

Analytics and Big Data

Session 1: Foundations of data analytics

Prof. Dr. Gerit Wagner

Why is Modern Analytics so Successful?

1. More Data for the Analysis
2. More Computing Power
3. New Methods and Algorithms
4. New Analytics Processes

More Data for the Analysis

Internet of Things as a driver of data



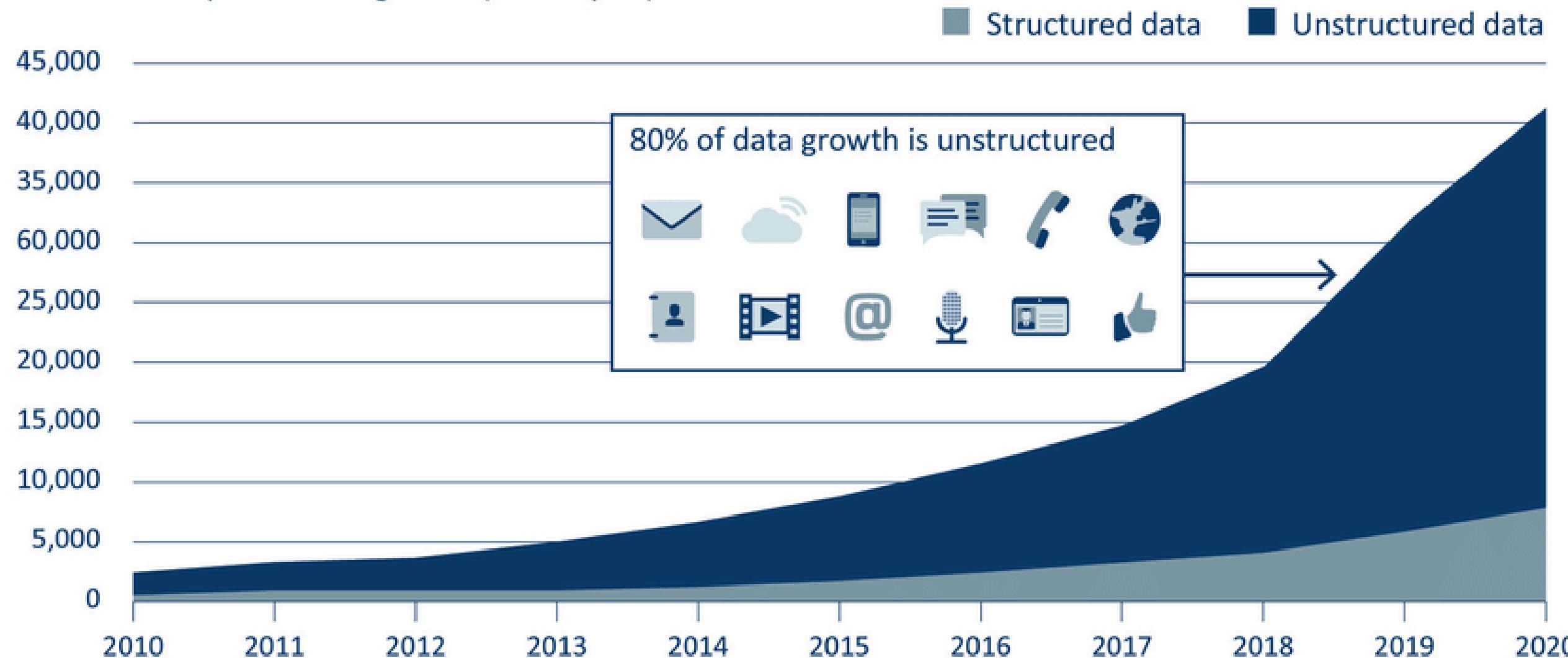
Source: Bernard Marr; Source: Ruoming Jin

Social media as a driver of data

Worldwide Corporate Data Growth

Massive growth in unstructured content

Worldwide corporate data growth (in exabytes)

