AI & ML – Why, What, How & Beyond

August 2018

What is this talk about? (and what it is not!)

What is this talk about:

- Broad Framework to think about AI & its techniques
- Highlight relationship between AI, ML & Deep Learning
- Articulate the impact of AI & ML in Business Decision Making

What this talk is not:

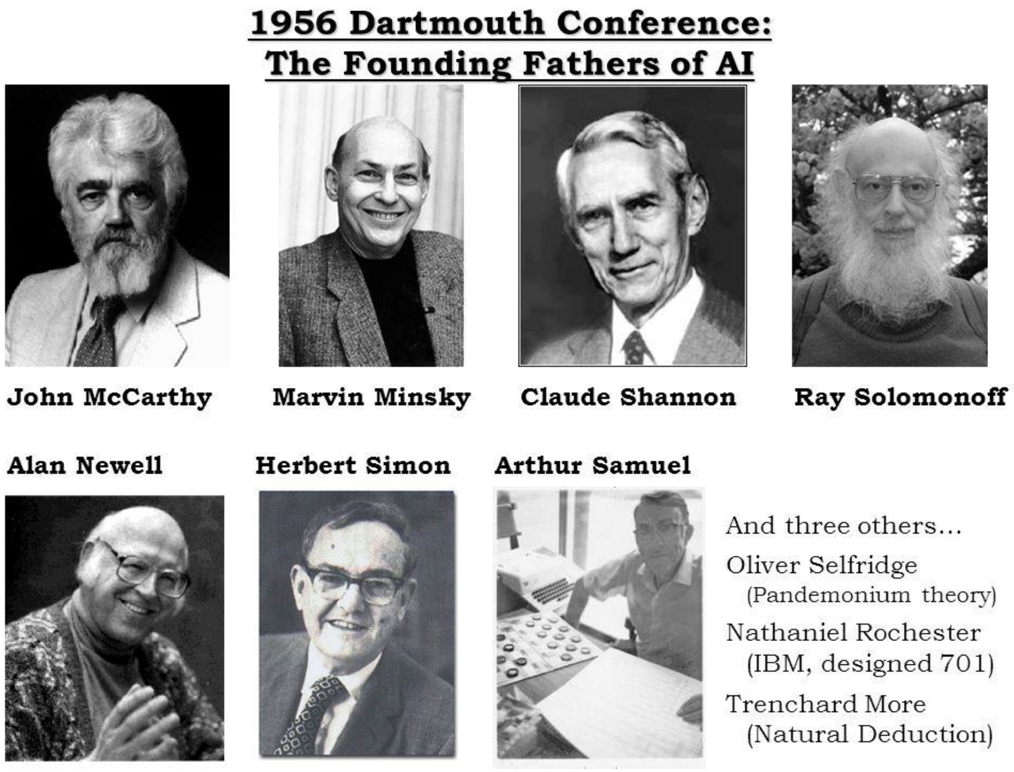
- Does not deal with cost-benefit analysis of AI & ML
- Does not cover moral, ethical dimensions of AI & ML
- Does not cover any math behind the techniques

How delivered: I am going to put myself in your shoes, ask & answer key questions that you might have in your mind as you embark on this course!

Q1: Artificial Intelligence brings images of Terminator, Robots, Enthiran etc. What is the simplest way to understand AI?

What is Artificial Intelligence?

Artificial Intelligence refers to the theory and development of computer systems & machines with the ability to perform tasks normally requiring <u>human intelligence</u>



What constitutes Human Intelligence?

1. <u>Perceive</u> the world, detect signals and collect data

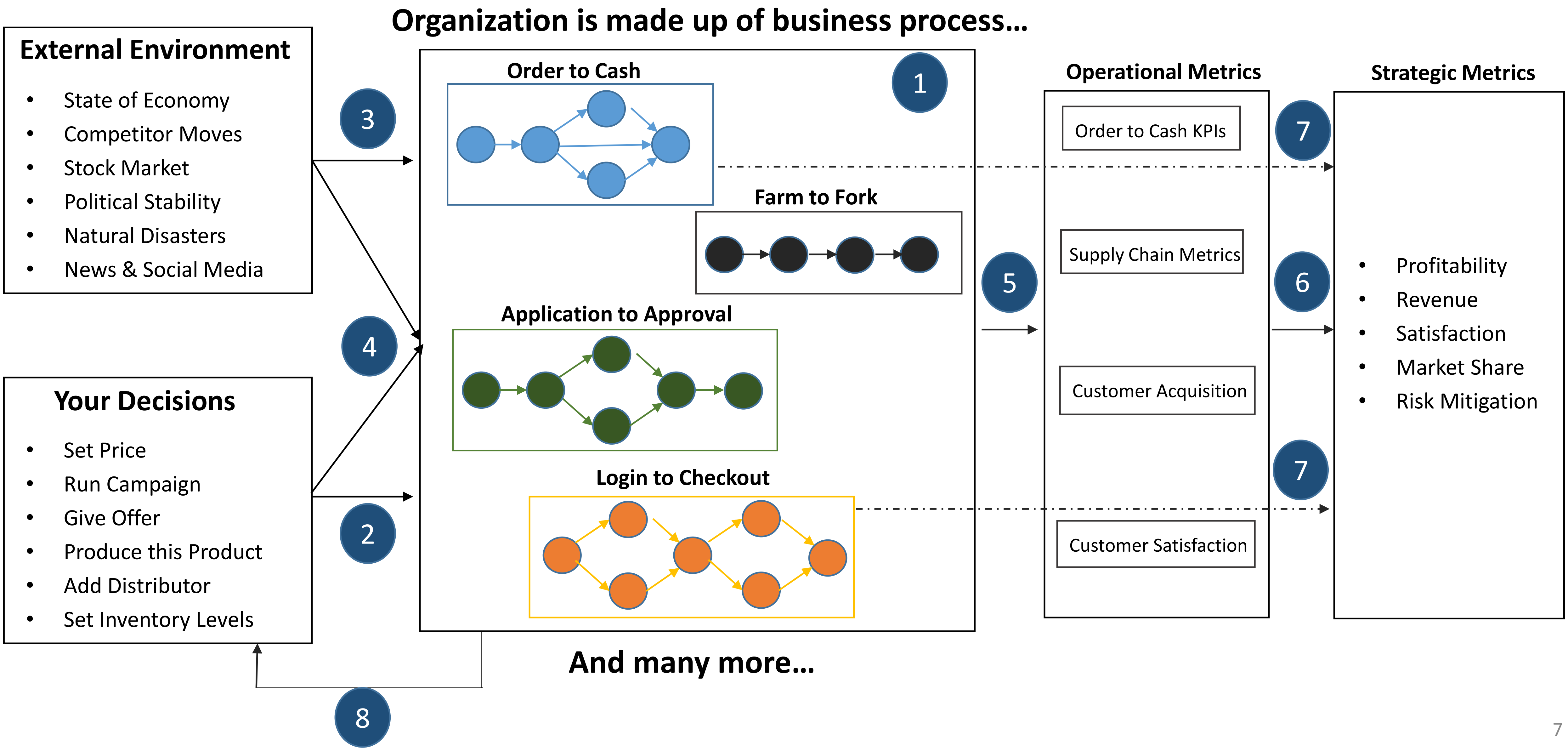
2. Make sense of the world using data (Insights, <u>Inference</u>, Predictions etc.)

