Feeding the Machine: Big Data AI/ML

“Turning Insights Into Action”

3/12/2020

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Agenda

8:30 – 9:15 AI / ML Overview

9:15 – 10:00 AI / ML Algorithms & Tools

10:00 – 10:15 Break

10:15 – 11:00 Data and Systems

11:00 – 11:30 AI / ML Processes & Case Studies

11:30 – 12:00 Q & A

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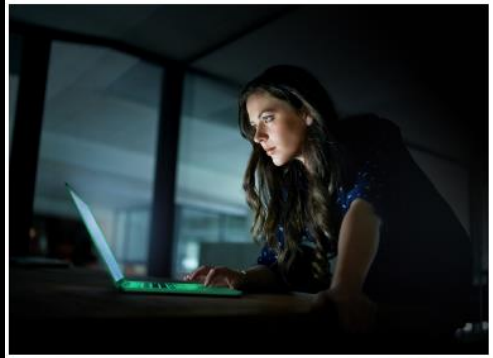
Technology is redefining how businesses engage

with their customers and the digital lives of consumers






4th		Cyber-physical systems, Internet of Things & Internet of Systems
3rd		Computerization
2nd		Electricity & Assembly Lines
1st		Steam & Water Power

We are in the midst of the 4th Industrial Revolution

- Transforming how people live, work, create & connect
- Disrupting existing markets & challenging the status quo
- Changing customers' expectations
- Constantly pushing the boundaries of what's possible

By 2021, connected devices will outnumber humans by three to one …

NCTA - The Internet & Television Association June 2017

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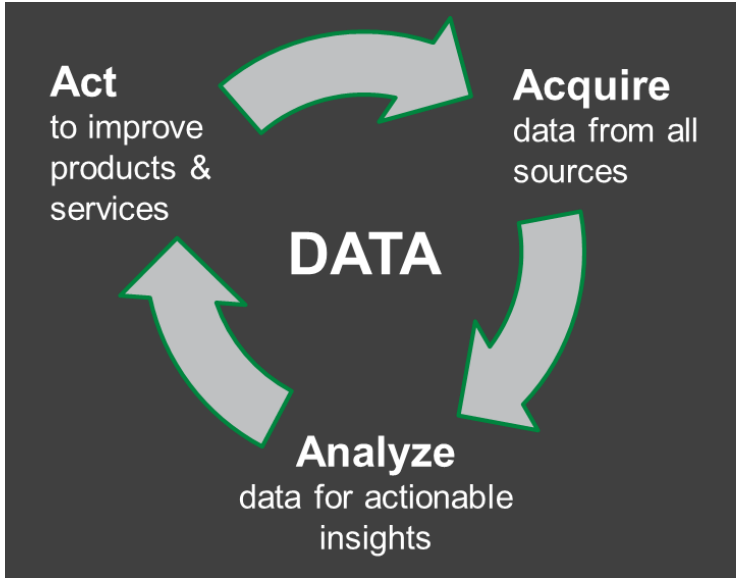
Thriving in this 4th Industrial Revolution requires Digital Transformation

Digital Business is
100% data-driven and
an **iterative, continuously** evolving model of business



Digital Business powered by Big Data and AI/ML

Analytics spanning across Systems, Processes and Data in the Telecom Industry lifecycle

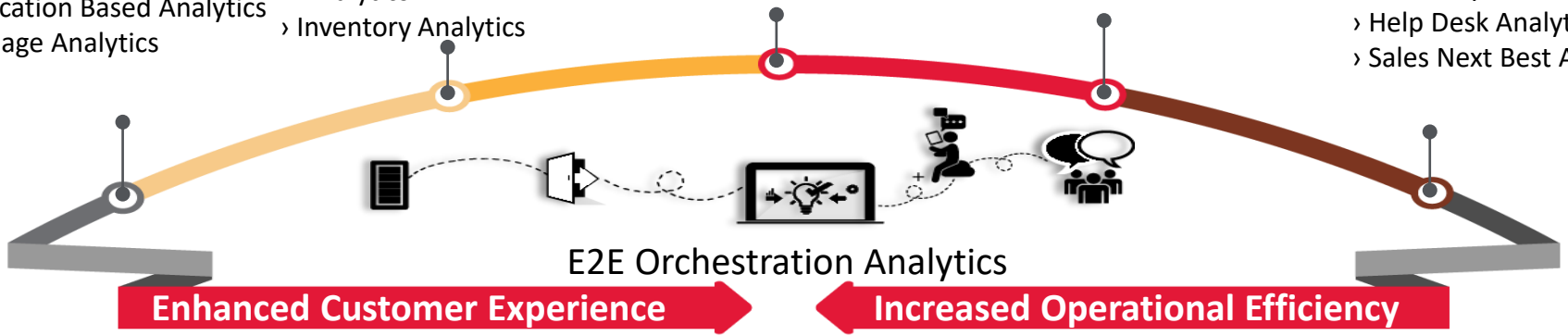
Customer Analytics
- › Subscriber Analytics
- › Churn Analytics
- › Location Based Analytics
- › Usage Analytics

Operational Analytics
- › Service Delivery & Fulfillment Analytics
- › Service Efficiency
- › Capacity Planning Analytics
- › Inventory Analytics

Network Analytics
- › Traffic Management
- › Performance Analytics
- › Demand Forecasting
- › Capacity Planning
- › Network Security Analytics

Social Media Analytics
- › Product & Branding Analytics
- › Market Analytics
- › Campaign Analytics
- › Sentiment Analysis

Contact Center Analytics
- › ICR Analytics
- › IVR Analytics
- › Help Desk Analytics
- › Sales Next Best Actions



a. Built on Scientific, Statistical and Operational research methodology
b. Multiple variants of the platform (Open Source, Commercial Low Cost and Commercial Best of the Breed)
c. Custom as well as 3rd party product based solutions

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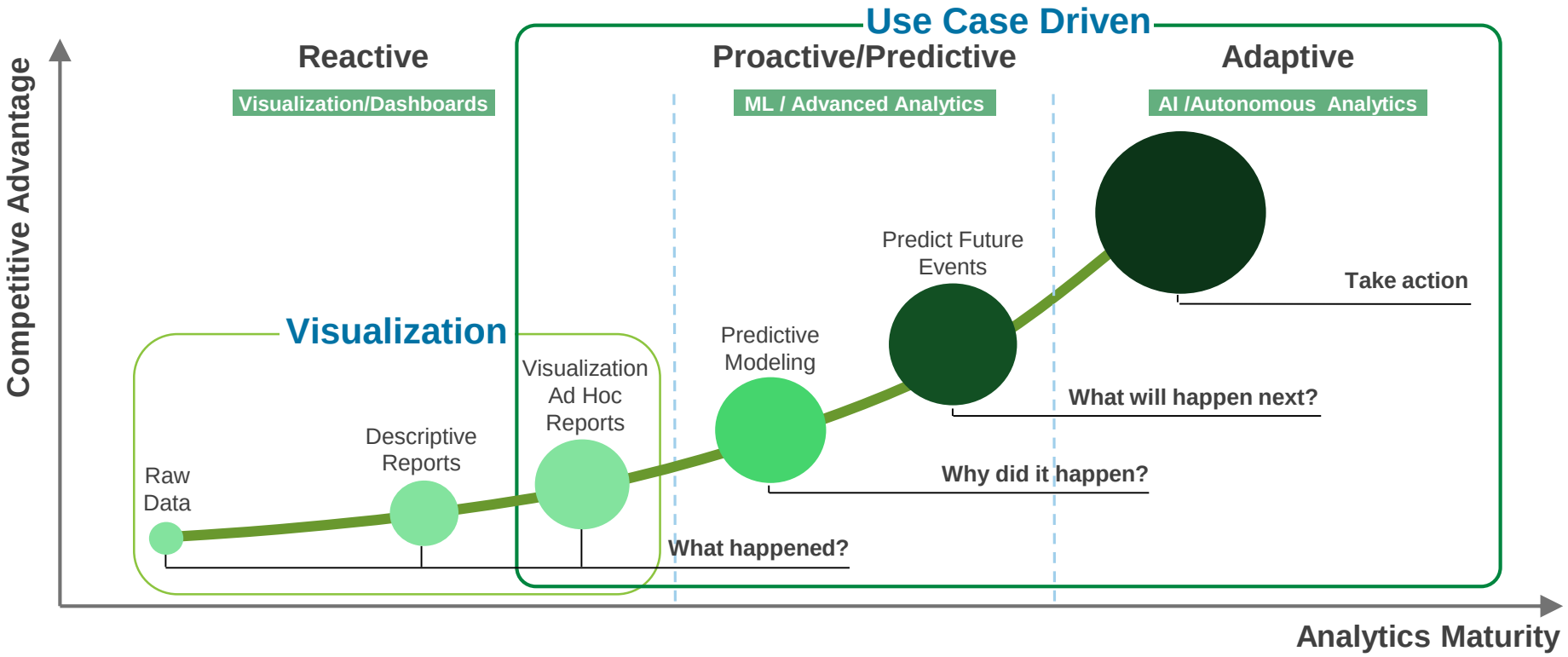
Enable the Full Spectrum of Analytics



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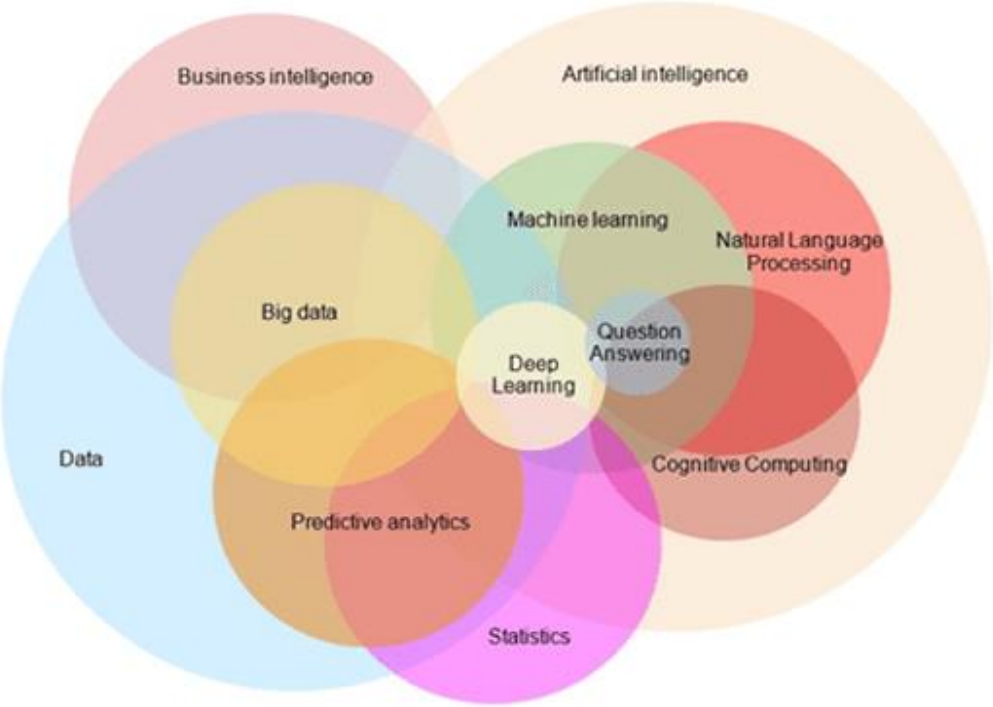
How do we define Analytics?

A Combination of:

- Business Intelligence
- Visualization
- Statistics
- Predictive Analytics
- Machine Learning
- Deep Learning
- Artificial Intelligence

All powered by Data



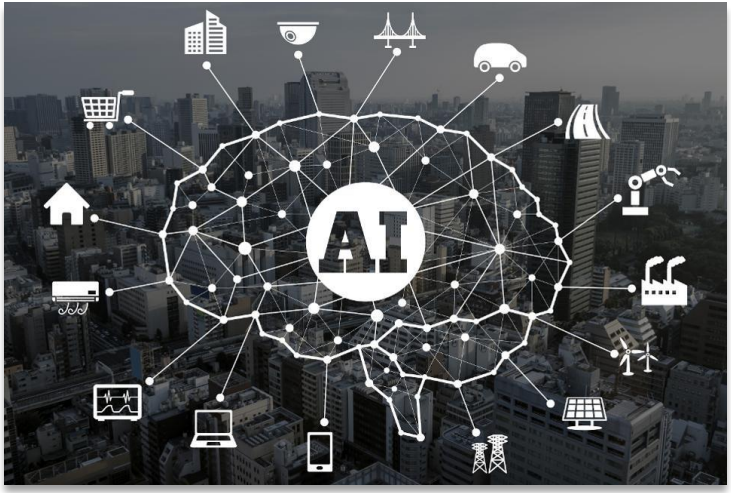
Rikus Combrink, Big Data Dictionary, October 2017

To simplify the discussion we'll call it AI / ML and Big Data

- The *Artificial Intelligence (AI) / Machine Learning (ML)* revolution is here transforming Big Data into insight into action

- AI / ML will affect the nature of activities, such as:
  - *Collaboration*
  - *Enterprise structures*
  - *Decision making*
  - *Research and development*
  - *Creative/artistic processes*

AI / ML enables new approaches to existing business models, operations, and deployment of people. These changes will fundamentally alter the way our organizations operate



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What is Predictive?

- Definition: The practice of extracting information from existing data sets in order to determine patterns and predict future outcomes and trends.
- Predictive models and analysis are typically used to forecast future probabilities with an acceptable level of reliability[1]
- To accomplish this analysts use a variety of techniques from statistics, modeling, machine learning, and data mining

1. http://www.webopedia.com/TERM/P/predictive_analytics.html

Example: Call Center Incidents

Predictive analysis enables you to extend your analytical capabilities

Moving from the rearview mirror to a **forward-looking view**

What happened?	Why did it happen?	What will happen?	How can I optimize?
Reactive	**Proactive**	**Predictive**	**Adaptive**
Respond to impacts post incident	Take action before or as incidents occur in real-time	Using historical data, identify possible risks of incidents and take action to prevent incident from happening	Monitors, correlates, and dynamically takes action to avoid incidents.

Sense and Respond → **Predict and Act**

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Artificial Intelligence / Machine Learning

Driven by data and exponential growth in computational power

We now have self driving cars, intelligent assistants, vison better than human, algorithms that develop new drugs…

Artificial Intelligence / Machine Learning – What is it?

- *Artificial Intelligence (AI)* is the development of computer systems able to perform tasks that normally require human intelligence. Such intelligence processes include:
  - *Learning*
  - *Reasoning*
  - *Decision making*
  - *Self-Correction*

- *Machine Learning (ML)* is the scientific study of algorithms and statistical models that computer systems use to effectively perform a specific task without using explicit instructions, relying on patterns and inference instead.

Source: Artificial Intelligence: A Modern Approach, Russell and Norvig, 2010; Special Report: Artificial intelligence apps come of age, Rouse, August, 2018

Note the emphasis on "take actions"

- This is a ***Critical difference*** between AI and conventional software
- AI allows computers to respond to their own signals from the world
- These are signals that software engineers do not directly control and likewise don't anticipate

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“Artificial Intelligence is the new electricity”

Dr. Andrew Ng
Former chief scientist at Baidu, Co-founder at Coursera

- Electricity transformed countless industries:
  - Transportation
  - Manufacturing
  - Agriculture
  - Healthcare
  - Communications
  - Etc.

- AI will bring about an equally big transformation

Why Artificial Intelligence?