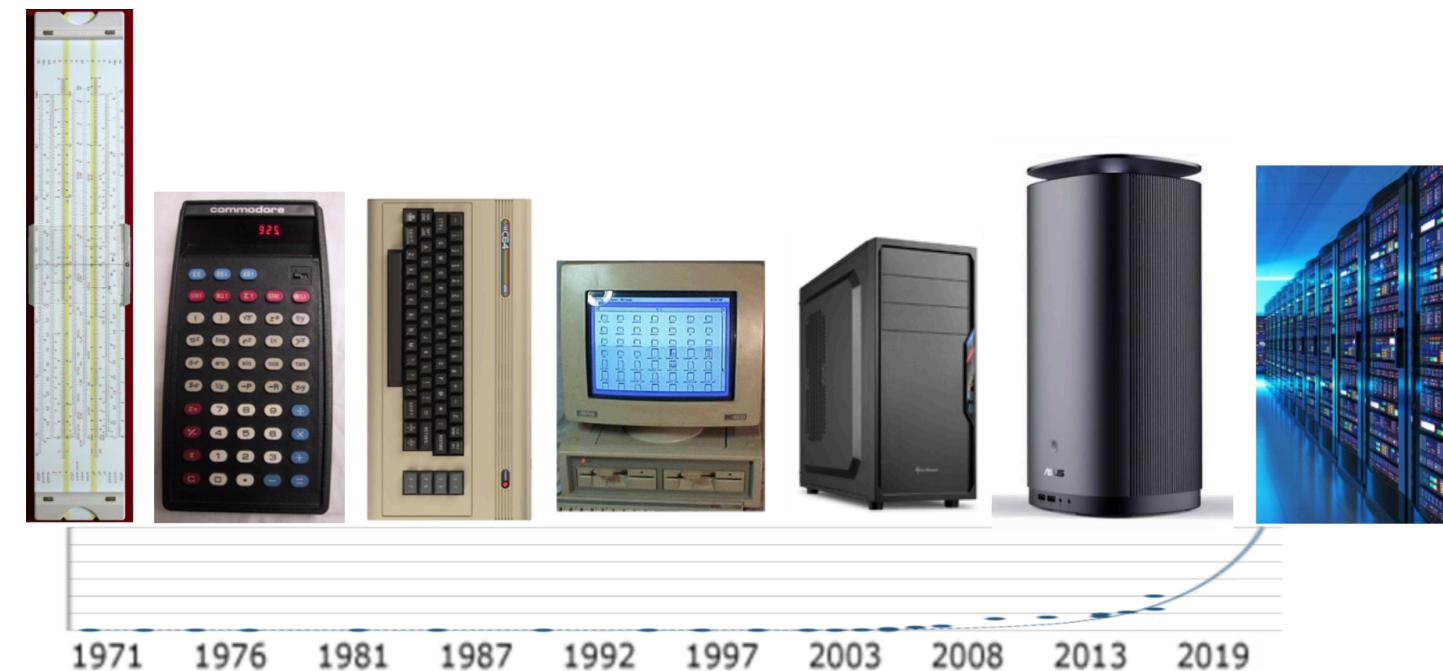


Source: The Digital Universe

Computing Power

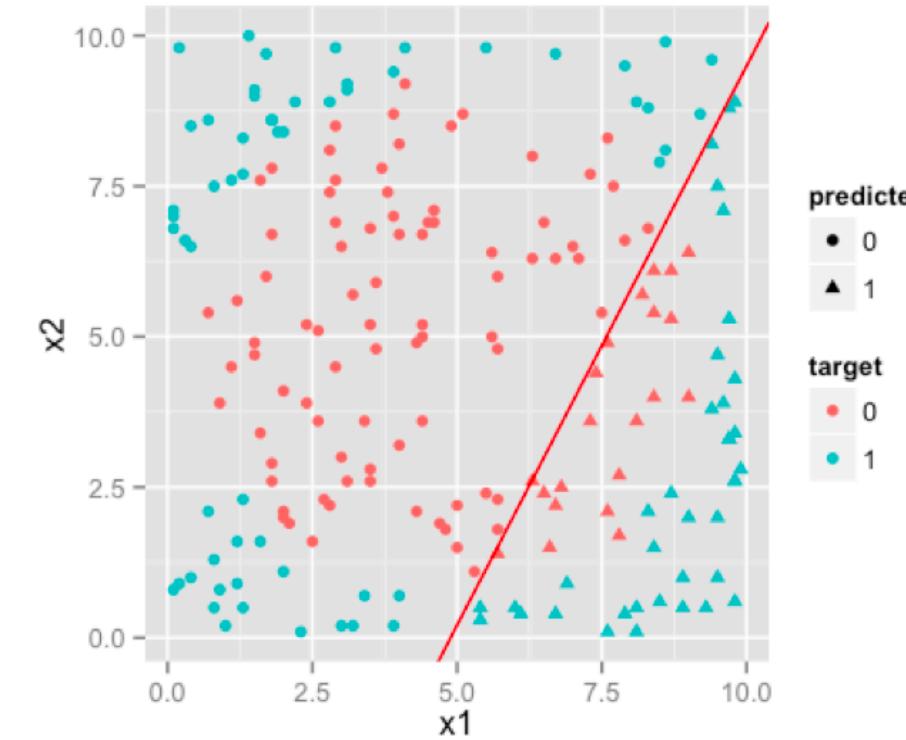
Growth of Computing Power

The rapid acceleration of computing power—driven by advances in hardware, cloud infrastructure, and parallel processing—has enabled modern analytics and machine learning to scale to massive datasets.