3. <u>Decide</u> on the next course of action

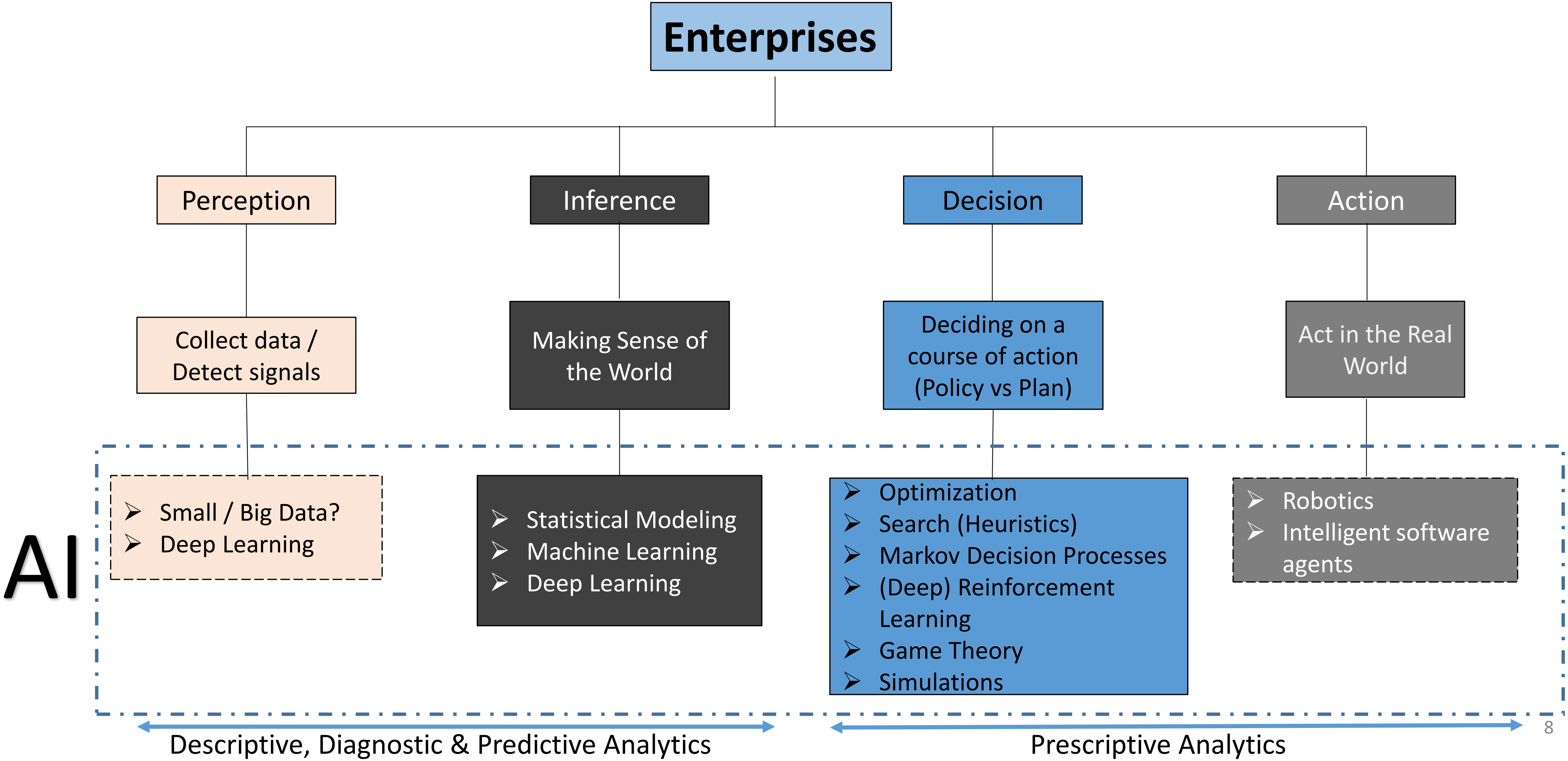
4. <u>Act</u> in the Real World

Q2: Ok. I kinda understand what constitutes Human Intelligence. How is it relevant for enterprises?

Business Decision Making is complex but worth it...

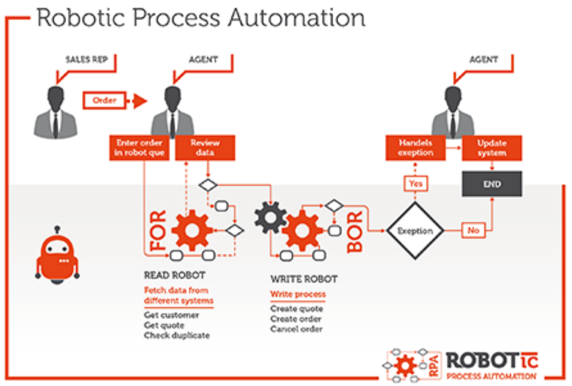


AI Techniques in Enterprises – Parallels to Human Intelligence



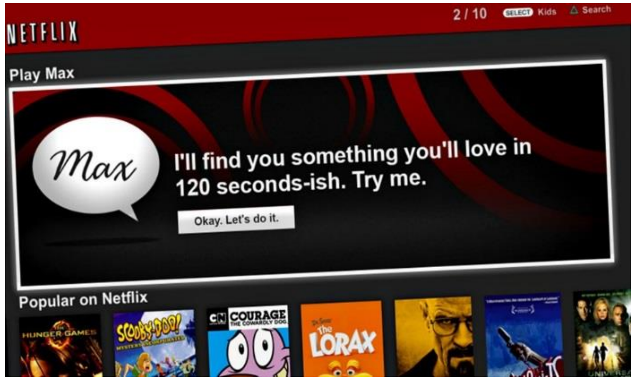
3 Categories of AI in Enterprises

Assisted Intelligence



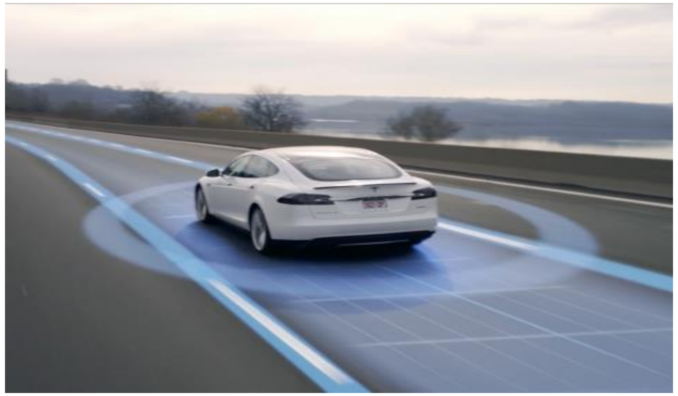
- Assisted intelligence amplifies the value of existing activity
- Assisted intelligence tends to involve clearly defined, rules-based, repeatable tasks. Ex: Robotic Process Automation (RPA)