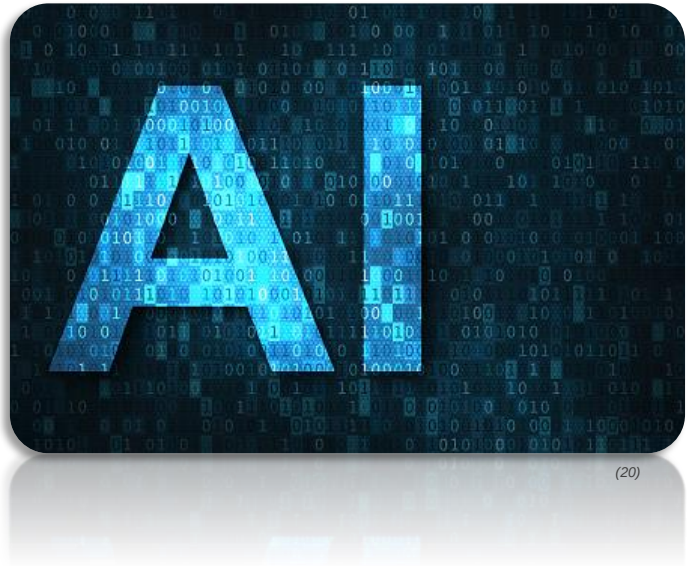
AI *is the theory and development of computer systems able to perform tasks that normally require human intelligence* [17]

*"Data is the fuel that powers **AI**." [15]*

"Over 2.5 quintillion bytes of data is created every single day, and it's only growing from there." [16]

"It's estimated that 1.7MB of data is being created every second for every person on earth." [16]

Large data volumes make it possible for machine learning applications to learn independently and rapidly" [17]



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(15) https://su.org/blog/artificial-intelligence-and-big-data-a-powerful-combination-for-future-growth/
(16) www.socialmediatoday.com
(17) https://en.oxforddictionaries.com/definition/artificial_intelligence
(13) https://vertassets.blob.core.windows.net/image/132e4a81/132e4a81-2301-4efd-99a248a7f96d0325/ai_artificial_intelligence_istock_832169838.png

Aoccdrnig to rscheearch at Cmabrigde Uinervtisy, it deosn’t mttaer in waht oredr the ltteers in a wrod are, the olny iprmoatnt tihng is taht the frist and lsat ltteer be at the rghit pclae. And we spnet hlaf our lfie larennig how to splel wrods. Amzanig huh?

- Dr. Rawlinson (1976)

Types of AI

- Machine Learning: is the scientific study of algorithms and statistical models that computer systems use to effectively perform a specific task without using explicit instructions, relying on patterns and inference instead
- Pattern Recognition: Type of machine learning focusing on identifying patterns in data, thus predicting scenarios and actions
- Natural Language Processing (NLP): Processing of human language by a computer program. NLP tasks include text translation, sentiment analysis, & speech recognition
- Robotic Process Automation (RPA): can be programmed to perform high-volume, repeatable tasks normally performed by humans. The difference from IT automation being that it can adapt to changing circumstances

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There are 3 main forms of AI:

ASSISTED INTELLIGENCE
Improves what we are already doing

1

Widely Deployed

We are here today

AUGMENTED INTELLIGENCE
Enables us to do things we otherwise couldn't do

2

Emerging Today

AUTONOMOUS INTELLIGENCE
Acts on its own, deciding its own actions on behalf of our organization's goals.

3

Wave of the Future

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Can We Harness the Full Potential of AI?

	Reactive	Proactive	Predictive/Adaptive
	Structured Data and Rules	**Semi-structured Data + NLP**	**AI / ML Decision Making**
	Automation of activities ***without changing the map of existing systems*** 	*(OCR+ML, NLP, Virtual Assistants, Chatbots)* 	*Machine Learning & Deep Learning based self learning* 
Customer Experience	Customer Feedback Analytics	ML Driven Customer Assistant	AI Assistant
Customer Service	Rules Driven Chatbot	Chatbot w/ ML	AI Agent
Network Infrastructure	Outage Identification	Proactive Outage Remediation	AI Self Healing Network
Service Assurance	Troubleshooting	Proactive Troubleshooting Automation w/ insights	AI Service Tech
Revenue Assurance	Automated Dispute Reporting	Proactive Reports with Insights	AI Billing Agent

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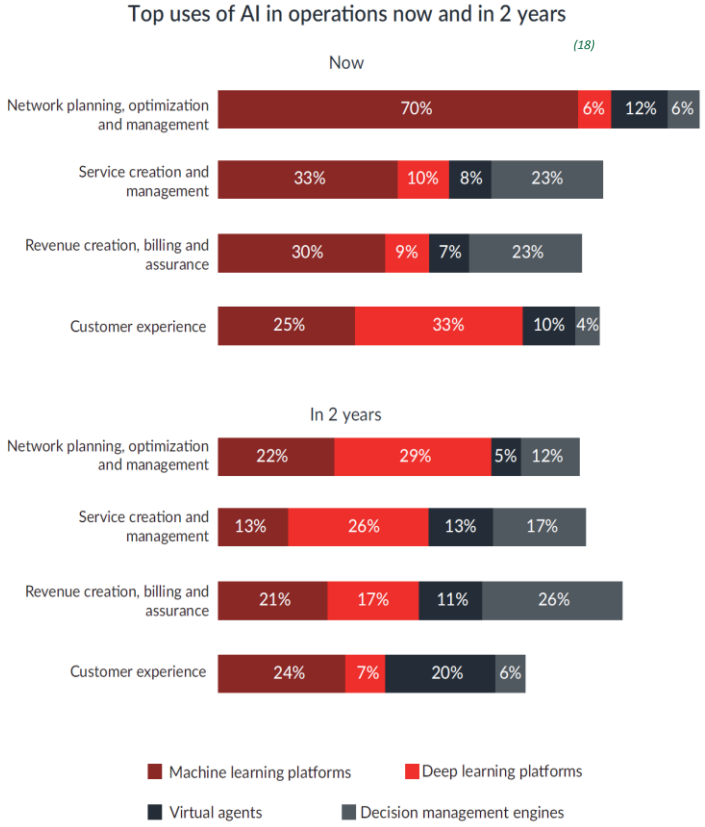
Where We Are Today?

54% of TMT (Technology, M&E, Telecom) companies report ROI above 20% from their AI / ML efforts – Investment in AI /ML is beginning to payoff. *

- *As per Deloitte's state of AI in the Enterprise, 2nd edition, TMT (Technology, M&E, Telecom) has significant artificial intelligence (AI) expertise and a comparatively large number of production deployments. **
- *CSPs across the globe are in different stages of adoption from yet to start to productionized AI deployments with tangible RoI.**
- *KPIs are essential in measuring both the effectiveness of AI and it's value against the investment.*



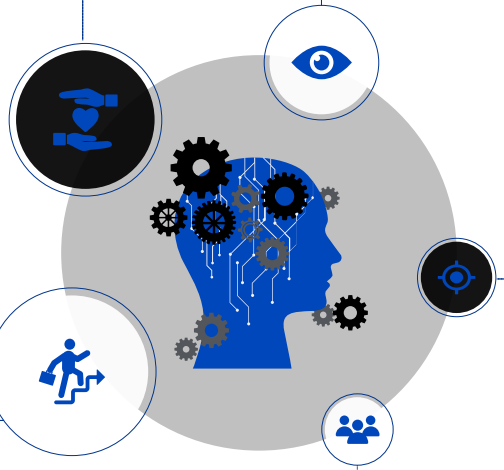
(18) Image source TM Forum Report

** Deloitte report*

AI / ML best practices for Digital Transformation

Build trust in AI / ML

Maintain oversight



Maintain an unwavering focus on user experience

Progress via small steps, moving rapidly and with purpose

Embed AI/ML professionals within your business units and customer teams

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Increasingly, we are embedding Artificial Intelligence and Machine Learning into the core of our businesses across every function and process.

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(19) https://www.brainyquote.com/quotes/pierre_nanterme_885741
(20) https://avatars.alphacoders.com/avatars/view/181624

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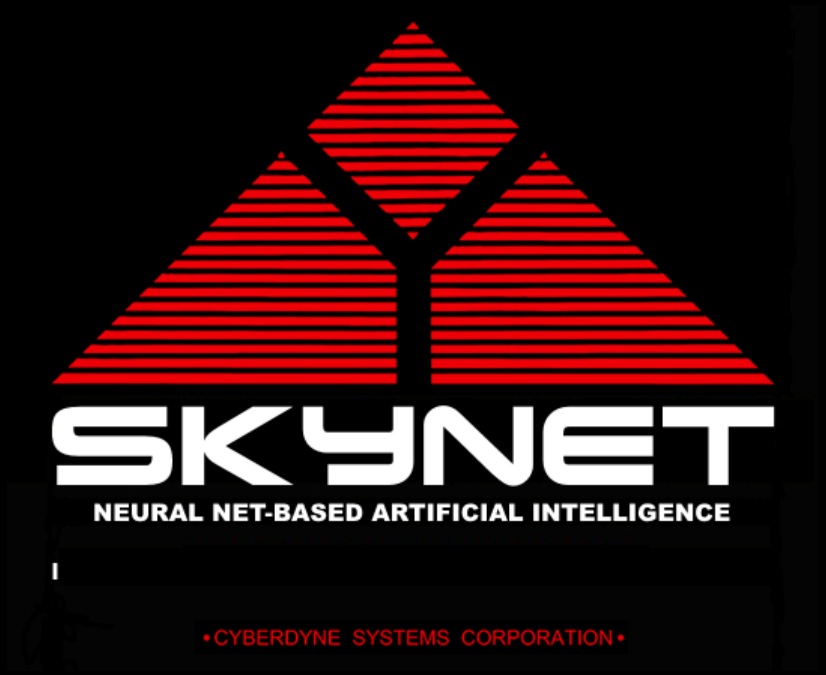
So…Let’s get started!

PRESS F5 ON YOUR KEYBOARD
THEN HIT THE SPACEBAR

The Full Potential of AI



AI / ML Tools and Algorithms

The 4 Eras of Analytics Competition

1.0 Rear View Mirror

Descriptive

- Reports and dashboards
- Light on predictive
- Reactive and slow
- Small, structured, static data
- Back office analysts
- Decision Support
- Analysts as “order takers”

2.0 Dawn of Big Data

Predictive/Prescriptive

- Experimental culture
- Predictive a focus
- Big, unstructured data
- High velocity and variety
- Hadoop is born
- Acceptance of Open source
- Rise of the data scientist

3.0 Artisanal

Hypothesis Driven

- Predictive & prescriptive fully take root
- Analytics a core capability
- Big Data goes mainstream
- Internal & external products
- Move at speed and scale

4.0 Autonomous

Adaptive/Cognitive

- Cognitive Analytics
- Analytics embedded, invisible and automated
- ML goes mainstream
- The rise of Deep Learning
- GPUs and TPUs as analytical engines
- Robotic Process Automation

Each Era Built on the Previous

Source: Thomas Davenport

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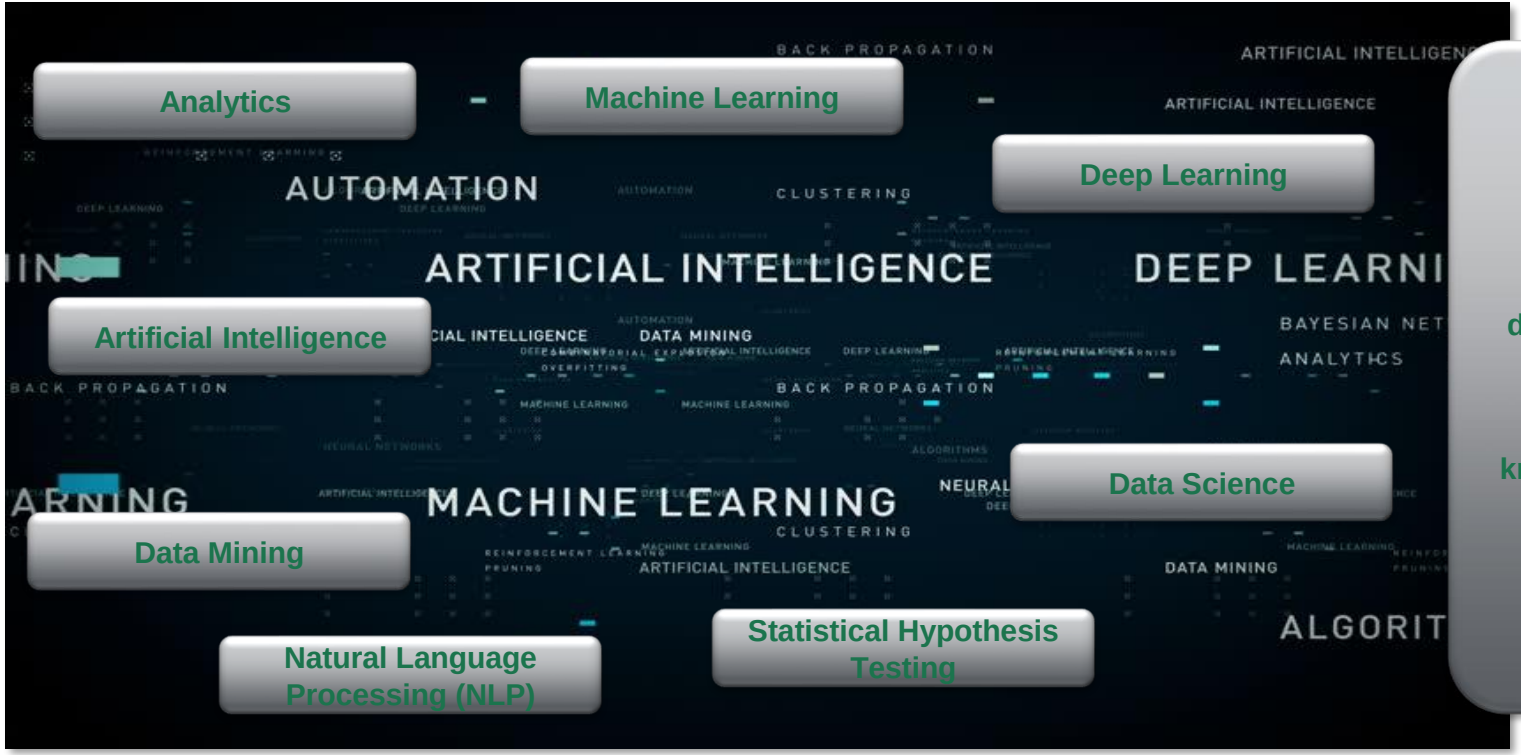
Commonalities among AI technologies

