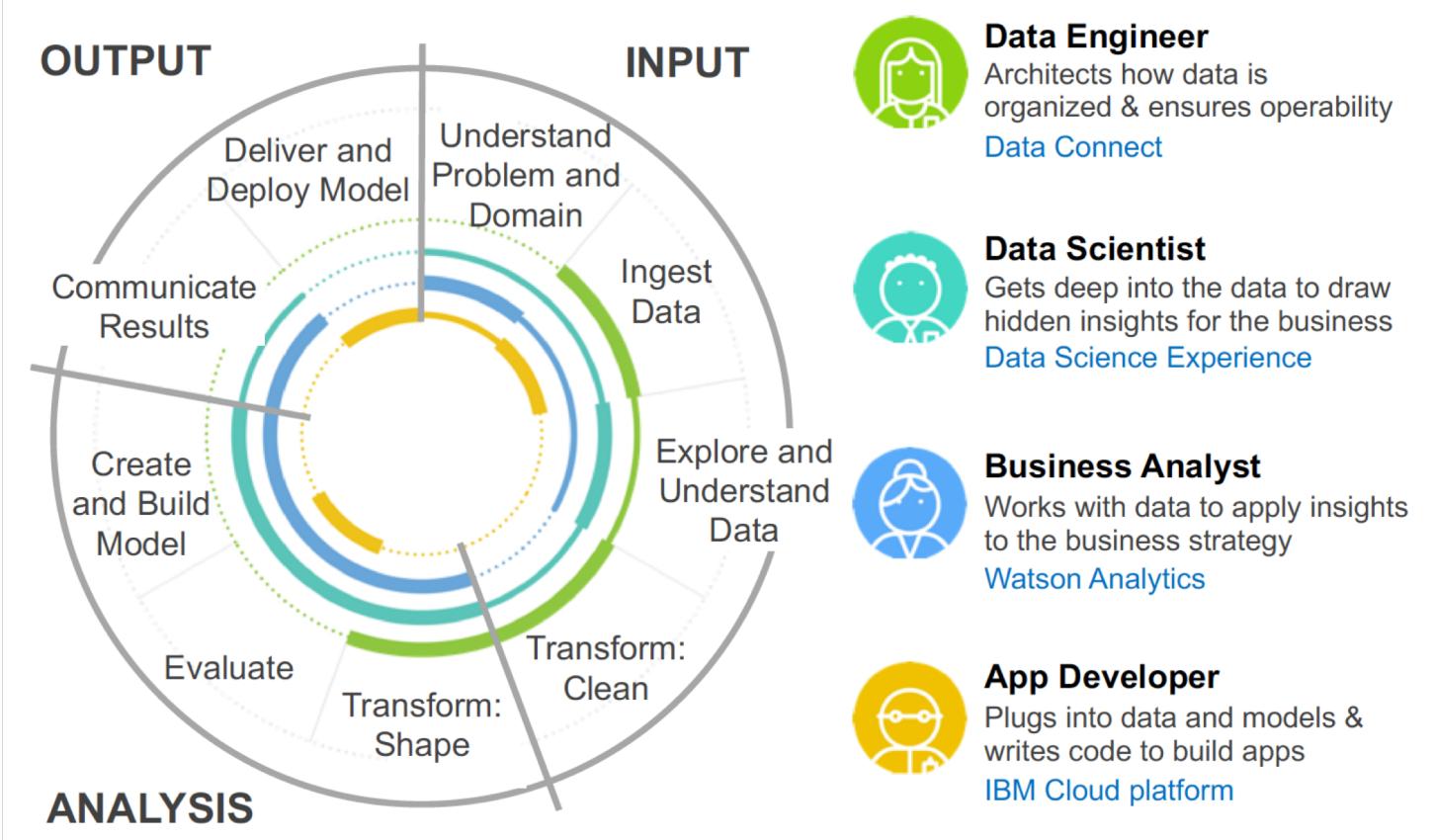


# Deep Learning – Industry use cases



Automotive and Transportation	Defense, Security, Public Safety	Consumer Web, Mobile, Retail	Medicine and Biology	Broadcast, Media and Entertainment
<ul style="list-style-type: none"><li>Autonomous driving:<ul style="list-style-type: none"><li>Pedestrian detection</li><li>Accident avoidance</li></ul></li></ul>	<ul style="list-style-type: none"><li>Video Surveillance</li><li>Image analysis</li><li>Facial recognition and detection</li></ul>	<ul style="list-style-type: none"><li>Image tagging</li><li>Speech recognition</li><li>Natural language processing</li><li>Recommendation and sentiment analysis</li></ul>	<ul style="list-style-type: none"><li>Drug discovery</li><li>Diagnostic assistance</li><li>Cancer cell detection</li></ul>	<ul style="list-style-type: none"><li>Captioning</li><li>Search</li><li>Recommendations</li><li>Real time translation</li></ul>

# IBM Data Science Solution - Tailored Experiences and User Collaboration



# Thank You



# Useful Links & Resources

## External

### Getting Started:

[Service Homepage](#)  
[Feature Requests / Suggestions](#)

### Case Studies:

[OmniEarth](#)  
[Aerialtronics](#)  
[BlueChasm](#)  
[iTrend](#)

### Tutorials & Best Practices:

[Training models with Watson Studio](#)  
[Getting started with Watson + Core ML](#)  
[Stacking Multiple Custom Models](#)  
[Create a Calorie Counting App](#)  
[Watson Visual Recognition & Twilio](#)  
[Best Practices for Custom Models](#)

### Code Patterns:

[Classify vehicle damage](#)  
[Analyze industrial equipment for defects](#)  
[Create an Android calorie-counter app](#)

## External continued

### Books:

[Redbook: Building Cognitive Application using IBM Watson Services vol3 – Watson Visual Recognition](#)

### Blogs:

[IBM Watson on Medium](#)

## Internal

[Slack Channel: #ibmvisual-recognition](#)  
[Service Roadmap](#)  
[IBMer key limit increase request form](#)  
[ZACS portal](#)  
[Digital Sales Play](#)  
[Content Request & Feedback Form](#)