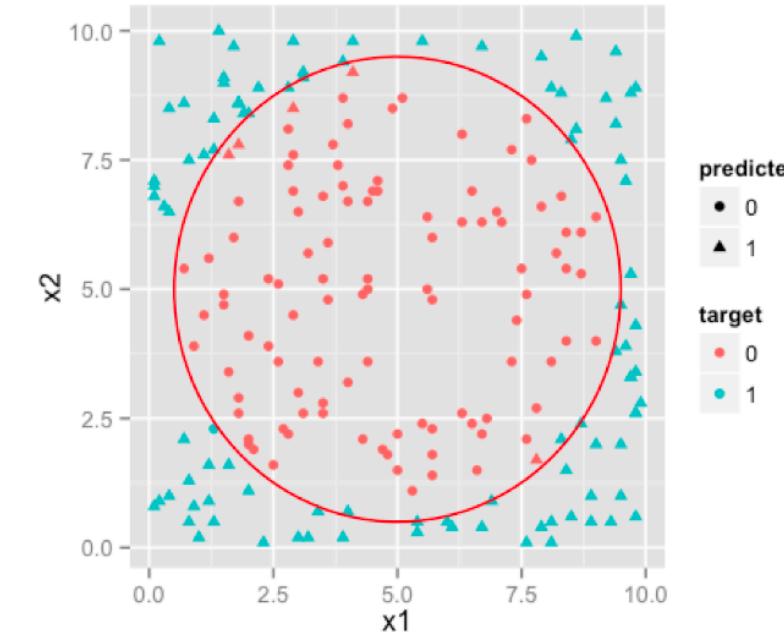
Algorithms

Old vs. New Methods



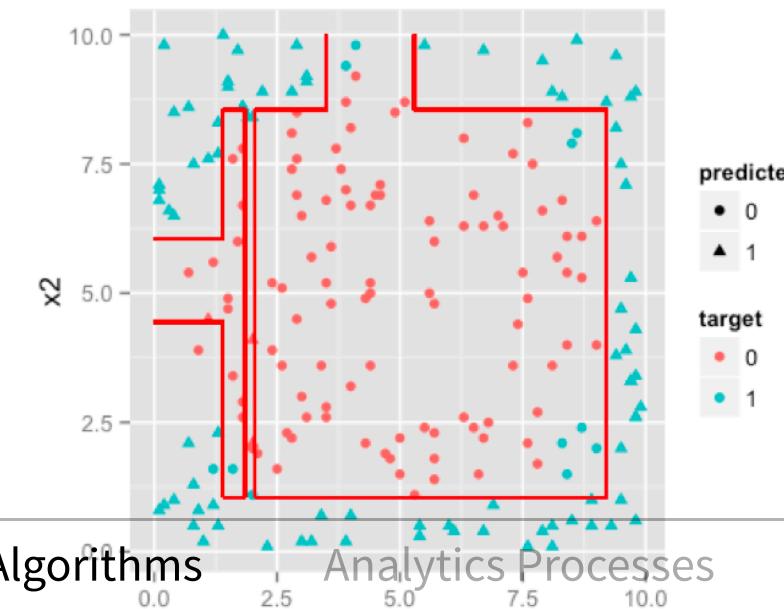
Regression

Source: Lalit Sachan



Decision Tree

Traditional



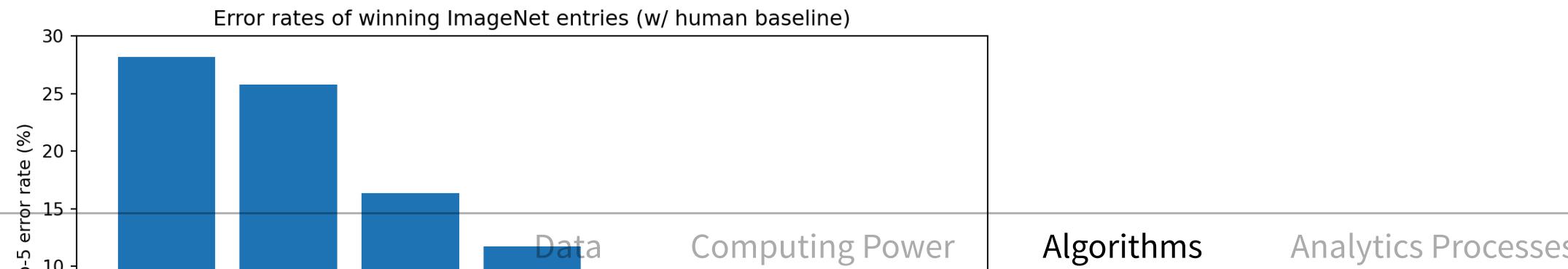
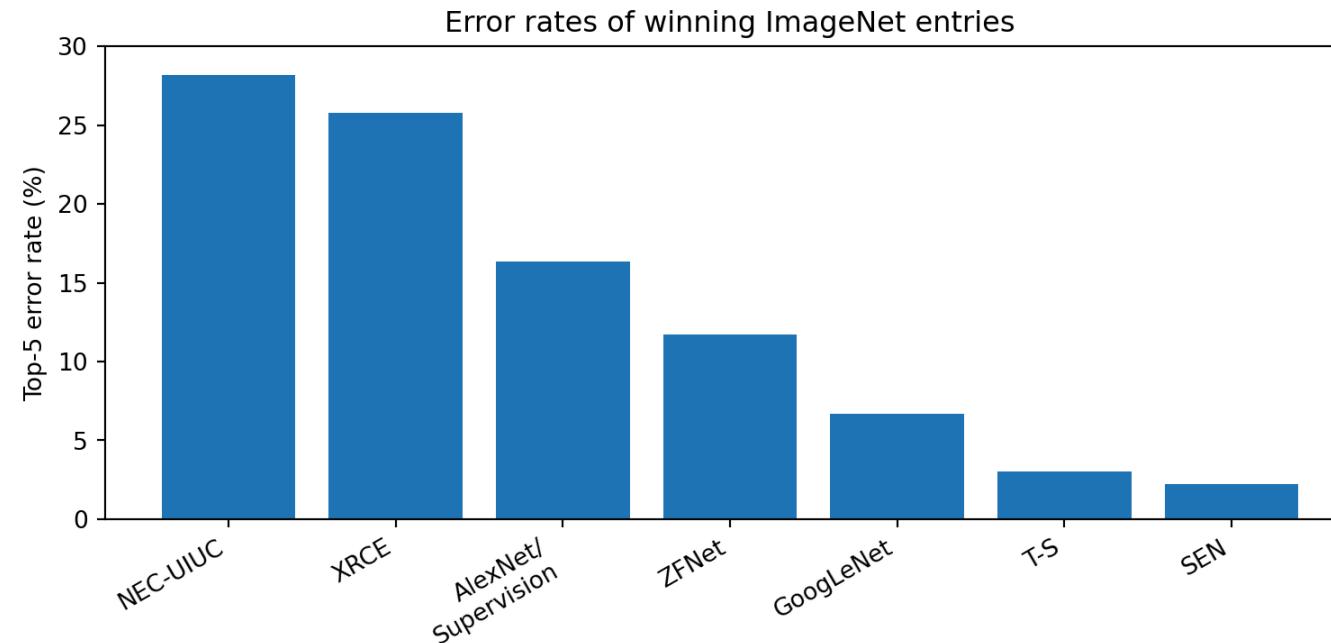
Data