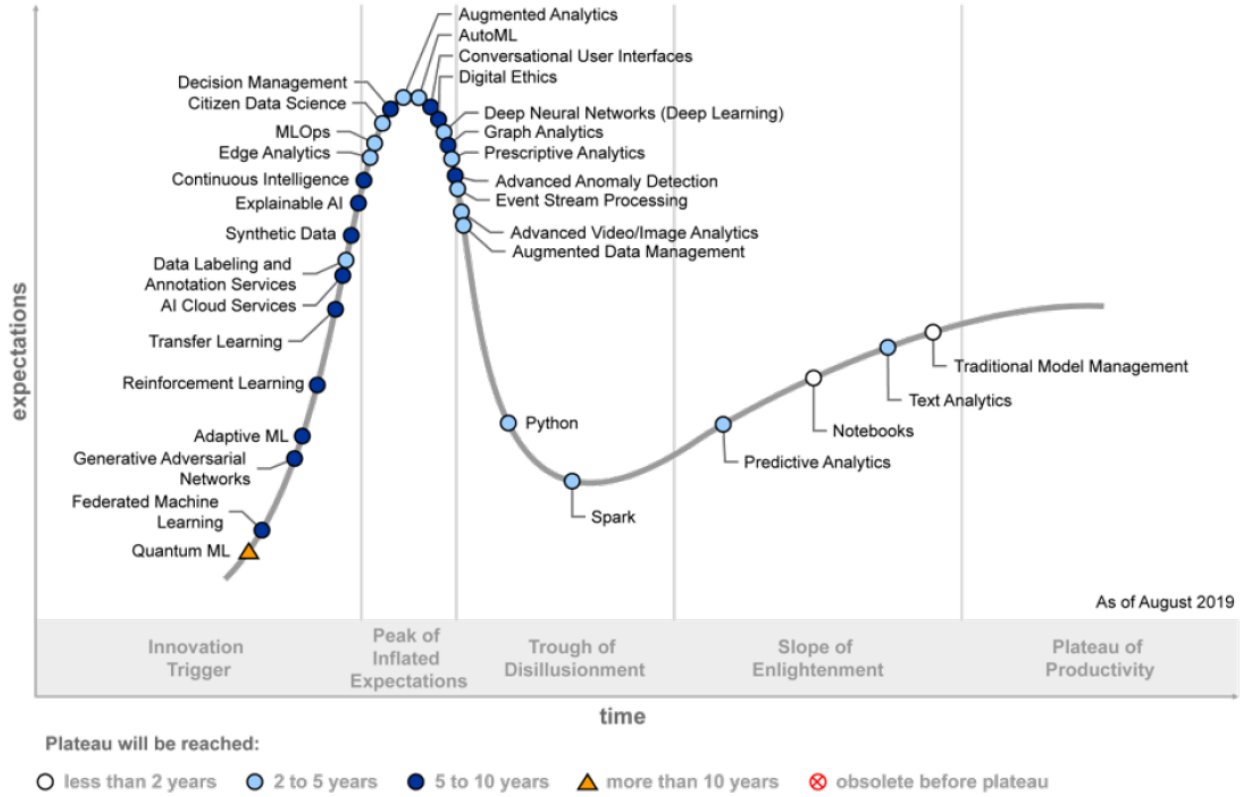


All support automated decision making

Use this knowledge as the path forward

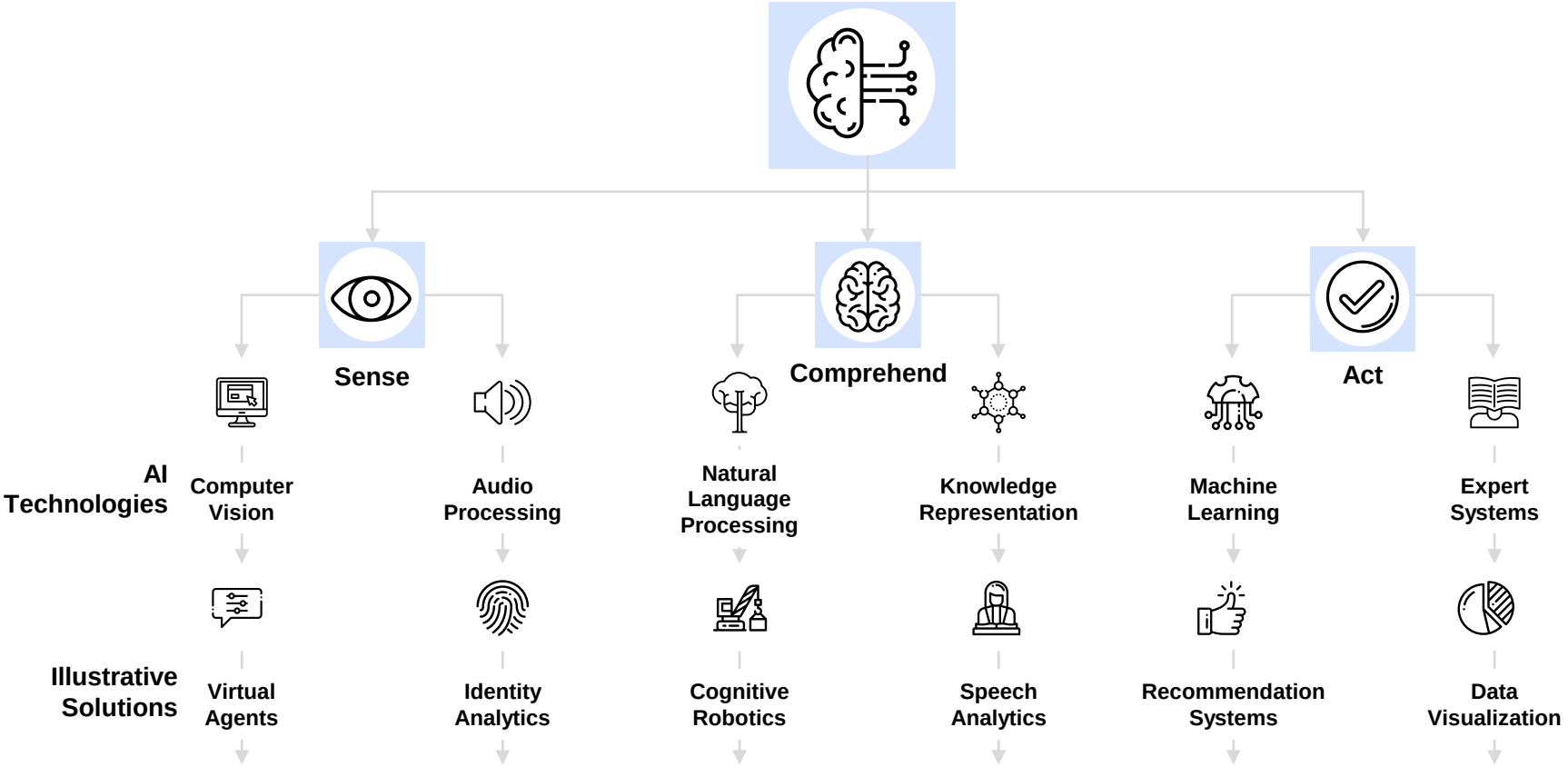
Glut of hype around Data Science and Machine Learning functions

Hype Cycle for Data Science and Machine Learning, 2019



Source: Gartner, 2019

Artificial Intelligence / Machine Learning Types



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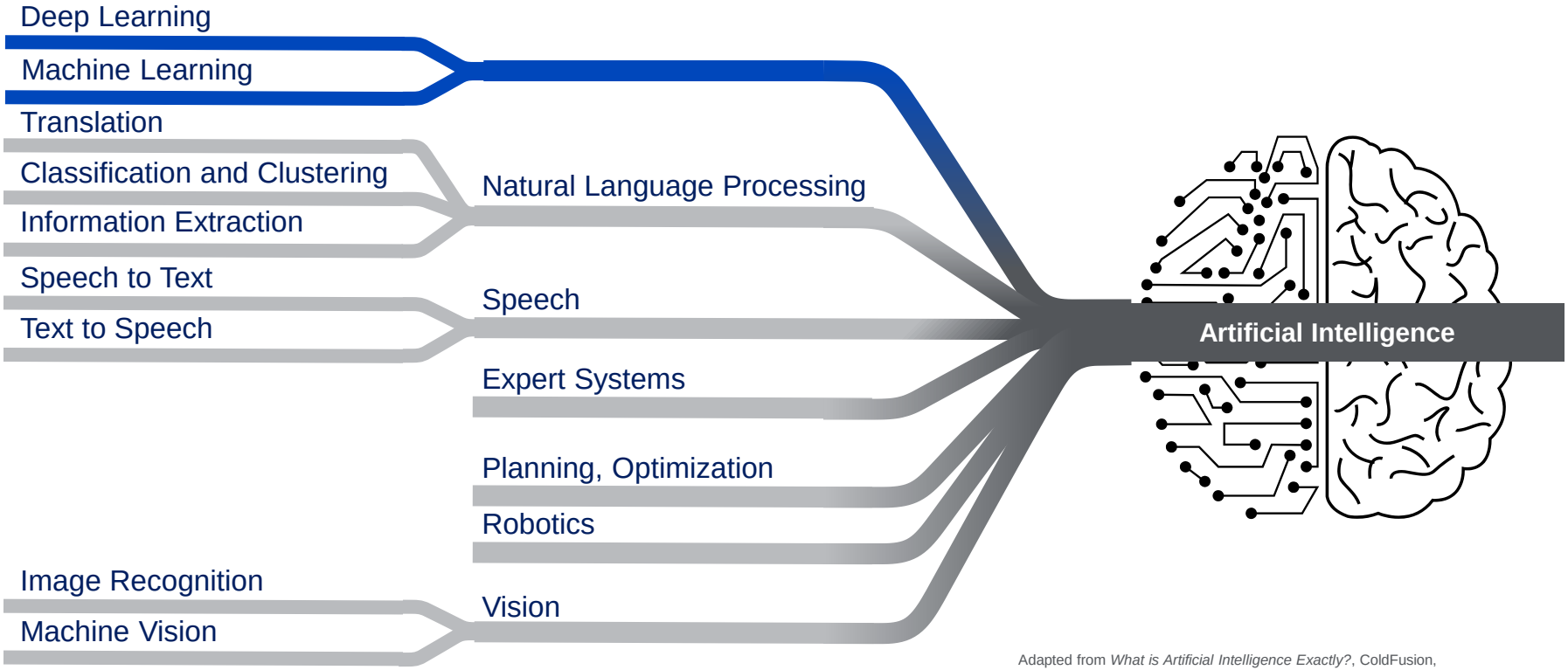
Artificial Intelligence - Algorithms



Adapted from *What is Artificial Intelligence Exactly?*, ColdFusion, https://www.youtube.com/watch?v=kWmX3pd1f10

Machine Learning Approaches

Supervised Learning: Learning with a labeled training set
Example: email subject line optimizer with training set of already labeled emails

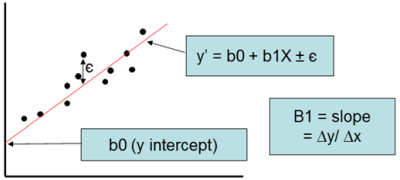
Unsupervised Learning: Discovering patterns in unlabeled data
Example: cluster similar documents based on the text content

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

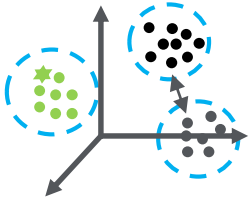
Problem Types

Classification
(supervised – predictive)

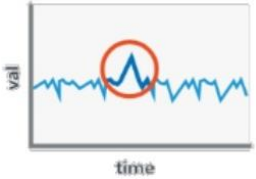
Regression
(supervised – predictive)



Clustering
(unsupervised – descriptive)

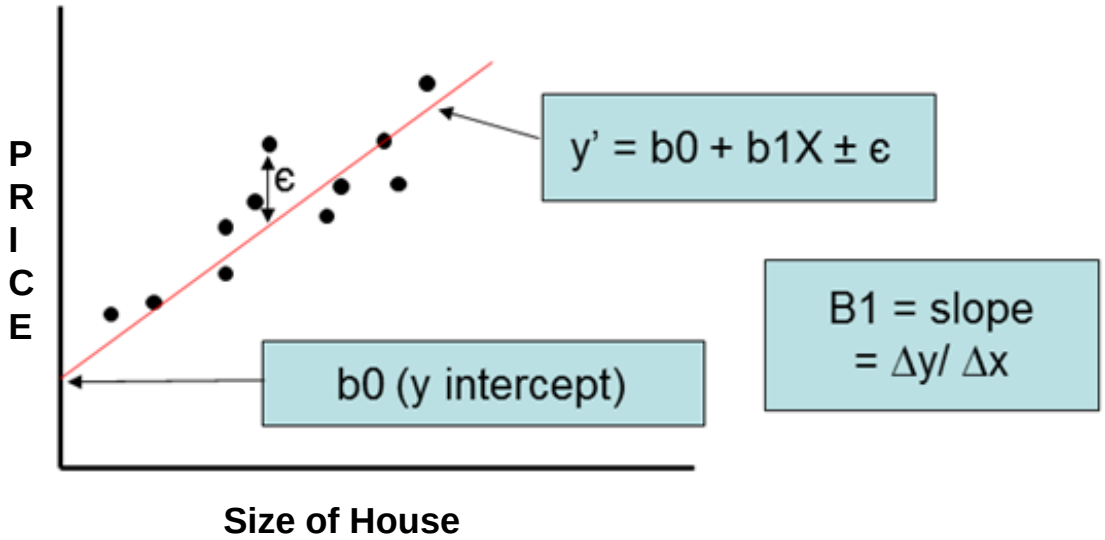


Anomaly Detection
(unsupervised – descriptive)



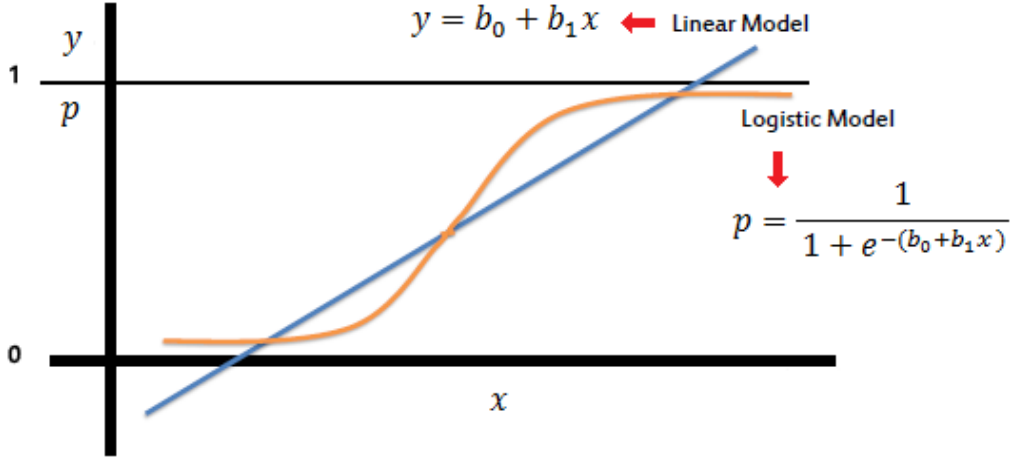
Linear Regression

- Explain the variation in a target (dependent) variable using the variation in explanatory (independent) variables
- Establish a functional form which can be used for prediction



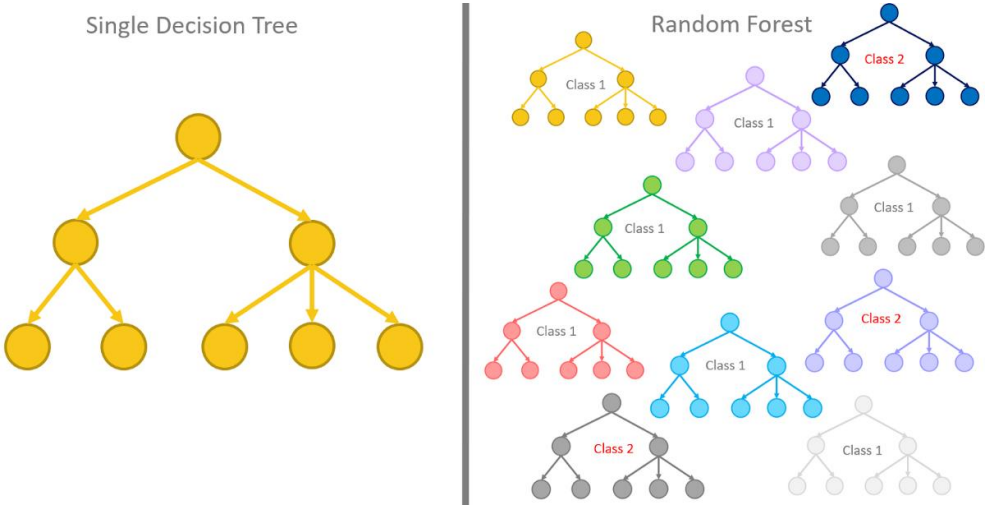
Logistic Regression

- When the target variable is dichotomous.
- The relationship between the explanatory and the target variable is not linear.