Augmented Intelligence



- Augmented Intelligence fundamentally alters the nature of the task, and business models change accordingly.
- They involve advanced forms of machine learning and NLP, plus specialized interfaces tailored to your company and industry. Ex. Netflix using ML to build a recommendation engine.

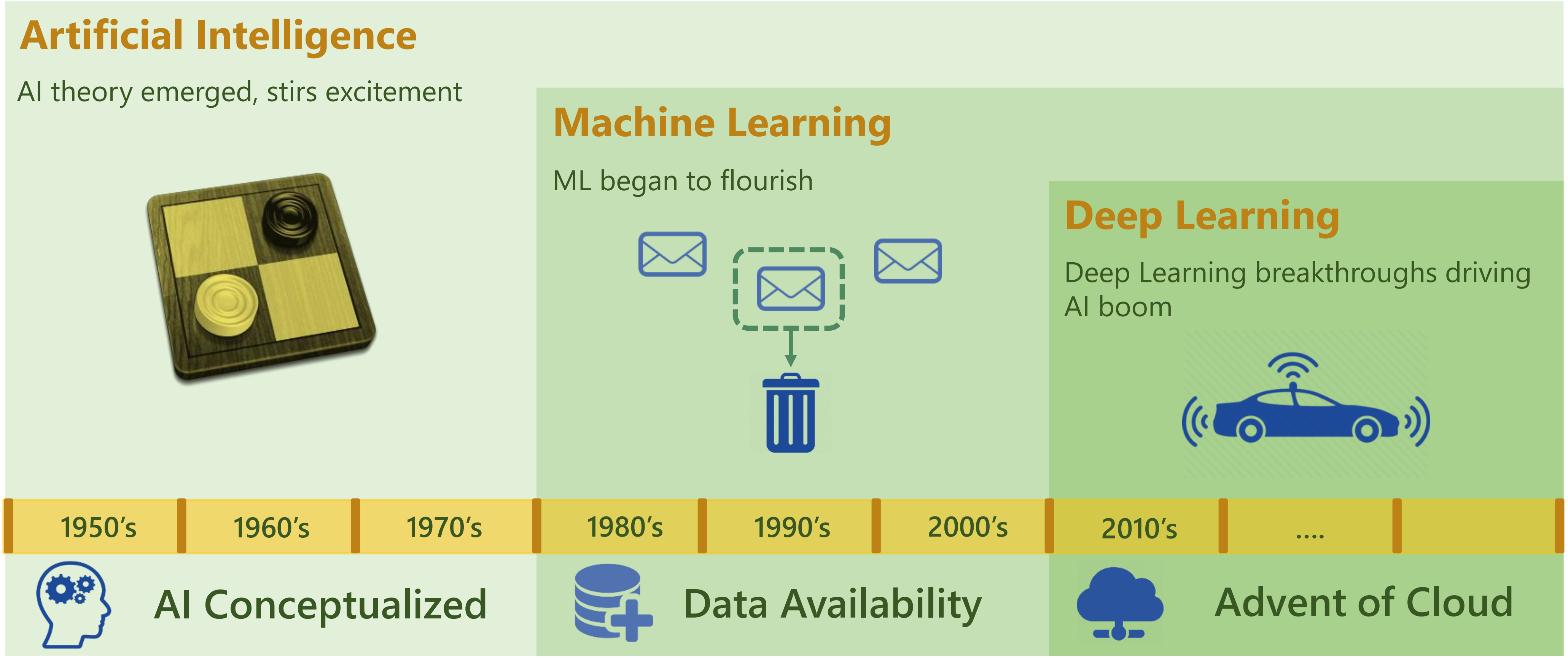
Autonomous Intelligence



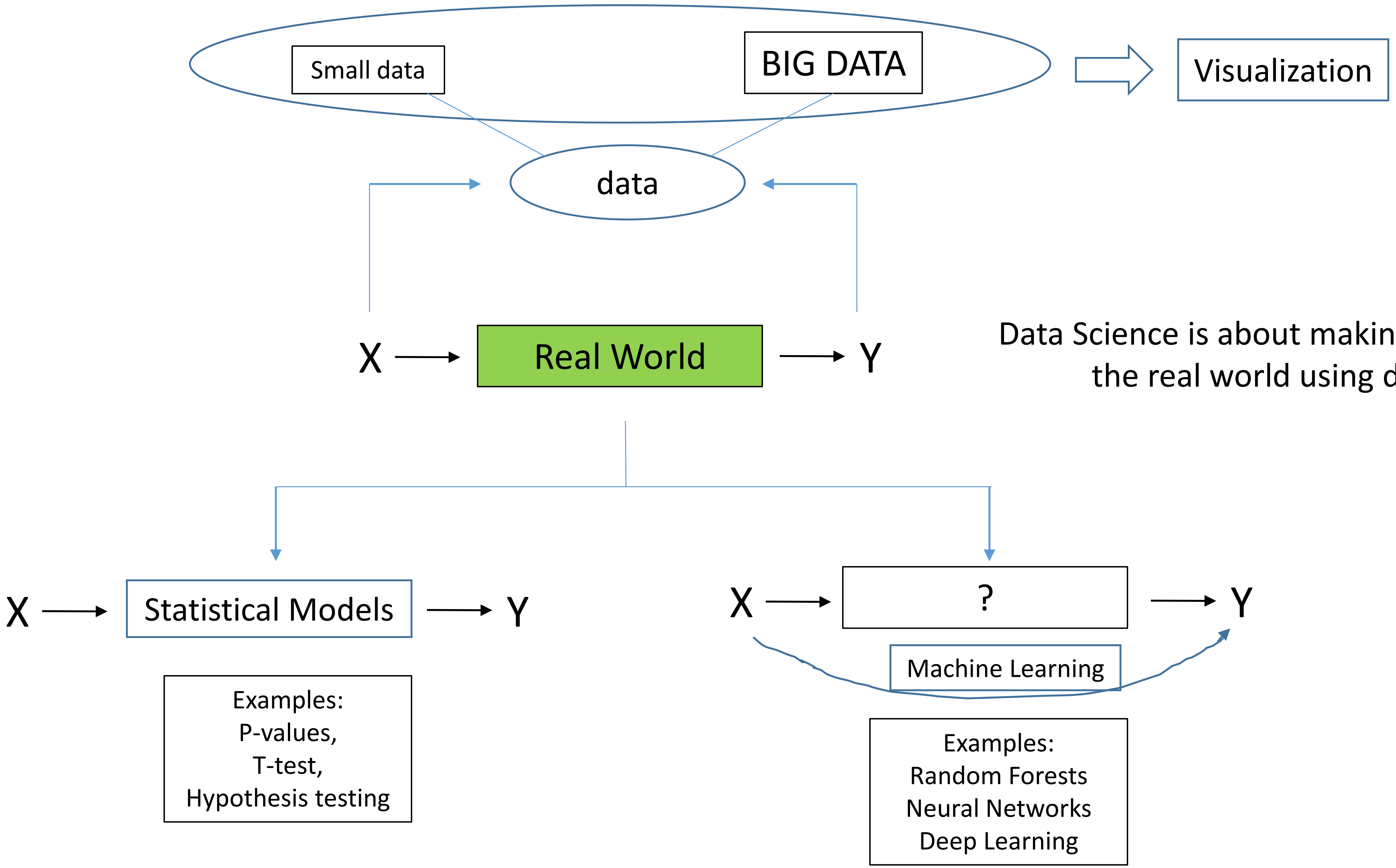
- Systems that make decisions without direct human involvement or oversight
- They will do so only after the human decision maker starts trusting the machine or becomes a liability for fast transactions. Ex. Autonomous cars, robots that dispose of bombs