Computing Power

Algorithms

Analytics Processes

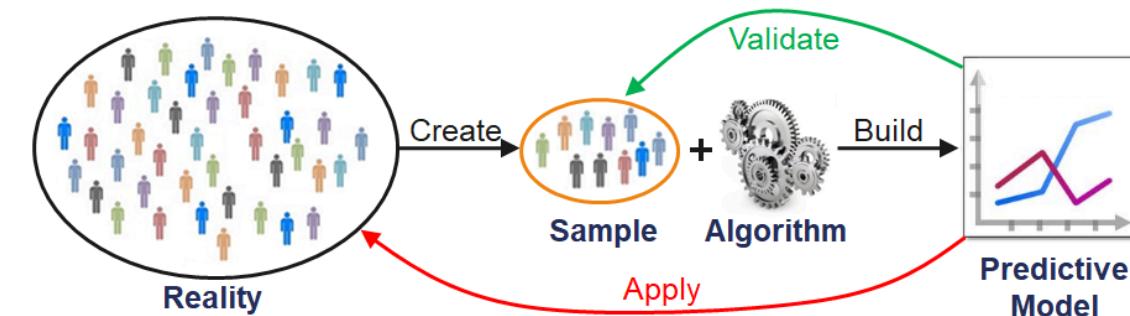
ImageNet is a large-scale image recognition competition where models compete to classify millions of images across thousands of categories. Breakthrough models have historically demonstrated major advances in deep learning.: Models vs Human Baseline



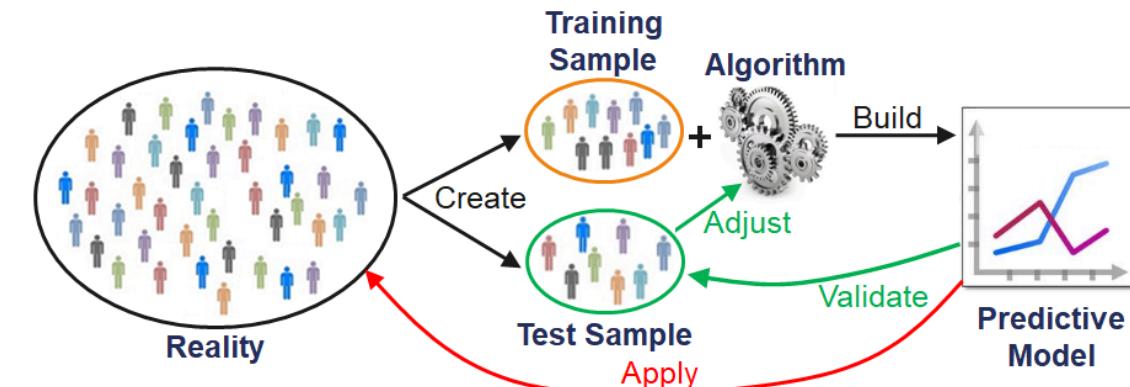
New Analytics Processes

Traditional vs. Modern Analytics Process

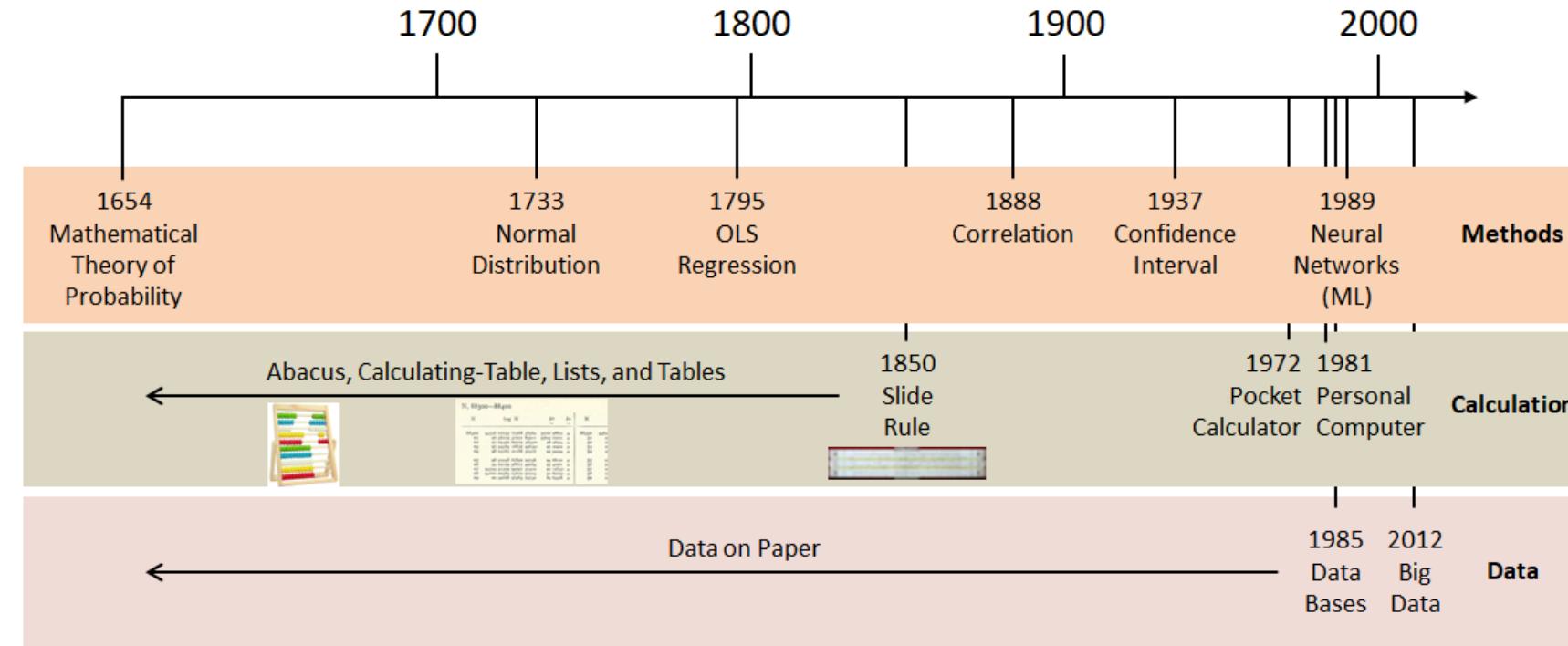
Traditional Analytics Process:



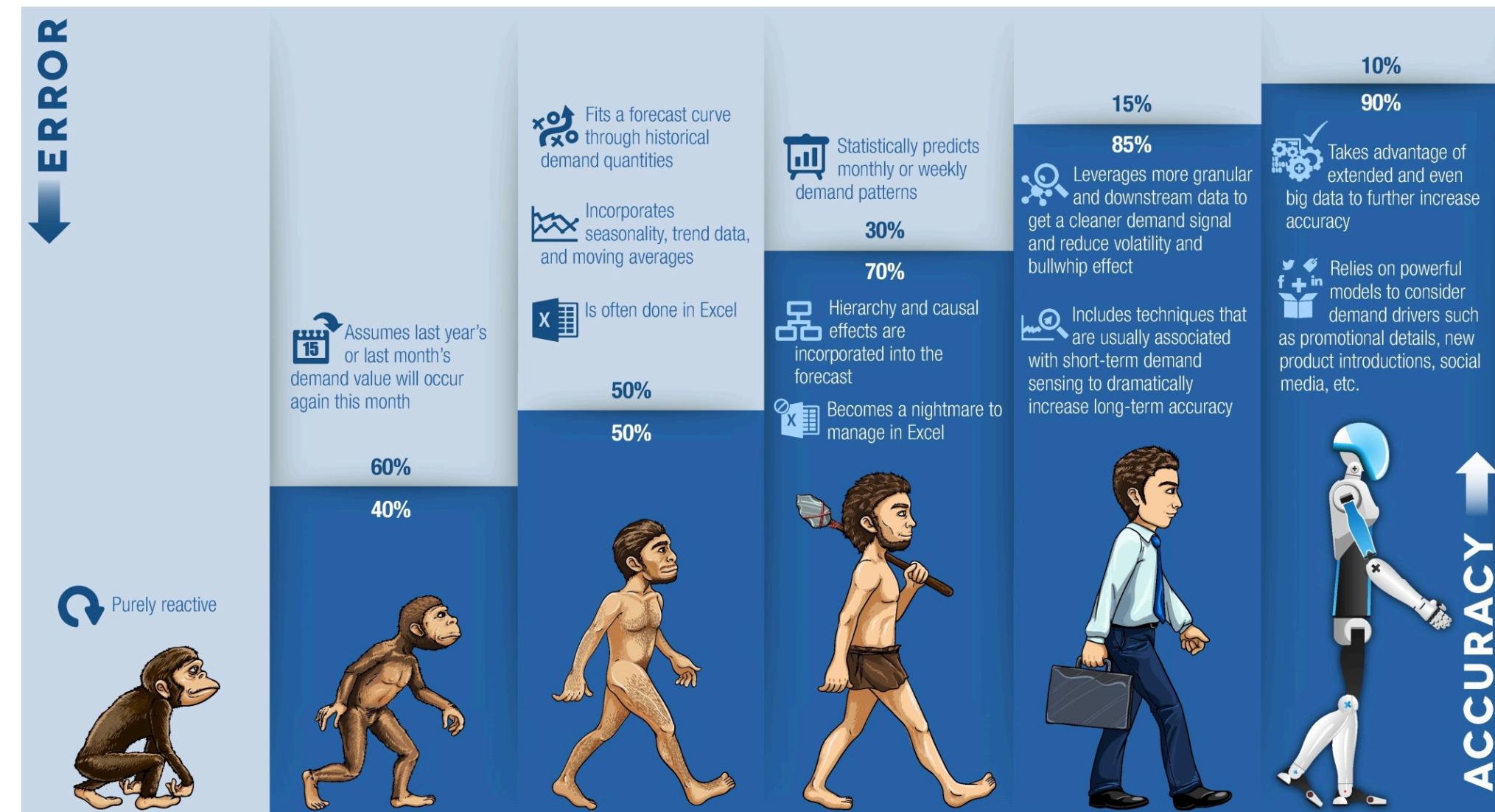
Modern Analytics Process:



From the Past to the Present

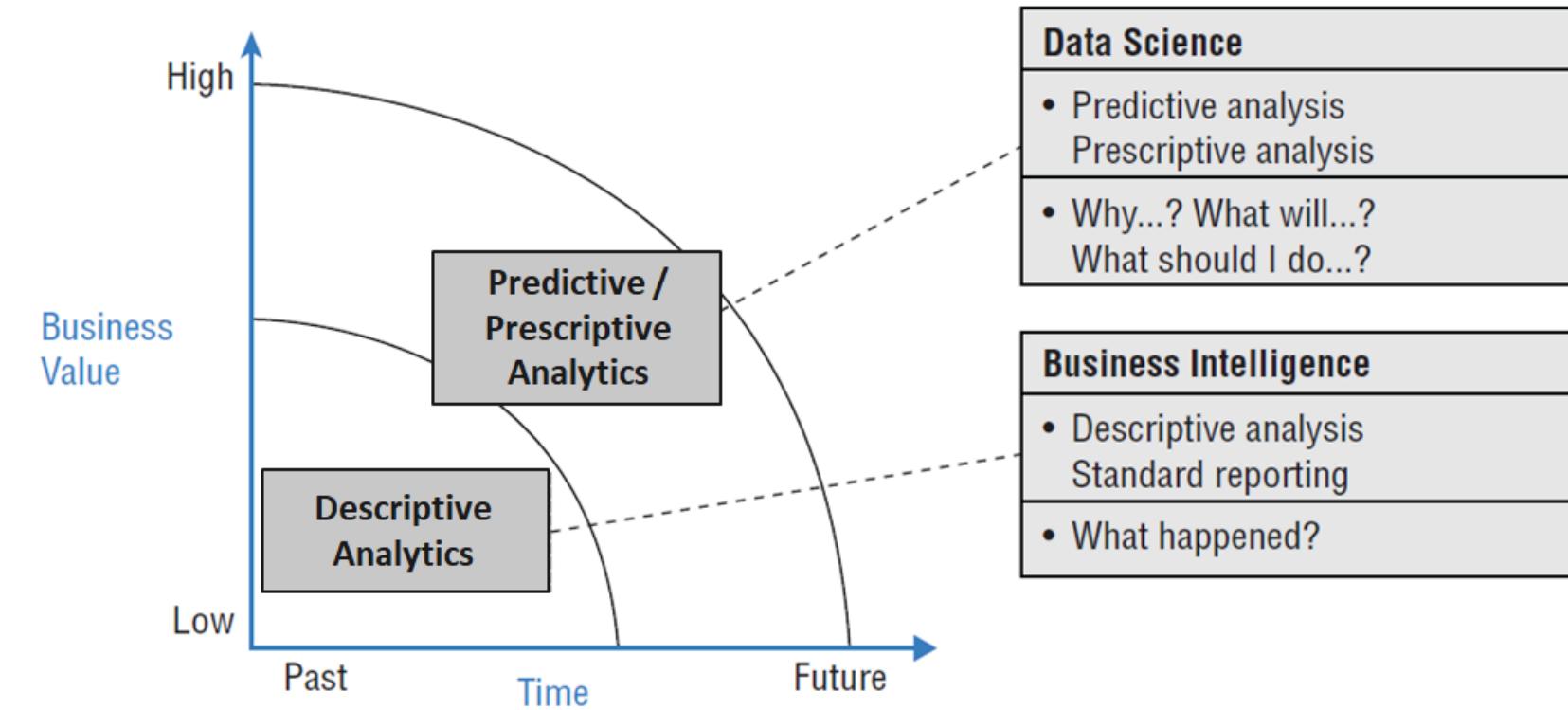


Evolution of Analytics



Source: <http://juxt.pro/blog/posts/machine-learning-with-clojure.html>

Types of Analytics (I)



Source: Schmarzo, p. 88

Types of Analytics (II)

Descriptive

- What happened in the past?
- Example: Report the profits of the last years.

Predictive

- Find patterns and relationships in data and use them for prediction.
- Example: Find the functional relationship between price and demand.