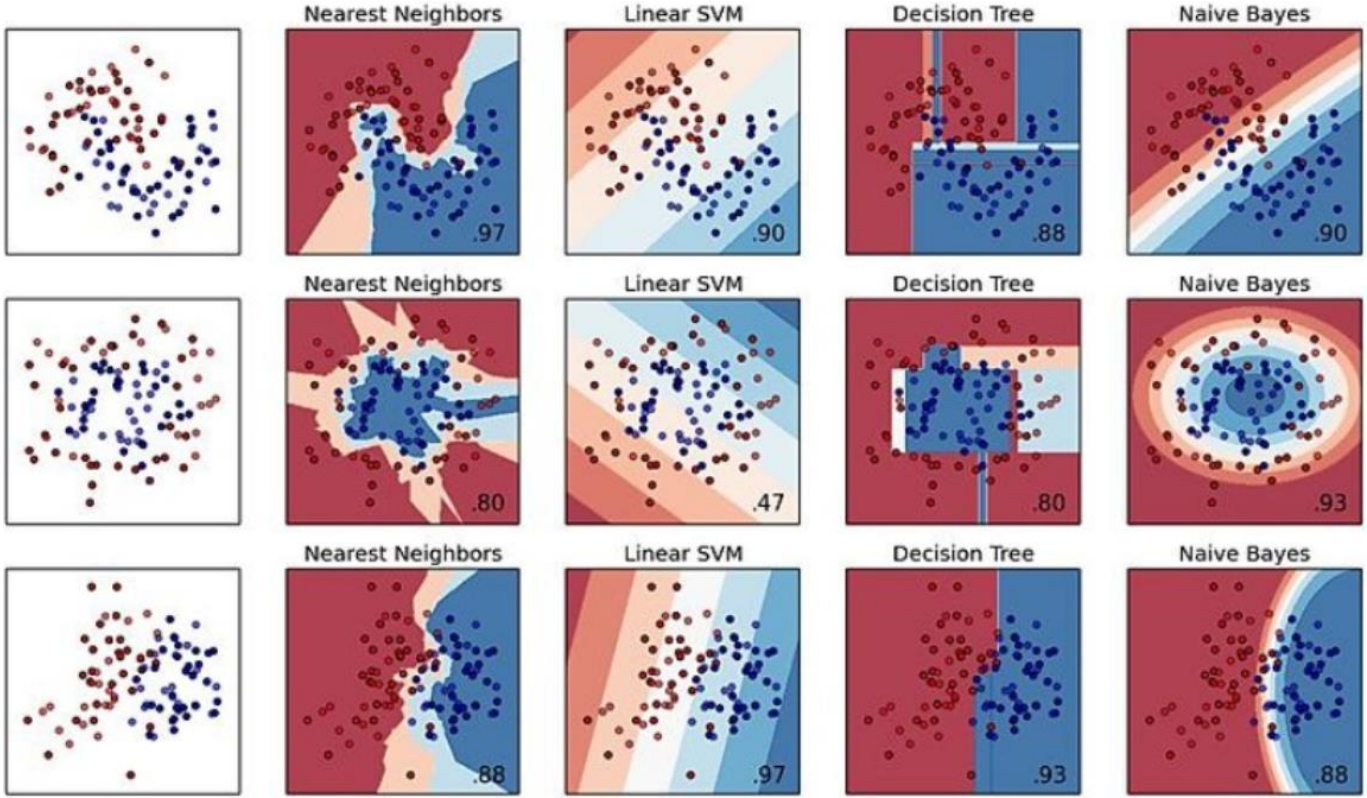


Random Forrest

- A classification algorithm consisting of many decisions trees
- Uses bagging and feature randomness to build each individual tree to try to create an uncorrelated forest of trees
- Prediction by committee method which has been proven to be more accurate than that of any individual tree



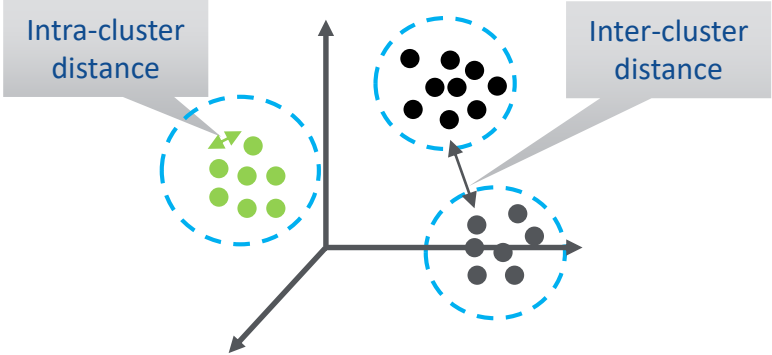
Algorithms Comparison – Classification / Clustering



Cluster Analysis

- Cluster analysis is a multivariate method which aims to classify a sample of subjects (or objects) on the basis of a set of measured variables into a number of different groups such that similar subjects are placed in the same group

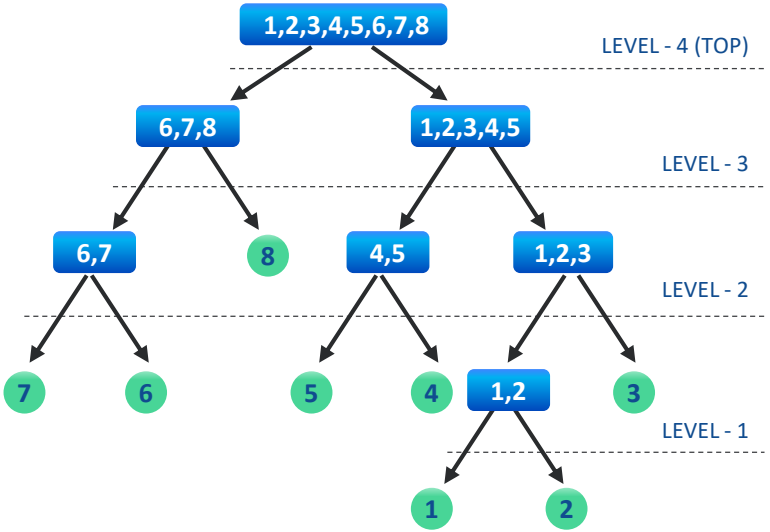
- The data is organized such that there is :
  - High intra-cluster similarity
  - Low inter-cluster similarity



Types of Clustering

Hierarchical methods

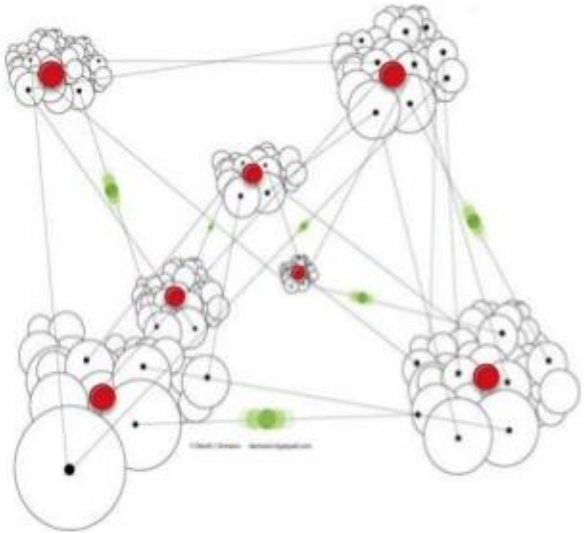
- A hierarchy or tree-like structure is constructed to see the relationship among entities
- The clusters by recursively partitioning the instances in either a top-down or bottom-up fashion



Types of Clustering Cont..

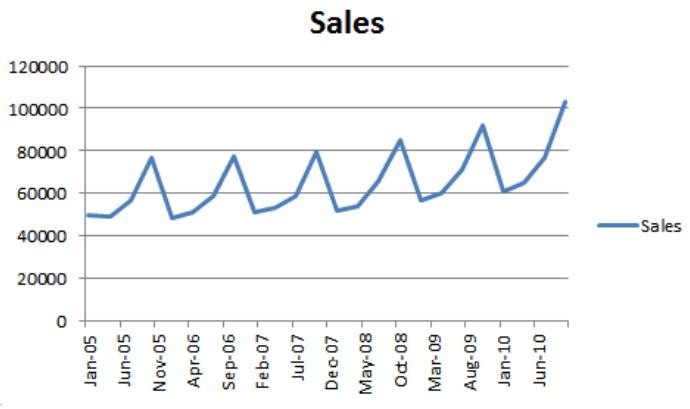
Non Hierarchical methods/k-means clustering methods

- A position in the measurement is taken as central place and distance is measured from such central point.
- The desired number of clusters is specified in advance and the ’best’ solution is chosen.



Time Series

- A time series is a sequence of data points, typically consisting of successive measurements made over a time interval.

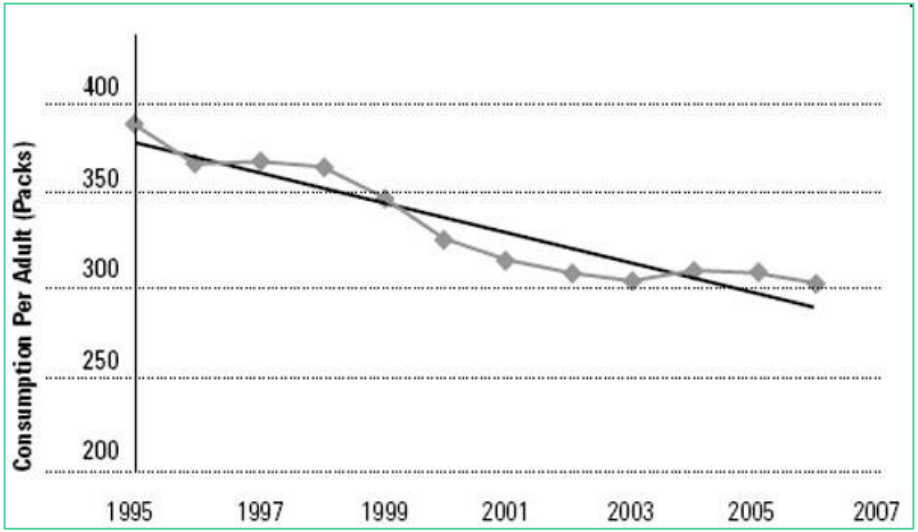


Components of Time Series:

- Trend
- Seasonal Component
- Cyclical Component
- Random Component

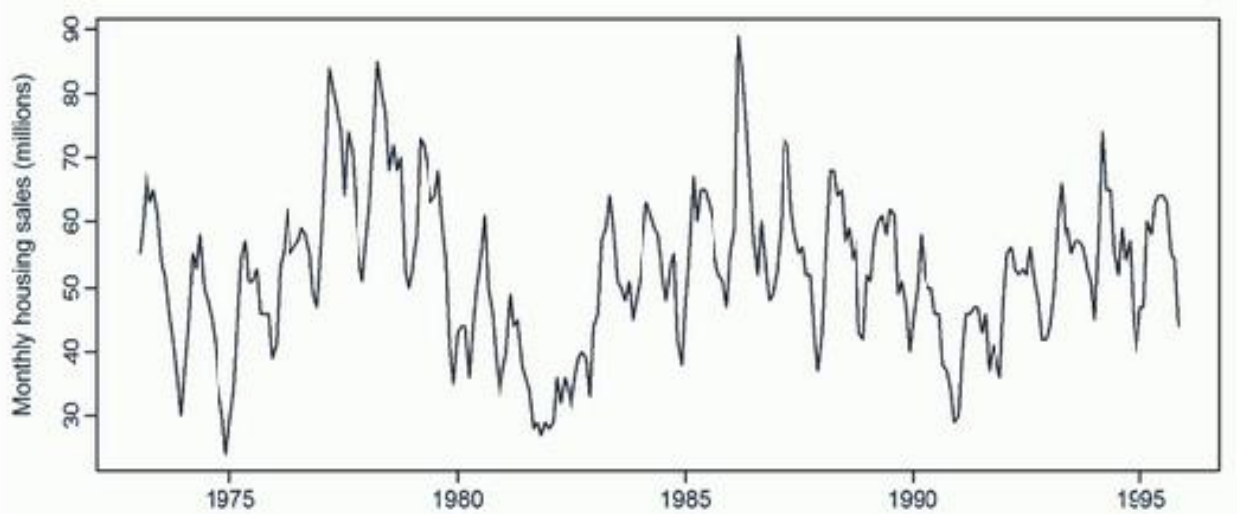
Trend

- Trend Component is any long-term increase or decrease in a time series in which the rate of change is relatively constant



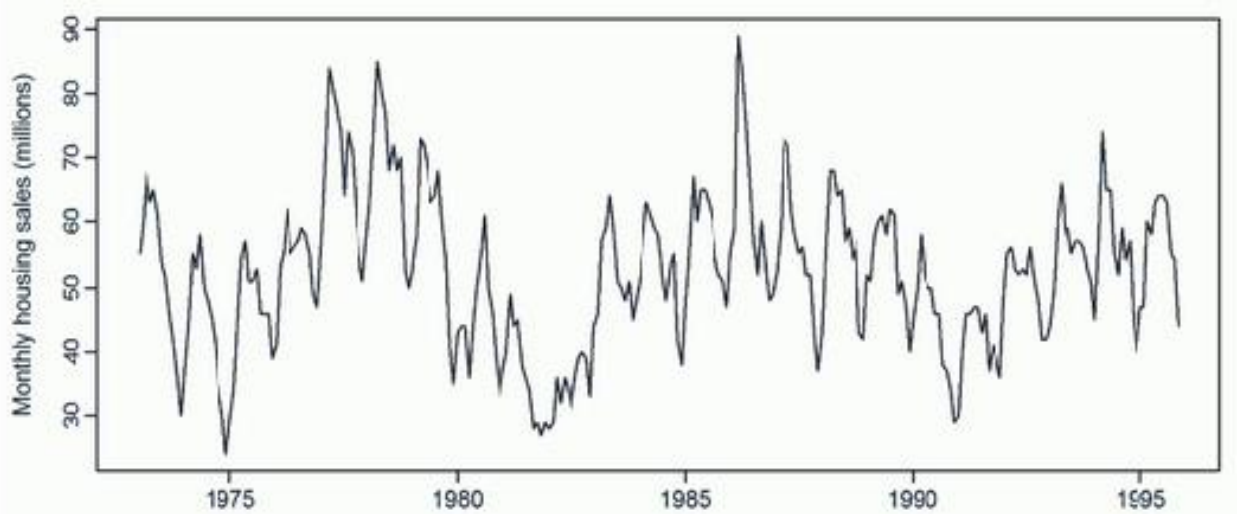
Seasonal

- Seasonal Component is a pattern that is repeated throughout a time series and has a recurrence period of at most one year.



Cyclical

- Cyclical Component is a pattern within the time series that repeats itself throughout the time series and has a recurrence period of more than one year.



Deep Learning

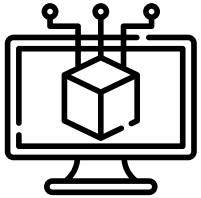
Part of the machine learning field of learning representations of data. Exceptionally effective at learning patterns.

Utilizes learning algorithms that derive meaning out of data by using a hierarchy of multiple layers that mimic the neural networks of our brain.

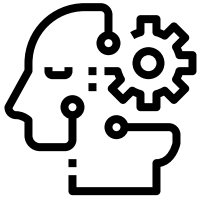
If you provide the system tons of information, it begins to understand it and respond in useful ways

Applications of Deep Learning

Speech Recognition



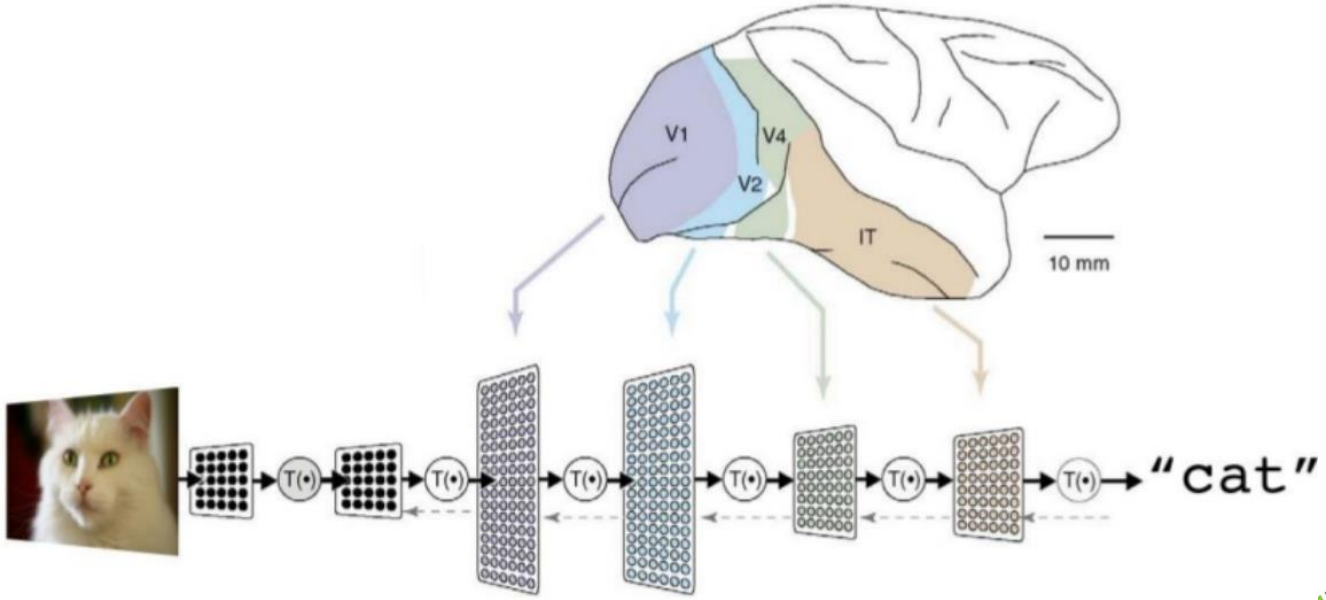
Computer Vision



Natural Language Processing

Deep Learning – How it works

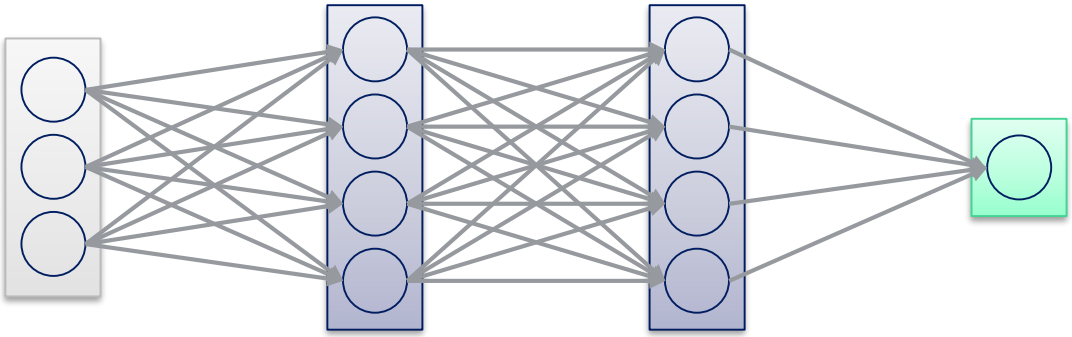
A deep neural network consists of a hierarchy of layers, whereby each layer transforms the input data into more abstract representations (e.g. edge -> nose -> face). The output layer combines those features to make predictions.