Q3: What is the relationship between AI, ML & DL?

AI in relation to ML & Deep Learning



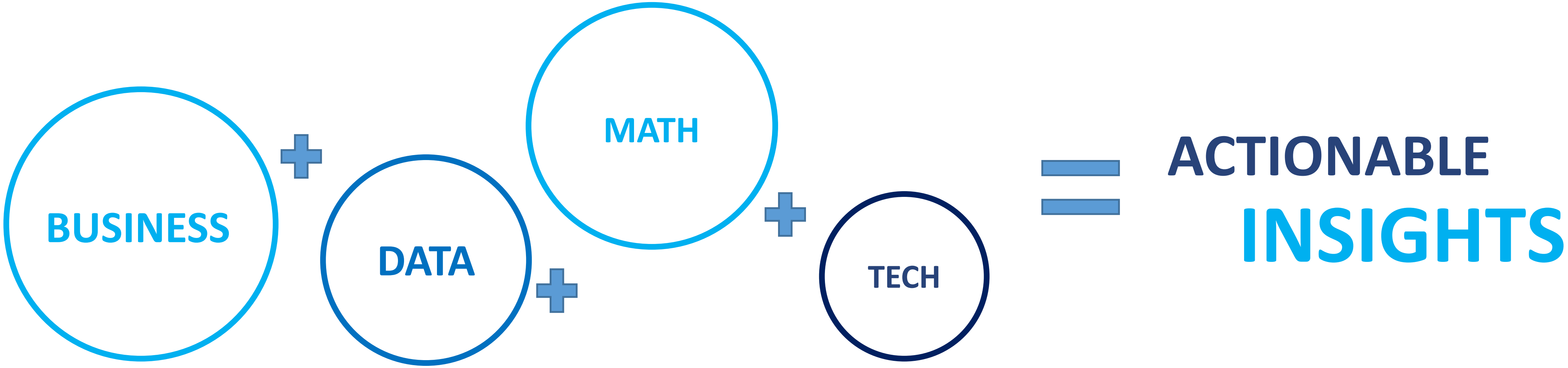
ML & DL - Making Sense of the World (using Data)



Data Science is about making sense of the real world using data

Q4: Enough of gyan on frameworks / high-level details. Practically, what skills do I need to acquire to solve problems? And can you show real-world examples?

What skills are required to deliver 'Actionable Insights'?



Case Study 1:
Famous Automobile Manufacturer

Starting Point: *3 Years of vehicle sensor data collected across 108 countries along with data on warranty claims*

Case Study 1: Customer Behavior Modeling

Salient Points from Analytics perspective:

- **Business:** Warranty costs were high & rising. Urgent need to control costs & increase customer satisfaction
- **Data:** Sensor (semi-structured) data collected from cars running in 100+ countries
- **Math:** Clustering done on data to identify driving styles which is then correlated with warranty claims to predict defects
- **Technology:** Spark on the Cloud platform called Databricks, User Interface for self-service

Case 2:
Large Consumer Durables Company

Starting Point: *Purchase drivers were determined by post-facto analysis of POS data at stores and survey data resulting in delays of up to eight months to get consumer feedback on product features.*

Case Study 2: Social Data to Drive Innovation

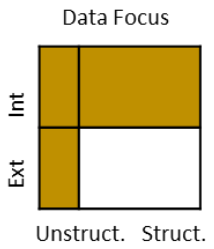
Industry Forums — Consumer Reports

+

Market Places

+

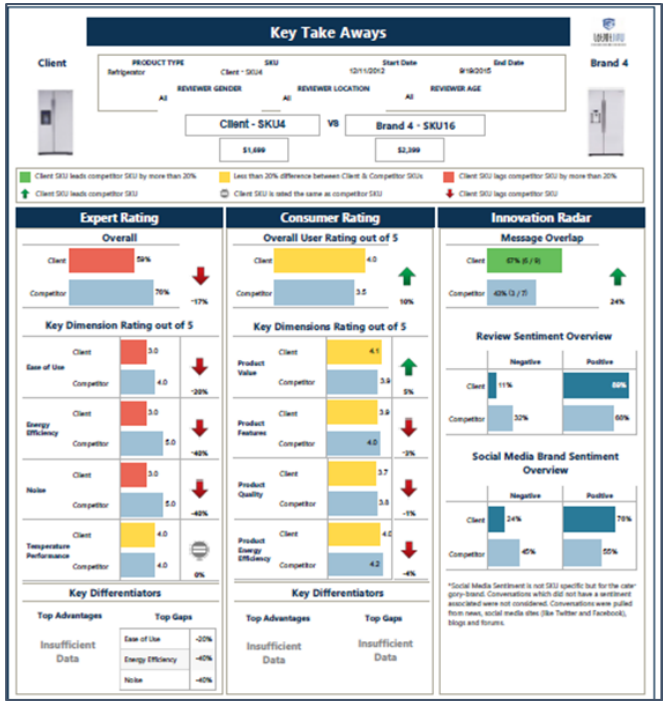
Brand Websites — LG, Whirlpool



Data Extraction & Data Landscape

- Sentiment Analysis
- Drivers of Purchase
- Triggers of Purchase
- Expert Opinion
- ★★★☆ Consumer Rating
- Popular Features