Prescriptive

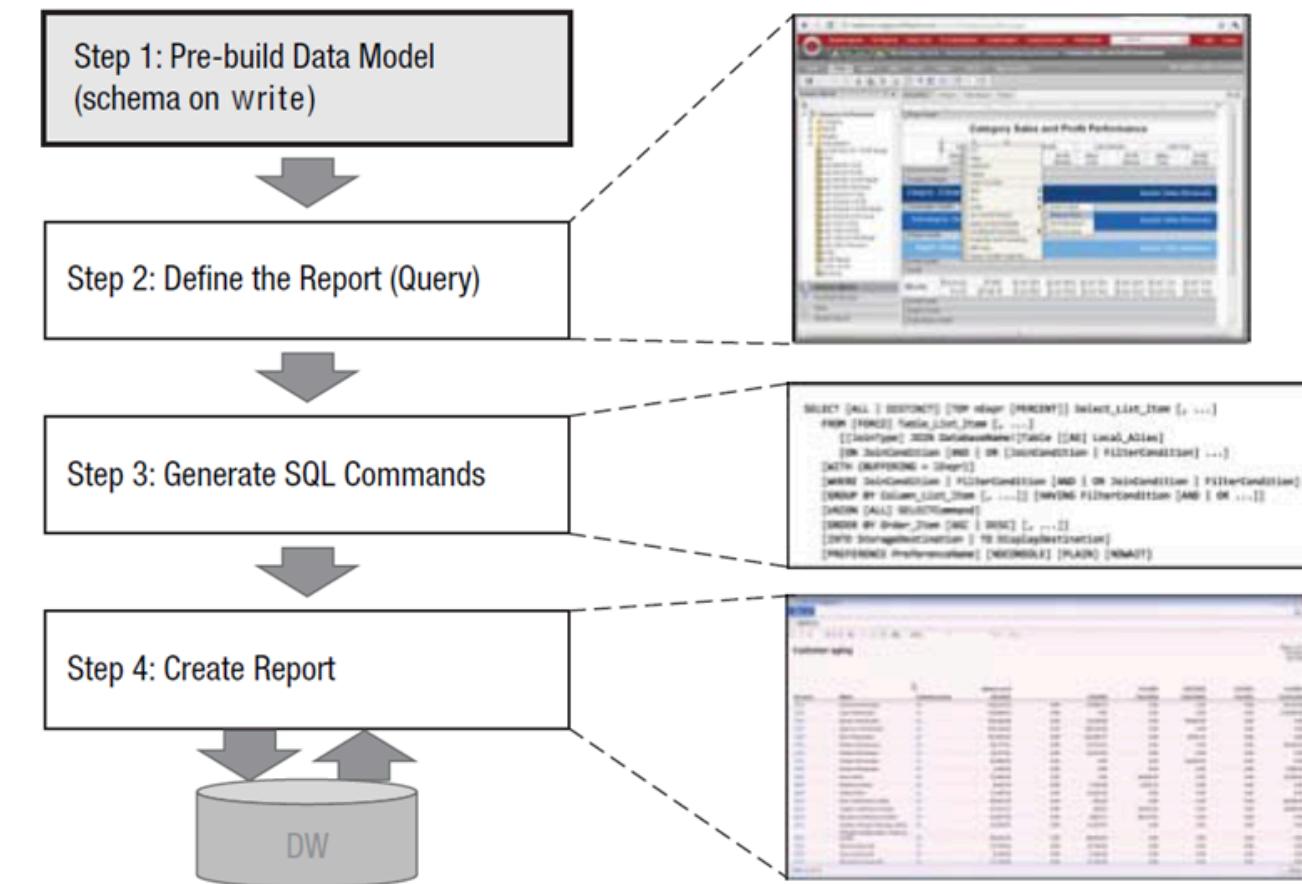
- Use the predictions to make decisions.
- Example: Set the best price to optimize the profit.

Types of Analytics (III)

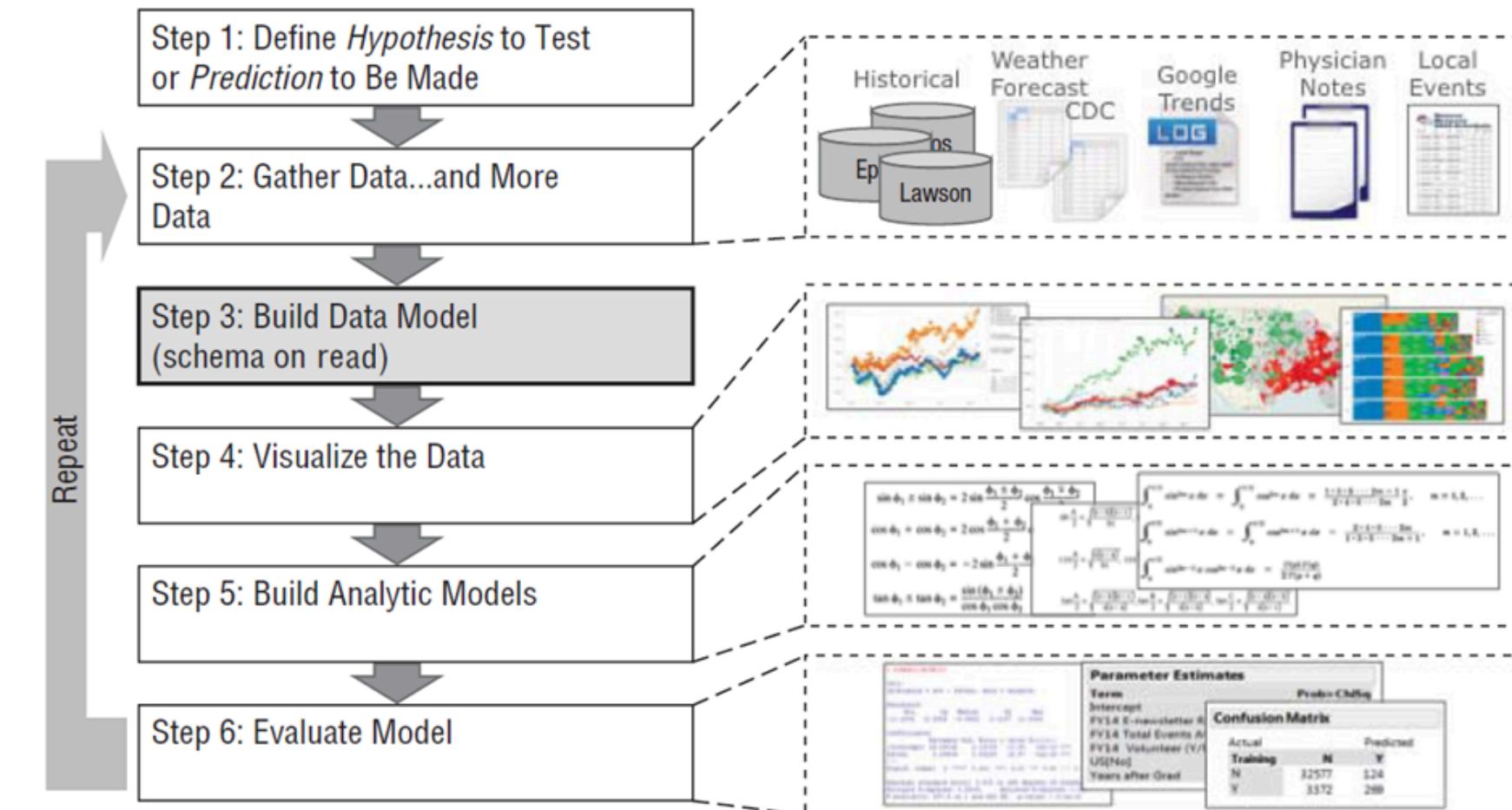
What happened? (descriptive / BI)	What will happen? (predictive analytics)	What should I do? (prescriptive analytics)
How many widgets did I sell last month?	How many widgets will I sell next month?	Order 5,000 units of Component Z to support widget sales for next month.
What were sales by zip code for Christmas last year?	What will be sales by zip code over this Christmas season?	Hire Y new sales reps by these zip codes to handle projected Christmas sales.
How many of Product X were returned last month?	How many of Product X will be returned next month?	Set aside \$125K in financial reserve to cover Product X returns.
What were company revenues and profits for the past quarter?	What are projected company revenues and profits for next quarter?	Sell the following product mix to achieve quarterly revenue and margin goals.
How many employees did I hire last year?	How many employees will I need to hire next year?	Increase hiring pipeline by 35% to achieve hiring goals.