Source: Lucas Mason, SAP

Deep Learning – Complex Artificial Neural Networks

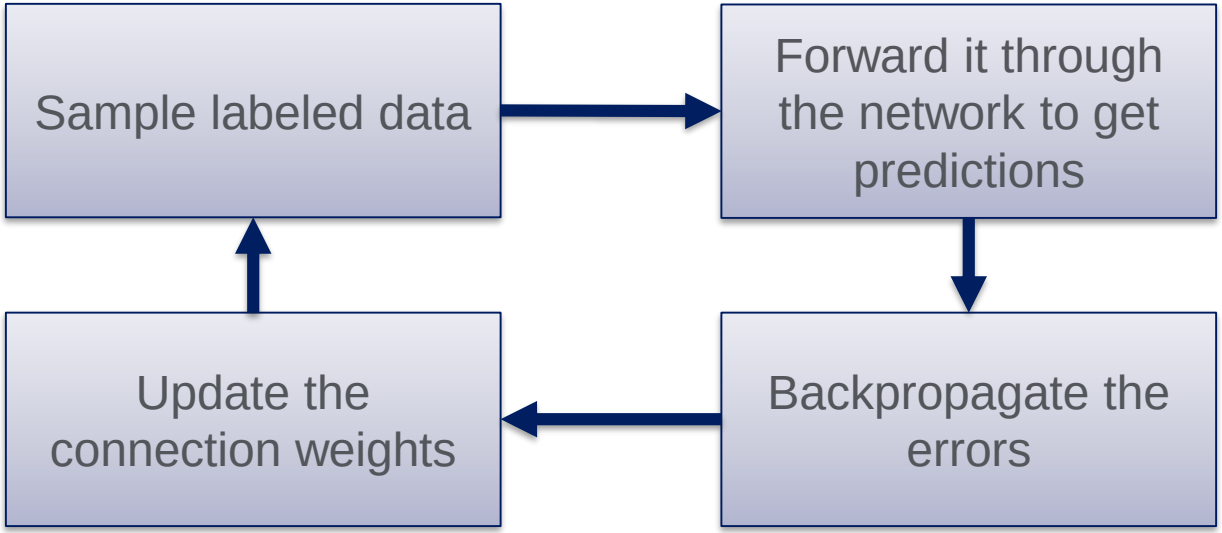
Consists of one input, one output and multiple fully-connected hidden layers in between. Each layer is represented as a series of neurons and progressively extracts higher and higher-level features of the input until the final layer essentially makes a decision about what the input shows. The more layers the network has, the higher-level features it will learn.



input layer hidden layer 1 hidden layer 2 output layer

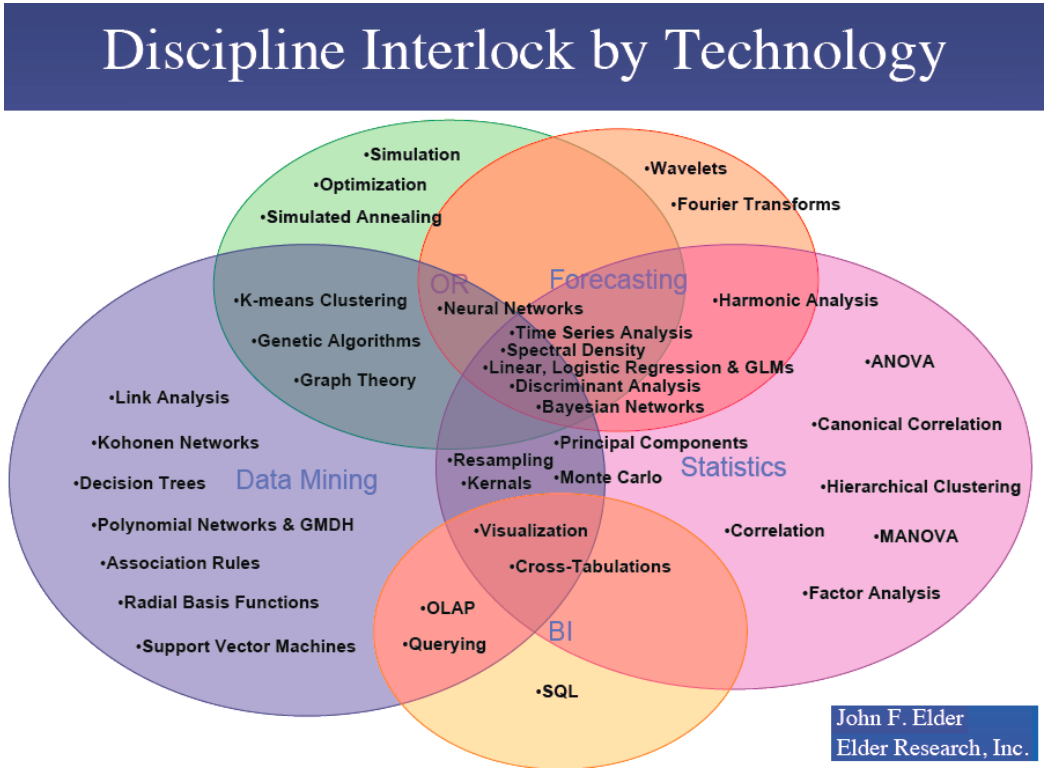
Deep Learning – The Training Process

Learns by generating an error signal that measures the difference between the predictions of the network and the desired values. Then, using this error signal, changes the weights (or parameters) so that predictions get more accurate.



AI / ML Algorithms

Machine learning has roots from many different disciplines: Statistics, Data Mining, Operations Research, Computer Science



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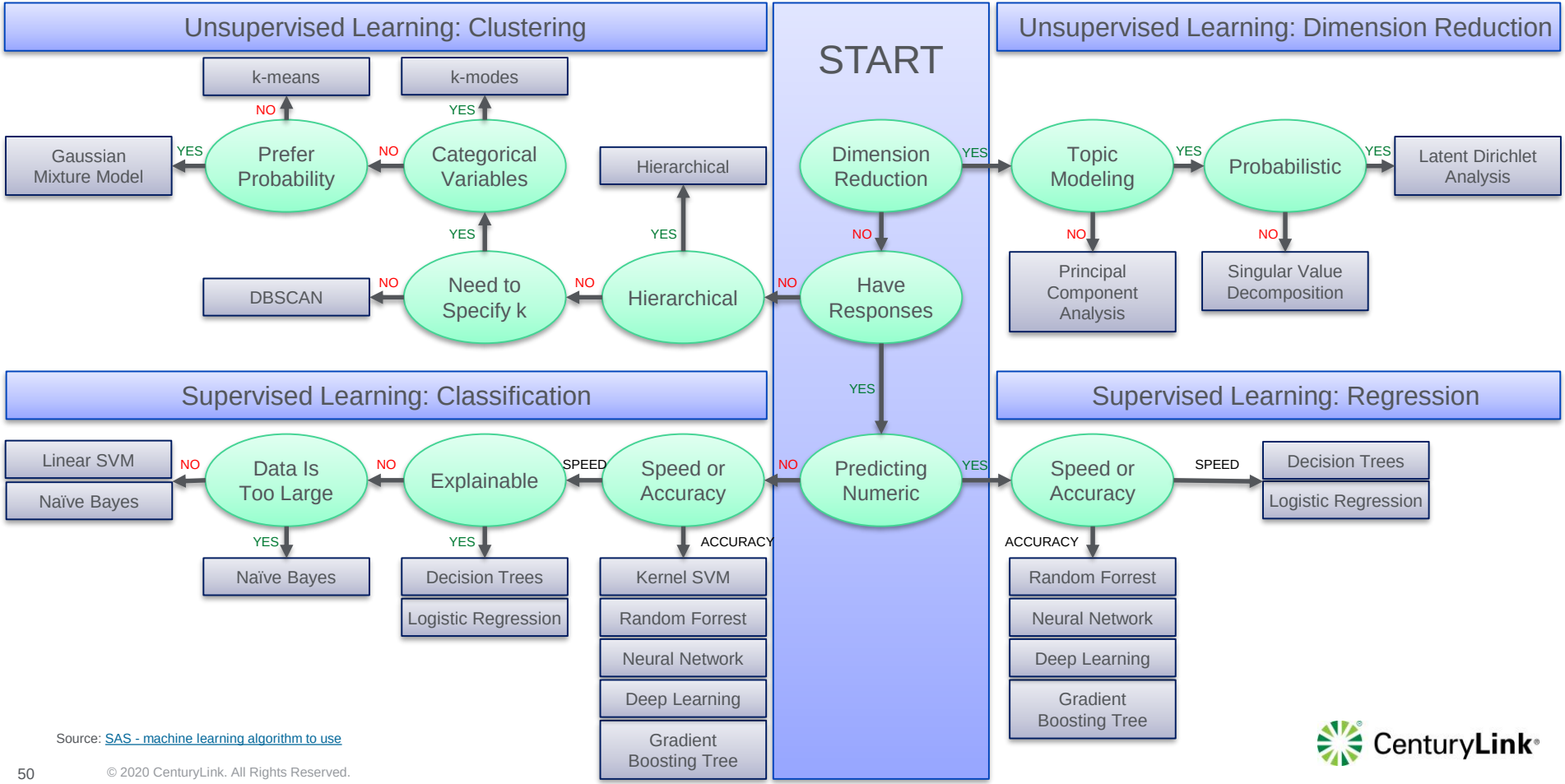
Machine Learning Algorithms Cheat Sheet



Source: SAS - machine learning algorithm to use

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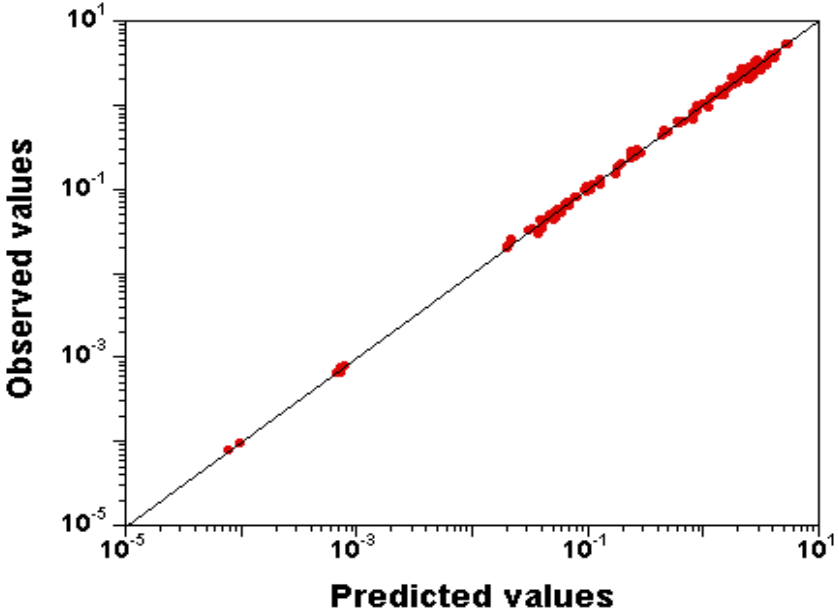
Model Validation - Predicted vs Observed Plot

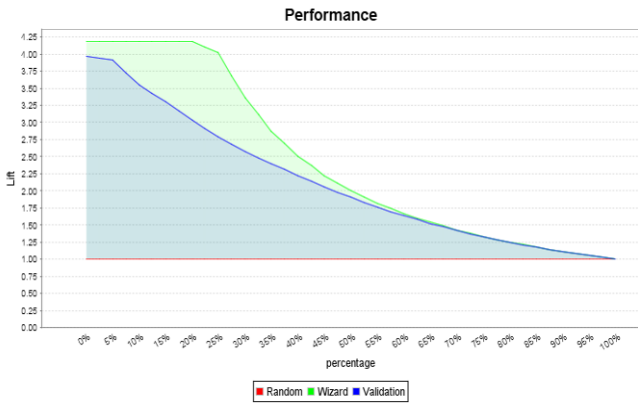
- This is the common used technique for checking the model validity. The plot is drawn between the predicted and actual values of the dependent variable.



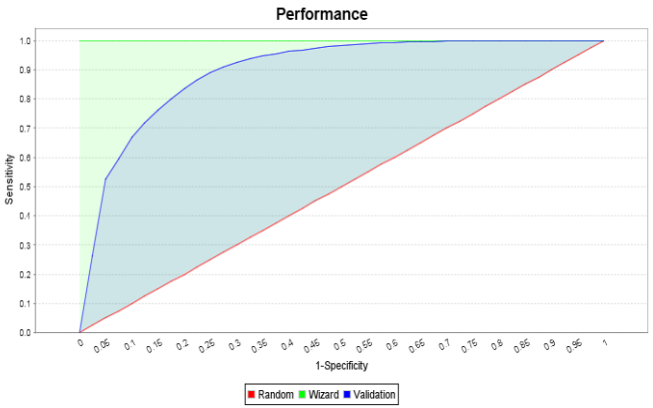
Model Validation - Cumulative Gains (ROC) and Lift Chart

- Lift is a measure of the effectiveness of a predictive model calculated as the ratio between the results obtained with and without the predictive model.