Text Analytics



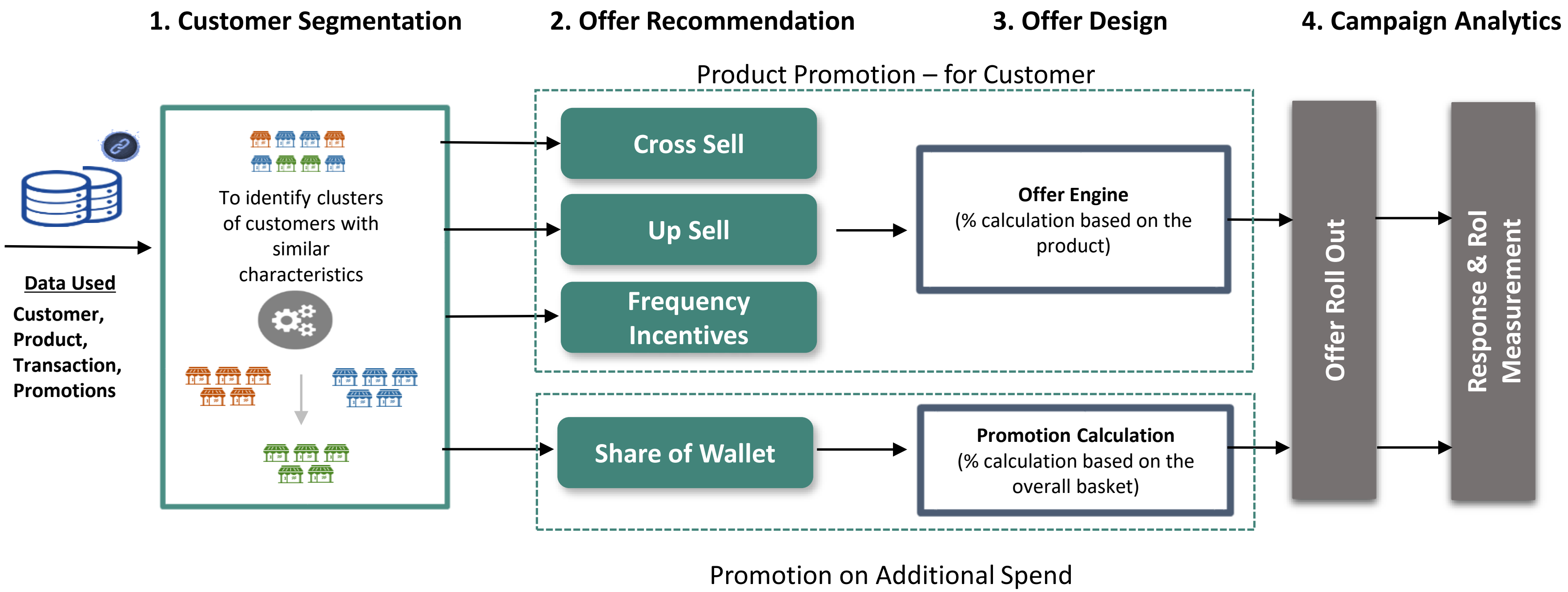
Salient Points from Analytics perspective:

- **Business:** Can we identify opportunities for Innovation using external data?
- **Data:** Reviews & Social Interactions captured across the globe. Unstructured data in the form of text
- **Math:** Sophisticated Natural Language Processing Techniques to extract insights from unstructured data
- **Technology:** Automated data pipeline to ingest & analyze data. Visualization using Tableau

Case 3:
World’s Largest Food Distribution Company

<u>Starting Point:</u> Customer & transactional data related to sales of food products to over 500,000 customer locations including restaurants, healthcare & educational facilities and other food service customers. They wanted to drive high margin product sales through effective cross-sell & up-sell

Case Study 3: Recommendation Engine to Increase Sales



Salient Points from Analytics perspective:

- **Business:** Can we identify opportunities for cross-sell / up-sell to sell more of high margin products?
- **Data:** Customer, Product, Transactions and Promotions
- **Math:** Clustering followed by Collaborative Filtering (Recommendation Engine)
- **Technology:** Automated pipeline that generates recommendations for every sales person

Q5: Business, Data, Math, Technology…hmm…that’s easy…so why should it take time & effort to acquire this knowledge?

Dimensions of Analytics

Business	Use Case Formulation	Interpret Analytics Output	Domain Expertise
Data	Acquisition & Wrangling	Data Visualization & Story Telling	Signals from data (subtract noise)
Math / Quant	Statistical Modeling vs ML	Select the right techniques & code	Evaluating the output of algos
Tech / Software	Understand the IT Ecosystem	Data Engineering / Pipelines	Software Engineering / SDLC

My Analytics Mindmap

Business Context

- **Global Trends in Society**
- **Macro-economy**
- **Business Fundamentals**
- **Specific Industry Domain**
- **Analytical use cases**

Analytical Platforms & Techniques

- **Data Management**
- **Reporting & Self-service**
- **Quantitative Techniques**
- **Performance Mgmt**
- **Insight Delivery**