- Cumulative gains and lift charts are visual aids for measuring model performance



Lift Chart



Gain (ROC) Chart

Key Takeaways

- Machines that learn to represent the world from experience through machine learning
- Deep learning is no magic! Just statistics in a black box, but exceptionally effective at learning patterns
- We haven’t figured out creativity and human-empathy
- Transitioning from research to consumer products. Will make tools you use every day work better, faster and smarter

Magic Quadrant

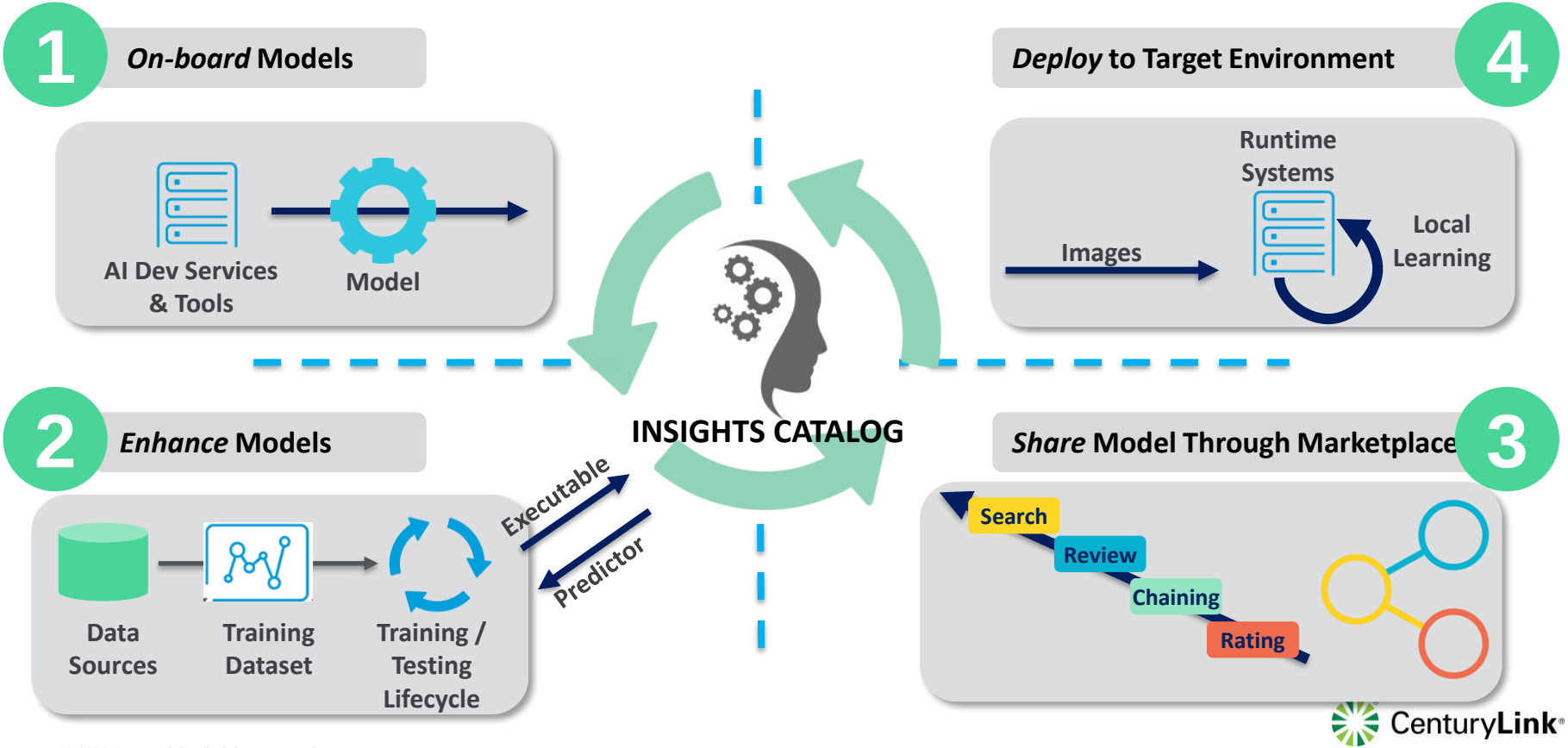
Data Science and Machine Learning Platforms

Source: Gartner (February 2020)

Capabilities Architecture

CenturyLink’s Target AI/ML Environment

Insights Catalog & Model Lifecycle



Data and Systems

Turning Data Into Wisdom…

"Data is not information. Information is not knowledge. Knowledge is not understanding. Understanding is not wisdom. ~Clifford Stoll

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Data Management – No Surprise…It's complex

Data Governance: planning, supervision and control over data and its use

Meta Data Management: integrating, controlling and providing consistent definitions

Data Architecture, Analysis & Design: ensuring development at the project level adheres to data modeling standards, procedures and "Best Practices"

Document Record & Content Management: ensuring that documents are stored and easily accessible across the enterprise

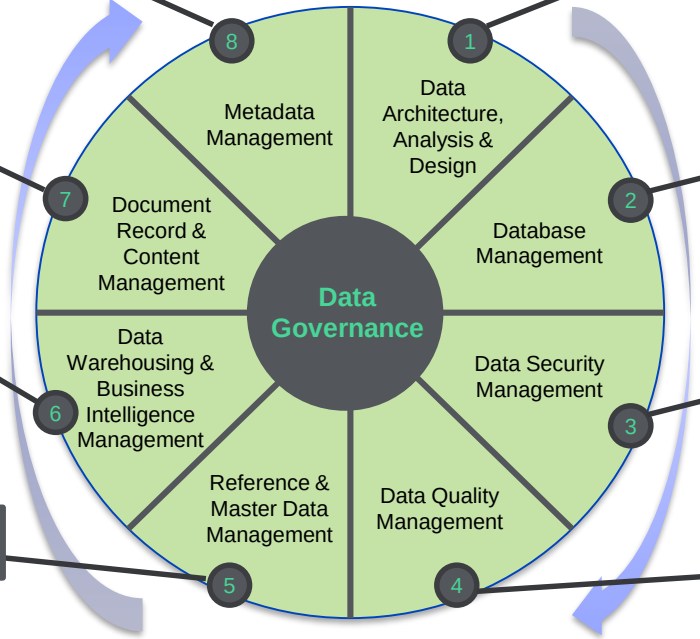
Database Management: management and maintenance of information stored in a computer system

Data Warehousing & Business Intelligence Management: ensuring transactional data is summarized and aggregated into useful business value

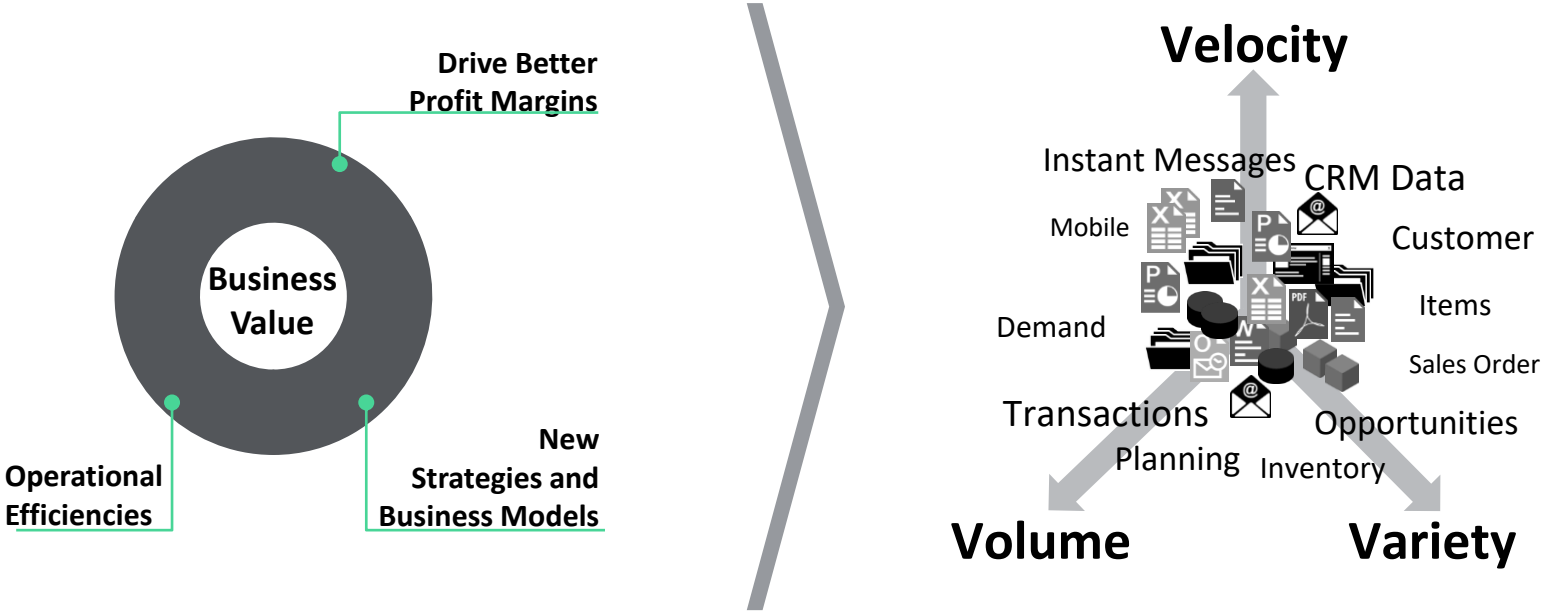
Data Security Management: ensuring that the right constituents have access do data when needed

Reference & Master Data Management: managing common and consistent non-transactional data across the enterprise

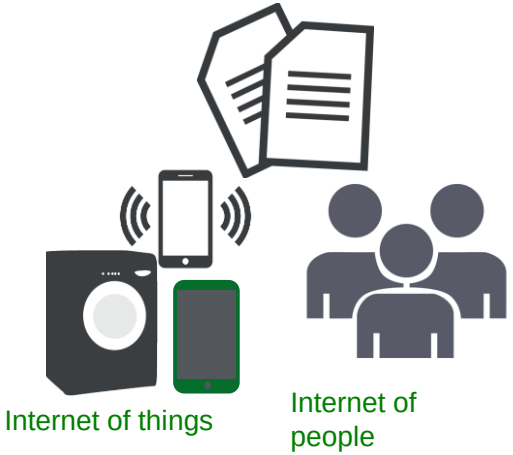
Data Quality Management: defining, monitoring and improving data quality via defined metrics and measurements



Big data matters: Transformational business value from data



Data Contributors & Consumers

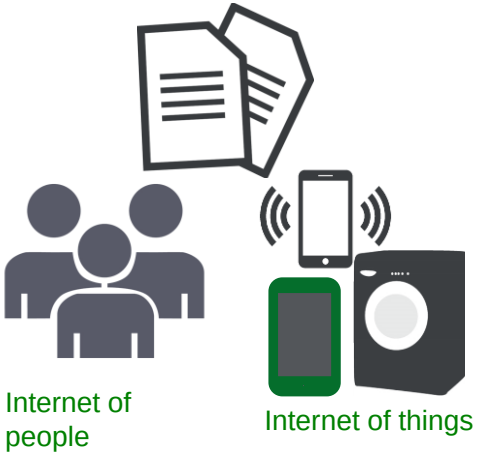


10+ Billion

Terabytes

44 Billion

Terabytes



2017

8.4 Billion

Connected Things

2020

20.4 Billion

Connected Things

*Numbers courtesy of Gartner

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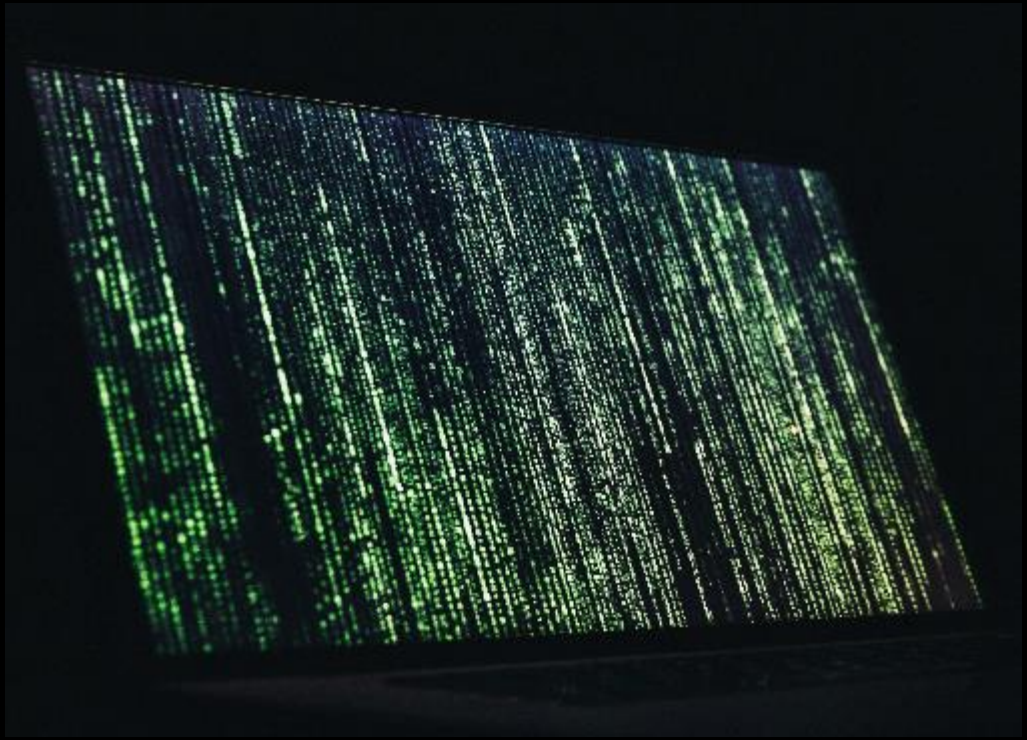
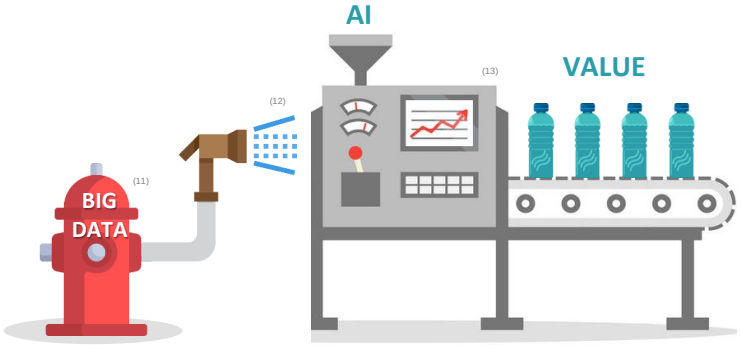
There’s value in all this data for your customers and business



Power of AI & Big Data – How to Control the Firehose?

*Applying **AI** (ML, NLP, Robotics, Reasoning, Statistics, Analytics, Business Intelligence) to Big Data drives business value*



***AI & Big Data** can…*

- *Process and analyze enormous amounts of data quickly*
- *Make data driven decisions using a broader scope of data points*
- *Correlate unstructured and structured data to predict future events*
- *Provide a level of efficiency and productivity that was not previously possible*

(11, 12) Icon made by Freepik from www.flaticon.com
(13) Image from VectorStock.com/14138010
(14) https://csirtgadgets.com/commits/2018/1/12/the-firehose

Data & Analytics Strategy / Pillars

Drive to a “data-driven” culture:
Believing and behaving as if **information is an asset** instead of an afterthought

Business Empowerment

Platform Elasticity

Literacy & Competency

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Data & Analytics Strategy / Pillars

Drive to a “data-driven” culture:
Believing and behaving as if **information is an asset** instead of an afterthought

Business Empowerment

Enable Business Units to wield Data & Analytics as:

- Weapon: Optimized Customer Experience, Product Portfolio, Network Capacity & Performance A Competitive Advantage
- An Operational Accelerant: AI/ML-driven Digital Transformation and end-to-end process improvement within and across business units
- An Innovation Catalyst: Leverage Data Science to reveal undiscovered models and challenge or enhance established models

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Data & Analytics Strategy / Pillars

Drive to a “data-driven” culture:
Believing and behaving as if **information is an asset** instead of an afterthought

Platform Elasticity

- Leverage Cloud to Remove Technology as a Barrier:
  - Independently Scalable Compute and Storage Capacity
  - Agility to Adapt to Continual Technology Evolution
  - Incremental Cost Model
- Provide Data Virtualization / Fabric to obscure Data Fragmentation
- Enable Self-Service Capabilities (BDaaS – Big Data as-a-Service) to reduce IT dependencies

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Data & Analytics Strategy / Pillars

Drive to a “data-driven” culture:
Believing and behaving as if **information is an asset** instead of an afterthought

Literacy & Competency

- Propagate data knowledge, analytics capabilities and a common information language
- Establish roadmaps and (qualitative) measurement to illustrate data-to-business value:
  - Data success stories
  - Gaps / Opportunities to improve data & analytics capabilities
- Resolve inconsistencies across data domains and organizations to improve trust in analytics

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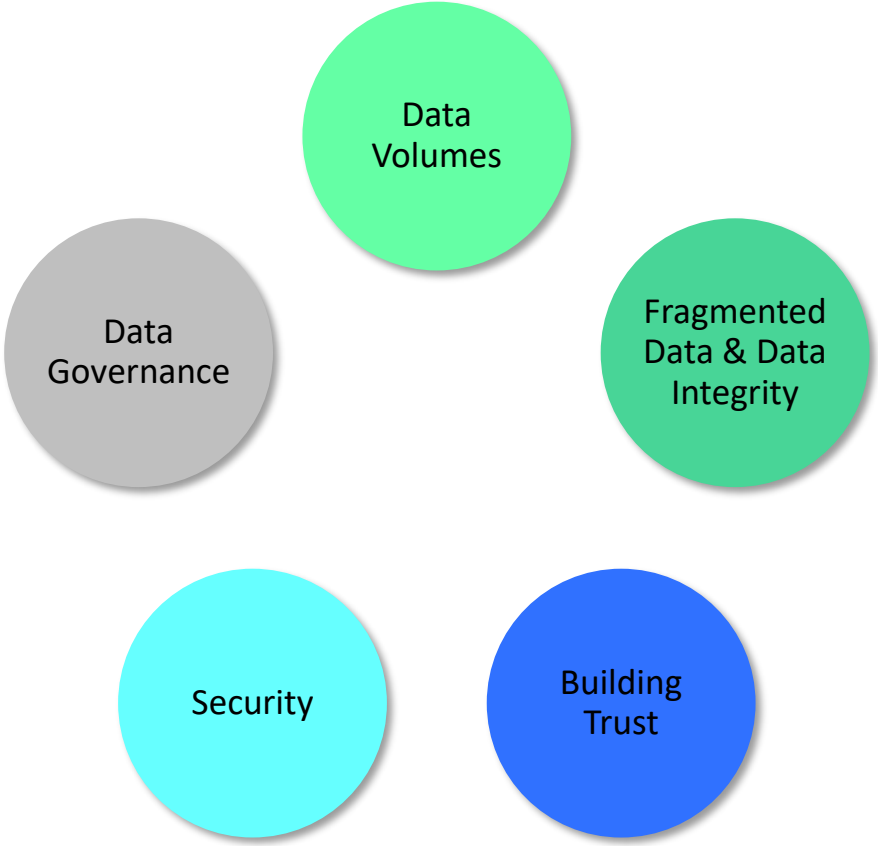
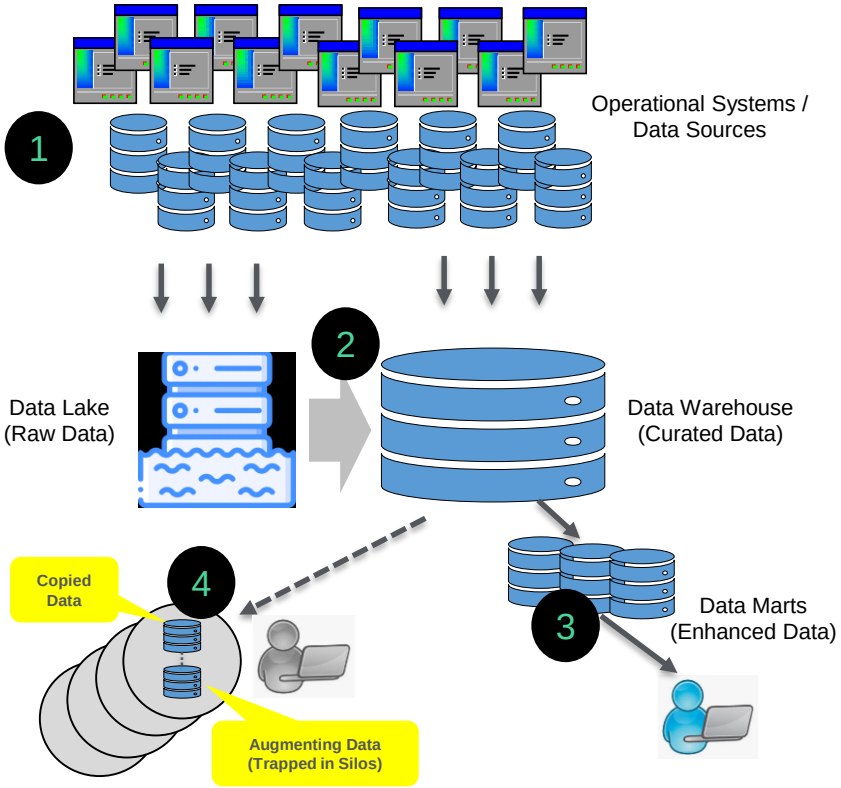
Overcoming Data Hurdles



Changing the Data Paradigm

1. Potential multiple sources for similar data
2. Deduplication/cleansing in Data Lake/Warehouses
3. Enhanced views with aggregated data (e.g. 360)
4. Data copied & sometimes enriched in silos



As we make business decisions, what data is the right data?

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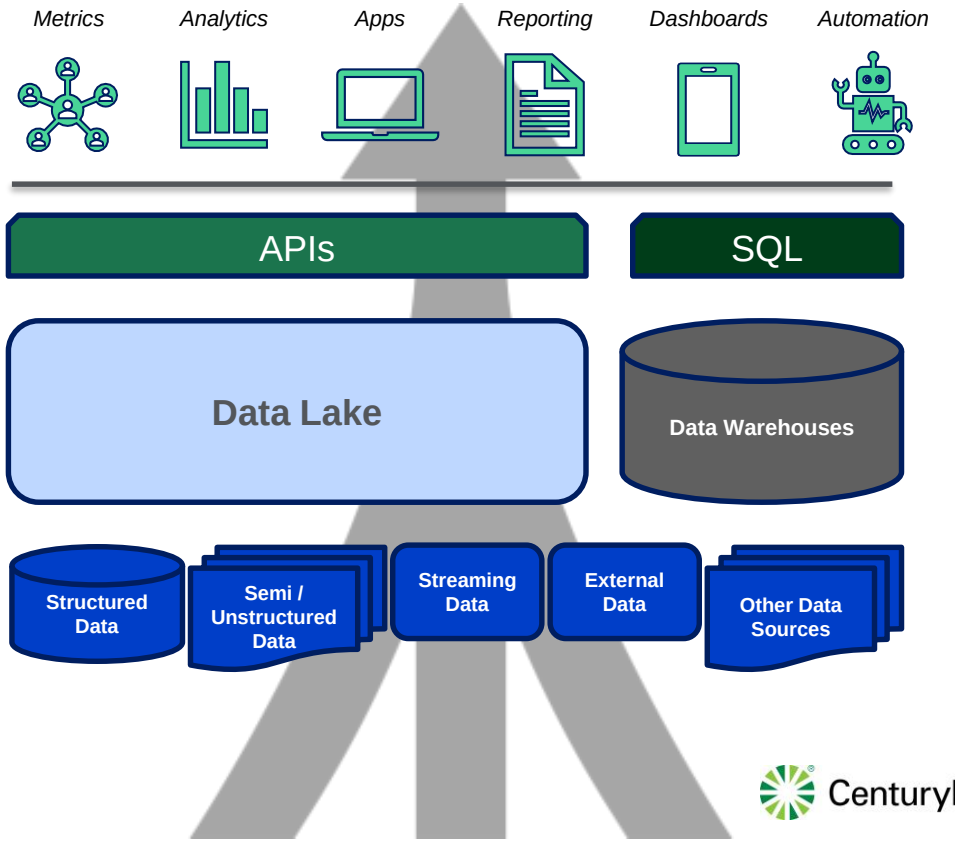
Big Data Platform

Typical Challenges:

- Consolidation of Data Sources
- Reduce Data Siloes
- Centralized Data Repository
- Enterprise Advanced Analytics and Reporting

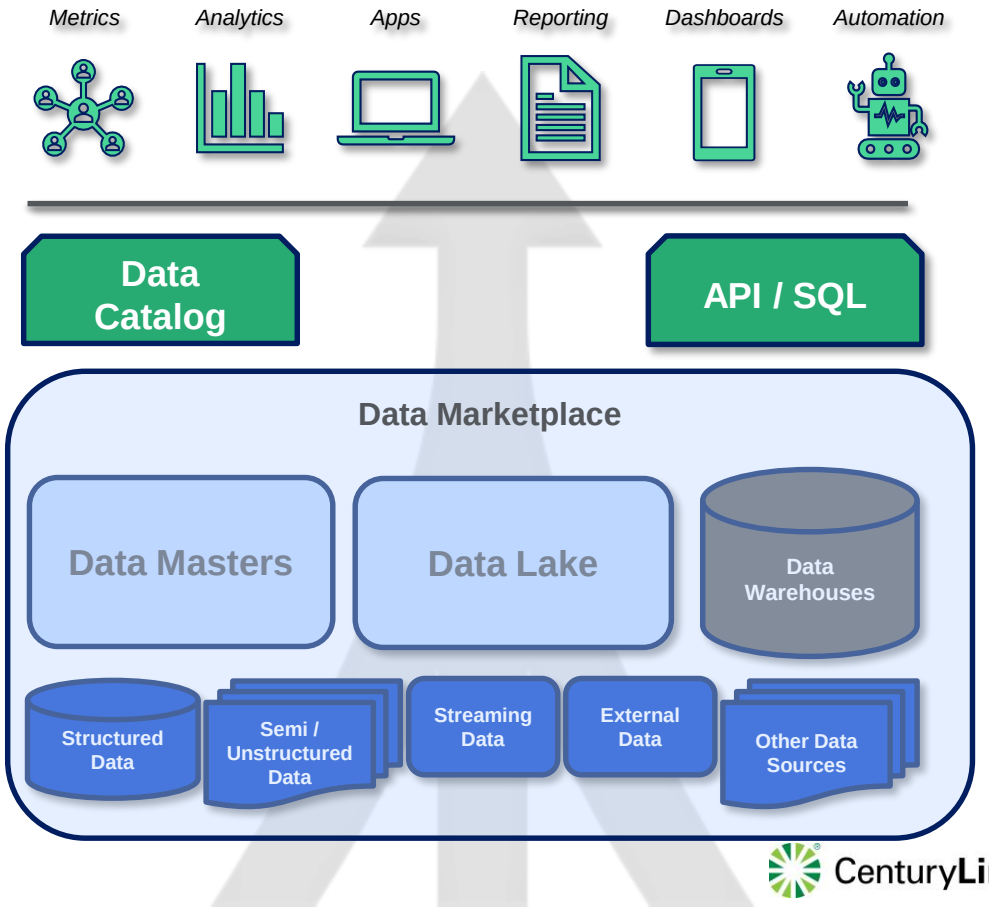
Typical Current Architecture



Data Marketplace Capabilities

- Aggregate raw data from diverse sources (i.e. Data Lake)
- Establish, maintain, and secure high performance “single source of truth” (data masters)
- Enhance and support governed and curated data aggregation sources (i.e. Data Warehouse)
- Provide rich, flexible composite data services to master data and aggregated data (i.e. 360° views)
- Enable role-based self-service access to curated data for emerging needs (Data Scientists)
- Publish catalog to find institutional and Citizen Scientist data assets for easy consumption (Data Democratization)
- In compliance with legal/regulatory/security

An Alternative: Data Marketplace



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Data Governance

A discipline to create repeatable and scalable data management policies, processes and standards for the effective use of data.

It is all about getting the right data to the right person at the right time with the right access.

Benefits of Data Governance

Data governance crystallizes enterprise data usability, availability and trust-worthiness

Prepare	Publish	Protect
Right Data	Right Time / Right Person	Right Access
Integrate, Transform, Cleanse & Move all types of data no matter where it resides on-premises or on the cloud	**Empower Self-Service** with easy methods to catalog, find and understand data with a 360° view of all the data	**Preserve Privacy and Protect** data with proactive measures to comply with regulations and preserve sensitive information

Enhanced with	**Analytics, AI/ML**
Workload portability across	**On-Premise and Cloud**
Governs all data	**Structured and Unstructured**

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Data Governance: Five Areas Of Focus

WHY	Data governance enables the secure delivery of trusted data to business users who need it
WHAT	Governed data includes all data deemed critical by the organization
HOW	Data governance council drives definition of processes that establish and execute data quality management
WHO	Data stewards and owners within each part of the business enhance and manage the data within the organization
WHERE	Data governance becomes part of the company fabric and is embedded throughout the company

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Data Governance Is the responsibility of the entire org

Information Governance is a cross-functional discipline allowing organizations to be comprehensive, consistent, and coherent in the way they define, discuss, analyze and leverage their data

Architecture
How well does the organization design, develop, deploy, and manage data architecture?

Business Rules Management
How well does the organization define, deploy and manage business rules across enterprise?

Change Management
Are capabilities in place to adopt required change and drive business value realization?

Data Quality
Is the organization able to consistently define, and measure data quality, and mitigate issues?

Metadata
How well does the organization capture, manage, and access business, technology, and operationalize corporate data?

Organization & Stewardship
Are there roles to support, manage, and improve DG process and capabilities?

Policy
How well does the organization define and manage organization behavior using policy?

Privacy & Security
Are appropriate considerations in place for protections of customer privacy and data security?

Regulation & Compliance
Is the organization prioritizing activities to address requirements for regulatory and compliance?

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Source: IBM

Security – Data Protection

GDPR/CCPA

- Discover/classify data
- Prioritize data on risk
- Protect data in operations & test

Data Privacy

- Identify PII, PHI and PCI
- Prioritize data protection
- Demonstrate compliance readiness

Dev Approach

- Locate sensitive data in production DBs
- Mask test sets for developers
- Validate protection of data

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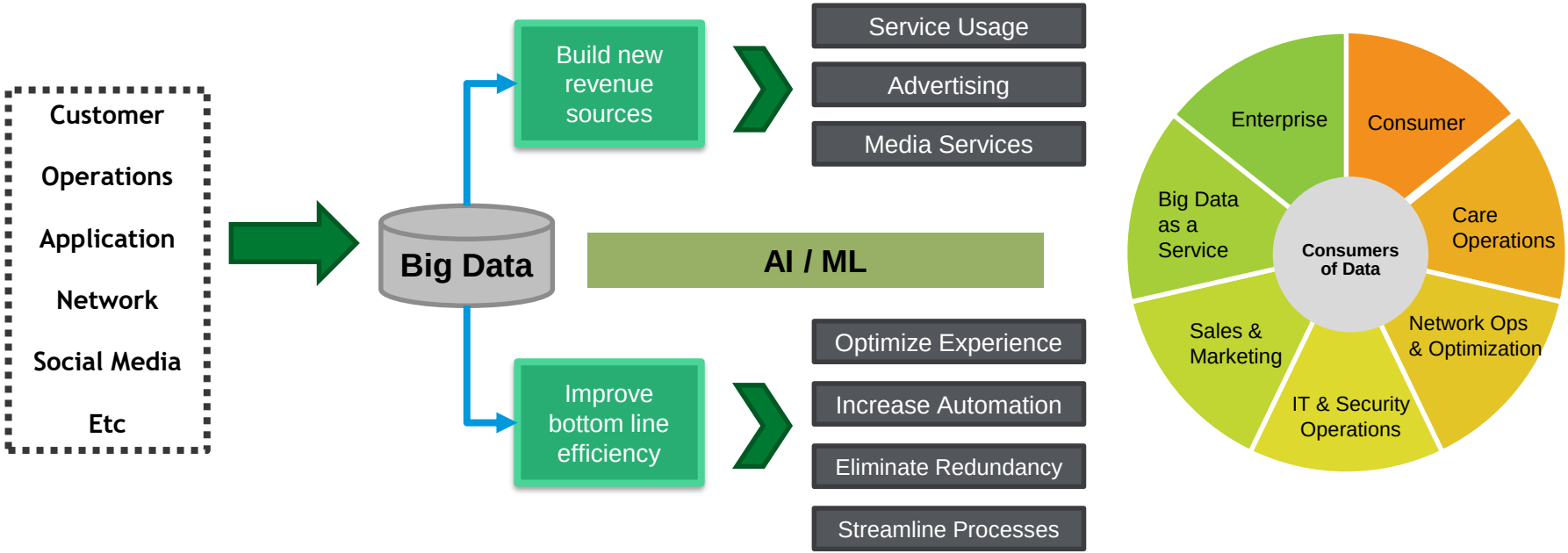
Data Value Chain



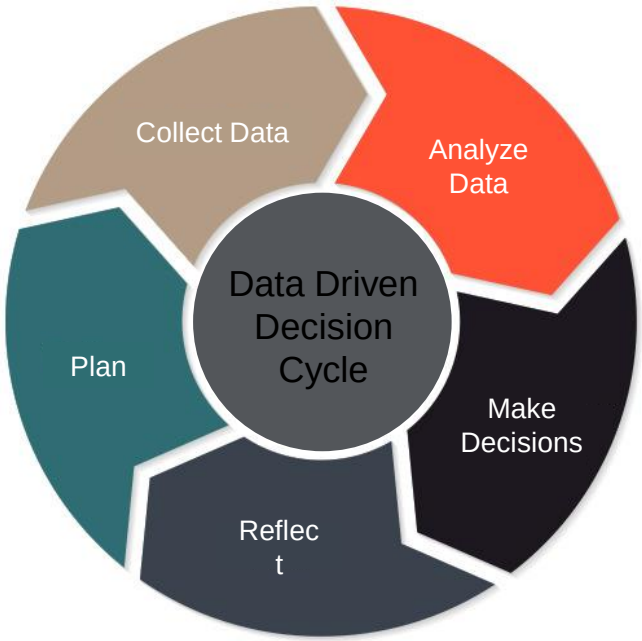
Reference- Big Telecom Conference Chicago 2015

Data Driven Focus

Data Driven companies in a Digital world.