Analytics for Business Value

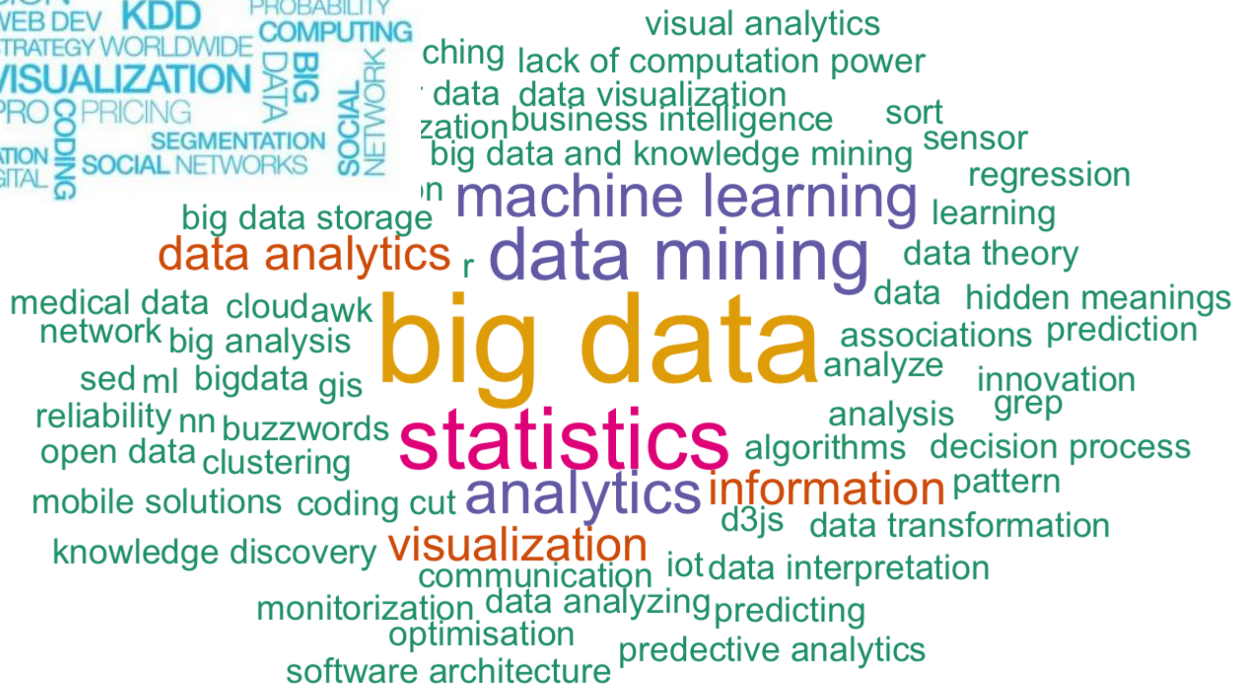
http://bit.ly/31KArT8

Ecosystem, Benchmark

- **Scan for New Products**
- **Evaluate Maturity**
- **Monitor Ecosystem**
- **Leverage Resources**

Q6: There could be many techniques and it is not possible to learn everything in a short timeframe? Any tips on how to keep track of them and learn as you go along?

Data Science Techniques – There are a lot of them!



Develop your own personal map

Categorization of Data Science Topics

Categories

- Category 1: Supervised ML on Structured Data
- Category 2: Unsupervised ML on Structured Data
- Category 3: Supervised ML on Time-series data
- Category 4: Supervised ML on Unstructured Data
- Category 5: Unsupervised ML on Unstructured Data
- Category 6: Reinforcement Learning / AI
- Category 7: Bayesian Machine Learning
- Category 8: Scalable Machine Learning at Webscale
- Category 9: Business Optimization
- Category 10: Machine Learning in Production

Programmers

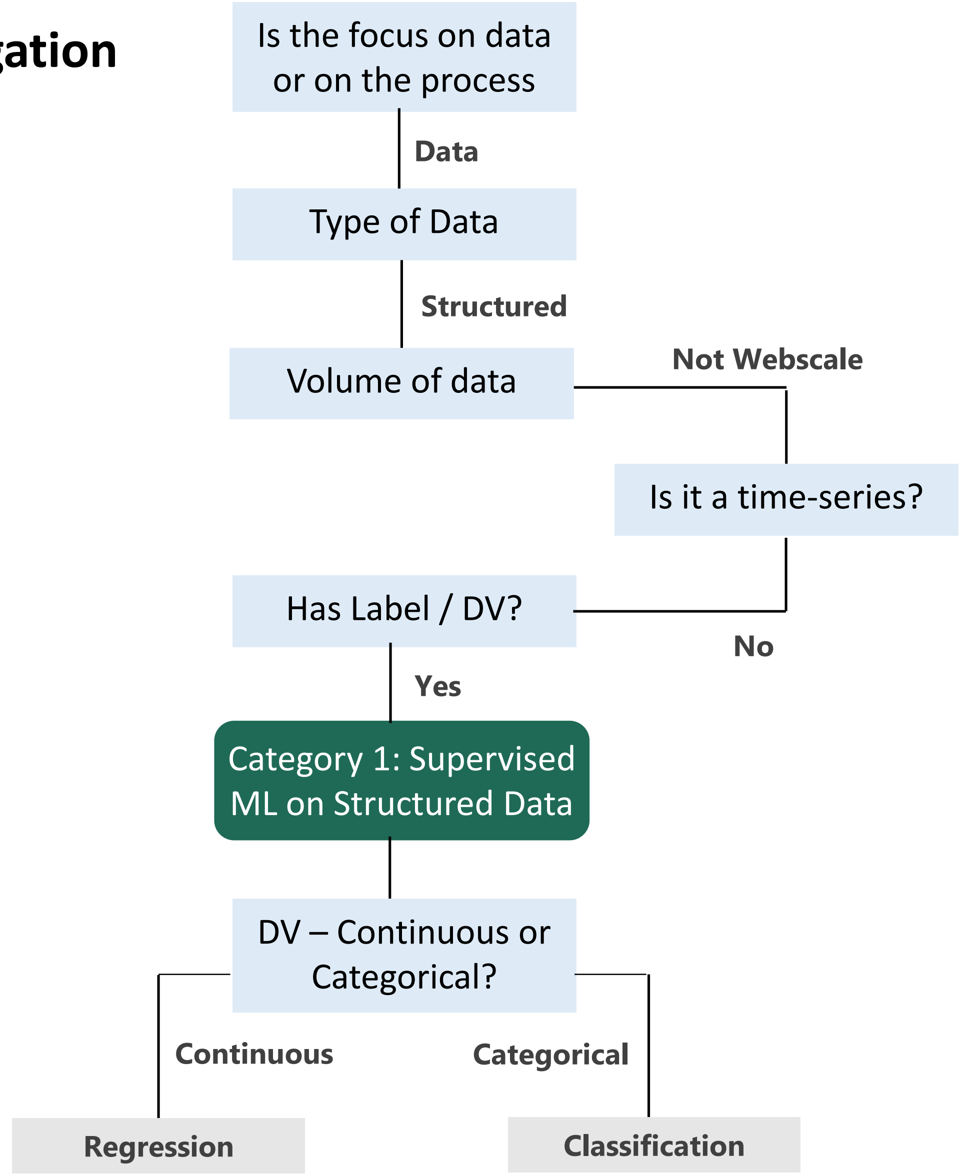
R, Python, etc.

Non-Programmers

Azure ML, BigML etc.

Example: Category 1

Navigation



Details

- Exploratory Data Analysis (EDA)
- Data Pre-processing – Outliers, Missing data, Variable Transformations
- Feature Selection & Dimensionality Reduction
- Feature Engineering
- Algorithms – Standalone vs Ensembles
- Algorithms – Parametric vs Non-Parametric
- Algorithms – Linear vs Non-linear
- Cross validation
- Hyper-parameter Tuning
- Predict on Test set

Q7: What are the useful components in the data science toolbox?

Data Science Toolbox

- Maths / Stats orientation (Not a tool but…)
- Atleast 1 programming language – Python (Jupyter notebooks), R
- Atleast 1 GUI based ML platform – H2o, Azure ML, BigML
- 1 Cloud based platform (Nice to have) – AWS, Databricks
- Github
- Kaggle (Competition & Kernels), AnalyticsVidhya
- Database / SQL knowledge (preferable)

Q8: Other than the analytical techniques themselves, what are the top 2 skills that needs to be developed?

Business Orientation is the cornerstone of Analytics

Business Decision Making Pipeline

Identify and Quantify Key Drivers
(Ex: Acquisition Rate, Monthly Balance)

→

Build Models to map drivers to actionable metrics / KPIs
(Ex: Financial Model)

→

Compute & Visualize KPIs
(Ex: Cash Flows, Net Present Value)

→

Take a Business Decision
(Ex: Change Price, Run Campaigns)

↕ Gap that needs to be bridged to deliver maximum business value

Collect Data
(Transactions, Observations and Interactions)

→

Manage Data
(Data engineering to store and ensure quality of data)

→

Analyze Data
(Apply Math to Data)

→

Derive Insights
(Decipher patterns and get predictions)

Data Science Pipeline

Think Technology Landscape

- Cloud
- Big Data
- Mobility
- Web Technologies
- Embedded Analytics in Applications
- Legacy Systems

Q9: What are the typical roles in the analytics space and entry possibilities for different experience levels?

Typical Roles in Analytics

Business	**Business Analyst**	**Functional Expert**	**Domain Expert**
Data	**Data Analyst**	**Visualization experts**	
Math / Quant	**Data Scientist** (Junior to Senior Level)	**Statisticians**	**AI / ML Engineer**
Tech / Software	**Data Engineer** (Cloud, Big Data etc.)	**Tech Leads / Architects**	**Project / Delivery Managers**

Typically one will need all skills in different proportions

How to make the transition? – Fresher / Developer

	Can Aspire to be	Skills to Acquire	How to Acquire
Fresher / Junior Developer	**Business Analyst**	➢ **Business Orientation** ➢ **Functional Knowledge (in 1 or 2 areas)**	➢ **Domain / Functional Certifications** ➢ **MBA**
	Data Analyst	➢ **SQL Skills / DB knowledge** ➢ **Translate business requirements to data needs** ➢ **Basic Stats knowledge**	➢ **Specialized courses** ➢ **Online Tutorials** ➢ **Technical certifications** ➢ **MOOCs**
	Data Engineer	➢ **SQL Skills** ➢ **Hands-on coding expertise in Big Data tools** ➢ **Cloud Platform knowledge**	➢ **Focused Big Data & Cloud Courses** ➢ **Online Courses** ➢ **MOOCs**

How to make the transition? – Experienced Techie (6-12 years)

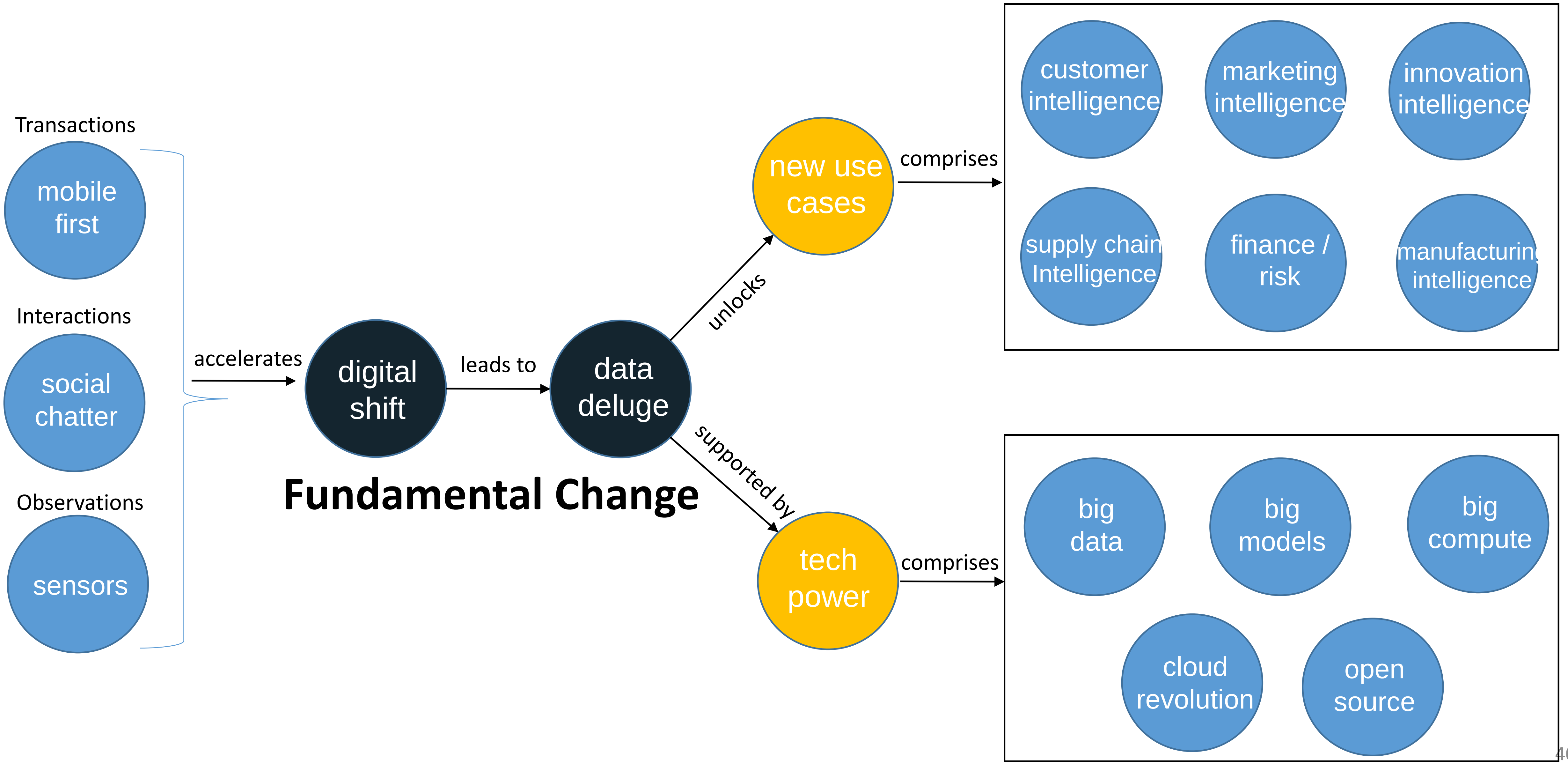
	Can Aspire to be	Skills to Acquire	How to Acquire
Lead / Architect	**Data Engineer**	➢ **Strong SQL & Programming skills in Java, Scala, etc.** ➢ **Design data pipelines for analytics**	➢ **Technical certifications** ➢ **Online Tutorials** ➢ **Focused Courses**
	Big Data / Cloud Specialist	➢ **Design Big Data Systems** ➢ **Expertise in using databases / cloud platforms in the Big Data context**	➢ **Technical certifications in areas of specialization**
	Mid-Level Data Scientist	➢ **Good Stats / Math knowledge** ➢ **Intuitive understanding of algorithms** ➢ **Hands-on coding expertise in ML/Data Science (R, Python etc.)**	➢ **Specialized Analytics Programs** ➢ **MOOCs** ➢ **Build a portfolio of ML projects** ➢ **Online competitions (Ex: Kaggle, AnalyticsVidhya)**