Data Driven model allows us to

- ✓ Make better decisions
- ✓ Measure results more effectively
- ✓ Customer Tailored Services and Products
- ✓ Better understand customers needs
- ✓ Improve & Automate processes



"Data is the oil of the 21st century, and analytics is the combustion engine"
~ Peter Sondergaard, Gartner Research

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AI / ML Process and Case Studies

CAPstone (CenturyLink Analytical Process) Methodology

Analytics-Focused Agile Approach

1 Problem Definition

- Stakeholder identification
- Identify current process
- Initial hypotheses
- Workshop on problem definition and ideation
- Ideation visualization tools
- Identify success criteria

2 Data Preparation

Data exploration:

- Identify data sources
- Descriptive statistics

Data selection:

- Data visualization to help identify variables
- Agree on Independent and Dependent variables

Data preparation:

- Data transformations, documentation
- Data flow

3 Model Development

Build

- Investigate available model approaches and techniques
- Select approach & development tools
- Document assumptions
- Assess data bias, sampling techniques, validation approaches
- Define model performance metrics

Validate

- Identify and assess expert judgments
- Compare to benchmark models
- Univariate testing
- Outlier assessment
- Verify data lineage
- Validate to regulatory standards

Implement

- Assess implementation criteria for speed, latency, cost, scalability, maintainability
- Select platform
- Deploy model on production platform
- User Acceptance Testing (UAT)
- Documentation
- End user training
- Visualizations for users (reports/ dashboards)

Review

- Testing relative to benchmarks models or alternative approaches
- Residual assessment and modeling
- Visualization tools used for on-going performance monitoring
- Trend and back testing reports
- Stress testing

4 Maintain & Improve

- Help desk support
- Assign responsibilities for review and test
- Performance evaluation schedule
- Model re-calibration

Well-defined Tollgates at each Step

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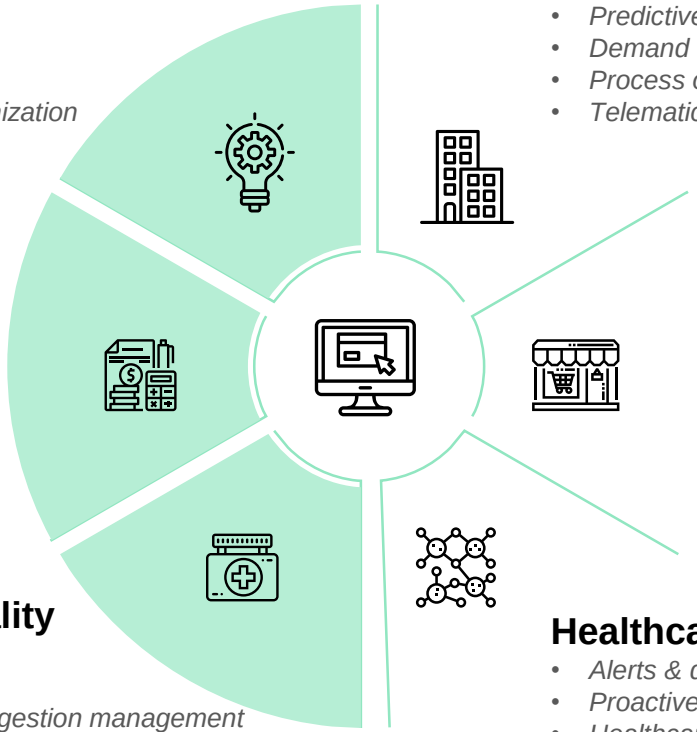
AI / ML Use Cases

Energy, Feedstock & Utilities

- *Power usage analytics*
- *Seismic data processing*
- *Smart grid management*
- *Energy demand & supply optimization*

Manufacturing

- *Predictive maintenance or condition monitoring*
- *Demand forecasting*
- *Process optimization*
- *Telematics*



Financial Services

- *Risk analytics & regulation*
- *Customer segmentation*
- *Credit worthiness evaluation*

Retail

- *Predictive inventory planning*
- *Recommendation engines*
- *Customer RoI & lifetime value*

Travel & Hospitality

- *Aircraft scheduling*
- *Dynamic pricing*
- *Traffic patterns & congestion management*

Healthcare & Life Sciences

- *Alerts & diagnostics from real-time patient data*
- *Proactive health management*
- *Healthcare provider sentiment analysis*

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AI / ML / BPM Based Workflow Engine for Care & Dispatch Automation

Deliver Best customer experience

Guided workflow engine allows the best care agent / technician experience for the customer.

Address training issues

Address training issues due to attrition and retirements

Enforce Process Compliance Guidelines

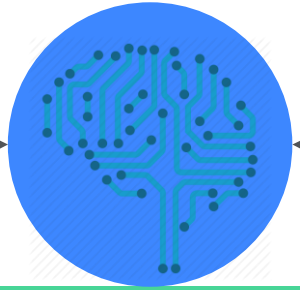
Enforce process compliance for efficient operations

Compliance Exception Reporting

Automated reporting to operations management

AI/ML SW Assistant Guide

AI / ML based SW assistant to guide the care and dispatch workforce



Artificial Intelligence

Machine Learning

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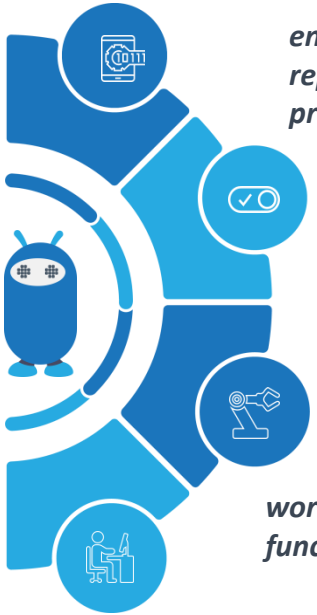
How is CenturyLink Utilizing Robotic Automation?

*CenturyLink leverages **RPA** coupled with **AI** to drive intelligent automation*

Business Benefits

- OPEX/Cost Optimization
- Improved Accuracy (Right First Time)
- Improved Productivity (24 / 7 Operations)



enable the automation of repetitive rule-based processes

mimic interactions of users with multiple systems

work across functions

- Automated data entry
- Multi-system integration
- Optical Character Recognition
- Chatbot w/ RPA
- Natural Language Processing w/ RPA
- Processing business rules

Service Delivery → Service Assurance → Network Management → Billing → HR & Legal → Sales & Marketing

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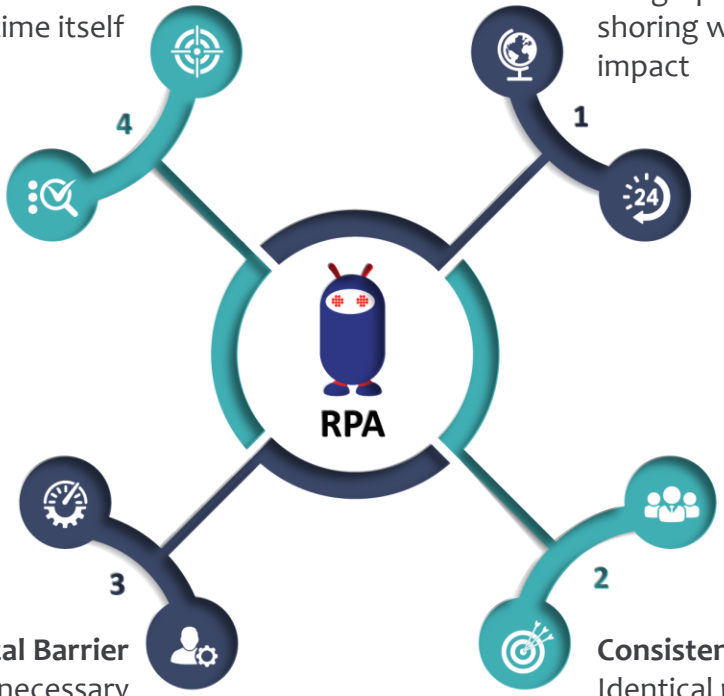
Advantages of Robotic Process Automation



Right Shoring
Geographical independence allow right shoring without negative business impact

Reliability
24/7, all year round, full availability

Staff Retention
Allow focus shift towards more stimulating tasks

Consistency
Identical process and tasks reducing the output variation

Low Technical Barrier
No Programming skills necessary to configure a Bot

Productivity
Process cycle times are faster compared to manual approach

Audit Trail
Fully maintained logs essential for compliance

Accuracy
The right result, decision or calculation in the first time itself

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Case Study: Predicting Router Failures

Customer Reports the Incident

Machine Learning/Artificial Intelligence

Before - Reactive

- **Router Fails**
  - Customers report individual tickets
  - Incident ticket opened for outage
  - Customer tickets researched and associated to parent incident ticket
  - Quantity of impacted customers notated on incident ticket for reporting
  - Tech resets and/or replaces the card once a spare is located

After - Proactive

- **Predict Router Failure 8 hours In Advance**
  - Locate a replacement card
  - Card and tech dispatched to site in advance
- **Create parent incident ticket in anticipation of failure**
  - Impacted customers identified in advance
  - Customer tickets associated to parent incident ticket more quickly
- **Predicted failures displayed on dashboard**

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Case Study: Predictive Copper Impairment Classifier

Unnecessary or Multiple Truck Rolls

Machine Learning/Artificial Intelligence

Before - Reactive

- **Customer calls to report the HSI issue**
  - Repair Agent does some high level troubleshooting
  - If high level troubleshooting does not fix the problem, the repair agent creates a ticket and dispatches a technician
  - Repair tech then troubleshoots on site to diagnose the problem. Possible outcomes:
    - Problem resolution
    - Network issue not associated with the site
    - Insufficient skills to fix the problem necessitating additional truck roll
    - Etc.

After - Proactive

- **Use ML to diagnose the most likely cause through a Copper Impairment Classifier**
- **Better understanding of root cause:**
  - Dispatch technician with the correct skills to fix the problem
  - If it is a network issue use the correct protocol to fix the issue without a truck roll
- **Provided additional information about the issue to the technician on a mobile device to streamline troubleshooting**

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Intelligent Trouble Ticket Routing

Before AI/ML

Machine Learning/Artificial Intelligence

Before (Reactive)	AI/ML Solution (Proactive / Predictive)
• Trouble ticket is submitted	• RPA Bot captures incoming ticket
• Ticket is reviewed manually and determination is made on issue resolution group	• RPA Bot polls ML engine for ticket routing recommendation
• Ticket is forward to the queue of the identified group	• ML engine determines ticket priority and resolution team based on ticket information and other signatures
• Team member prioritizes ticket and works ticket accordingly	• Sends resolution team and routing recommendation to RPA Bot
	• RPA Bot routes ticket to appropriate group

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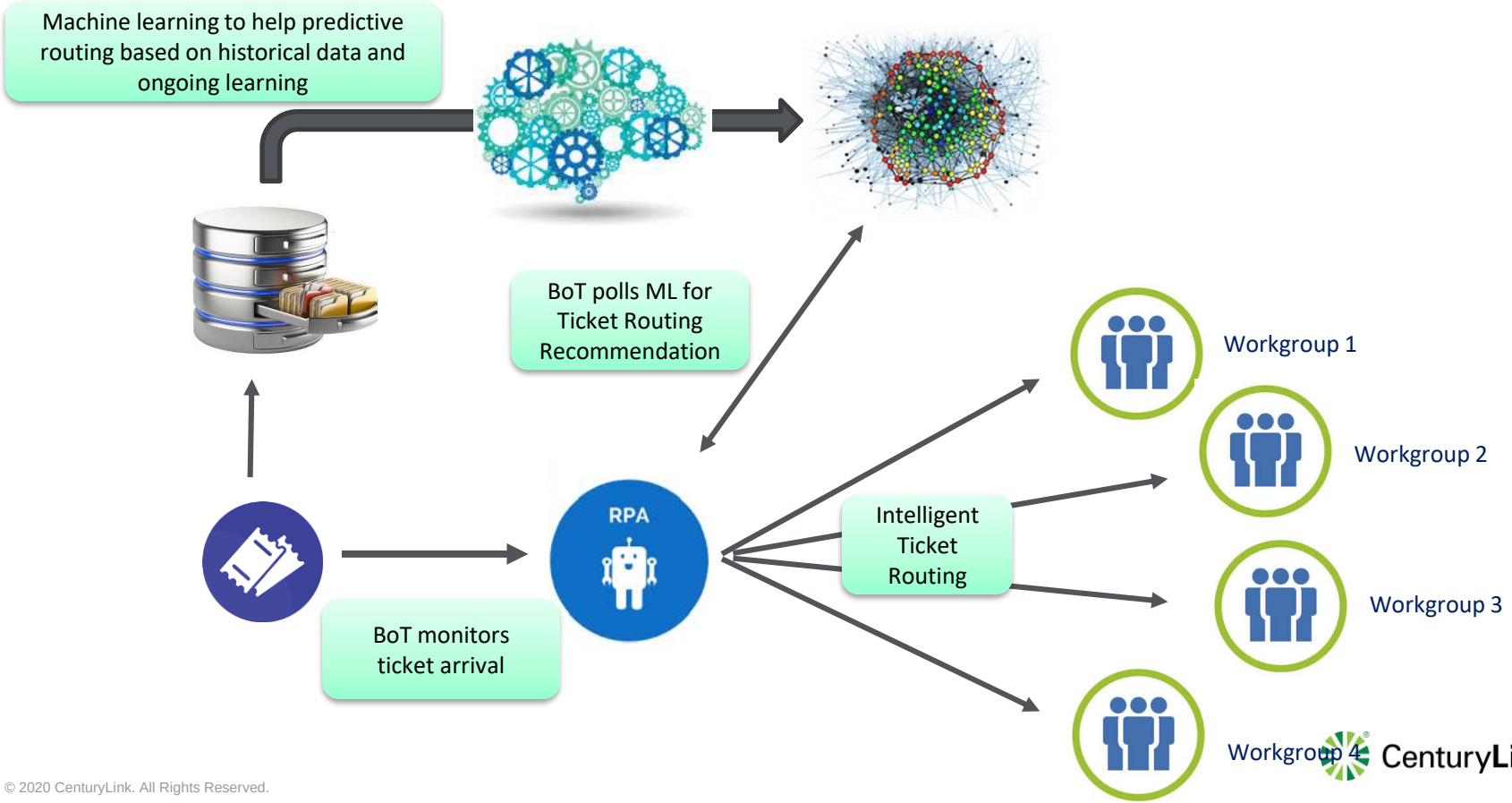
Intelligent Ticket Routing



Jeopardy Management Dashboard (Rx Heatmap w/ Weather Data)

Before AI/ML

Machine Learning/Artificial Intelligence

Before (Reactive)	AI/ML Solution (Proactive / Predictive)
• High call volumes due to fiber cut, DSLAM outage, extreme weather • Agent receives customer call regarding impact to service and troubleshoots the problem	• Agent is able to proactively program IVR • Agent has a geospatial tool which shows high call volumes (IVR or Agent) • The tool has capability to associate the problem to a CO or DSLAM or CBRAS • The geospatial tool also shows weather data to facilitate troubleshooting • Reduced truck roll and agent calls • Proactive notification to customers

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Threat Research at CenturyLink

- Create a holistic knowledge of threats to predict future risk by:
  - Creating and maintaining the broadest view of Internet-wide threats possible
  - Using our unique data to develop stronger visibility to specific threats

This allows us to:

Develop the Adaptive Threat Intelligence product for customers to have visibility to threats against their organization and industry

Integrate our unique visibility in to all products possible, with a focus on Adaptive Network Security, SLM and DDoS mitigation

Lean in to cleaning up the Internet and resolving the root of many ongoing problems and risks for the global Internet

Thoughts and Lessons Learned

- Fail Fast and Execute
- Bring Business Units, Operations, Network Engineers, Software Developers, and Data Scientists Together to tackle AI/ML business problems
- Have a clear plan to change process based on Insights. Change Management is the key to success
- Rules/Decision making at scale – needs to be simple
- Need data integrity cleanup teams (network, inventory, etc.)
- More focus, larger teams, shorter projects
- Deploy continuously – not quarterly, not monthly
- Need enterprise architecture tuned to both AI/ML learning and deployment

Thank You

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