How to make the transition? – Senior Professionals

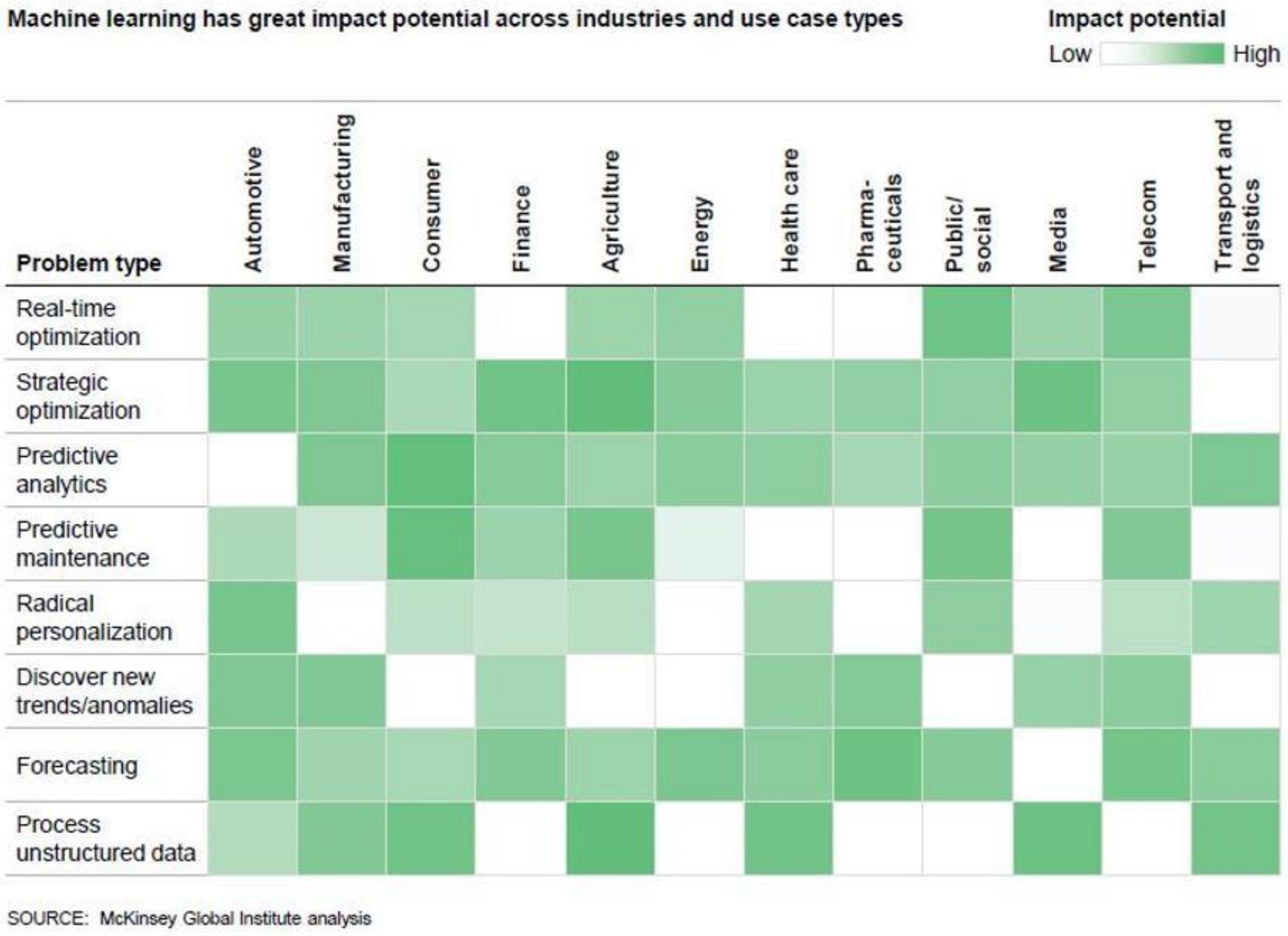
	Can Aspire to be	Skills to Acquire	How to Acquire
Delivery Manager / Business Head	**Functional / Domain Expert**	➢ **Strong Functional / Domain Knowledge** ➢ **Conceptual Knowledge of Analytics**	➢ **Executive MBA programs** ➢ **Specialized Analytics programs (Online / Offline)**
	Project / Delivery Manager	➢ **SDLC as applicable to analytics / big data projects** ➢ **Conceptual knowledge of Business + Data + Math**	➢ **On the job** ➢ **MOOCs (Case study based approach)**
	Mid-Level Data Scientist	➢ **Good Stats / Math knowledge** ➢ **Intuitive understanding of algorithms** ➢ **Hands-on coding expertise in ML/Data Science (R, Python etc.)**	➢ **Specialized Analytics Programs** ➢ **MOOCs** ➢ **Build a portfolio of ML projects** ➢ **Online competitions (Ex: Kaggle, AnalyticsVidhya)**

Q10: How are you sure that AI & ML techniques are for the long-term and is not just a fad?

Digital Shift – Fundamental, Irreversible Change



Data Science & ML can have great impact on industries



More stories for inspiration…

- **Predictive Policing:** https://en.wikipedia.org/wiki/Predictive_policing
- **Genome Sequencing:** https://www.techemergence.com/machine-learning-in-genomics-applications/
- **Self-correcting Machines**: https://www.ge.com/reports/ge-takes-predix-cloud-edge/
- **AlphaZero:** https://www.extremetech.com/extreme/260215-alphazero-new-chess-champion-harbinger-brave-new-world-ai
- **Self-Driving Cars:** https://en.wikipedia.org/wiki/Autonomous_car

Yipee! Let’s get going on AI / ML

Strong Motivation – Data Science is a journey

Curiosity – Ask yourself, others & internet the right questions

Connecting the Dots – Learn & Assimilate

Skill - Should enjoy working with numbers

Q & A

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