Source: Schmarzo, p. 13

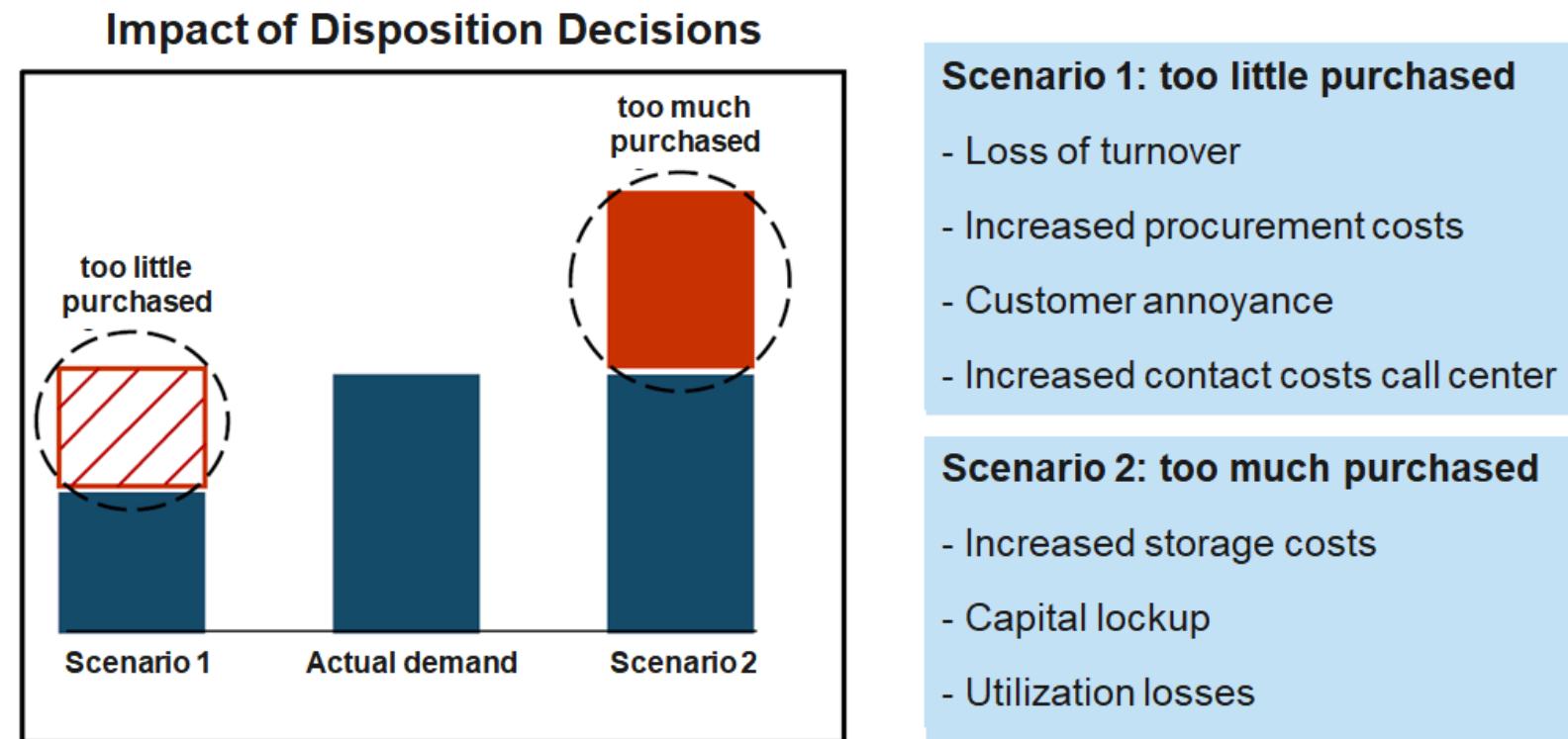
Descriptive Analytics Process



Predictive Analytics Process



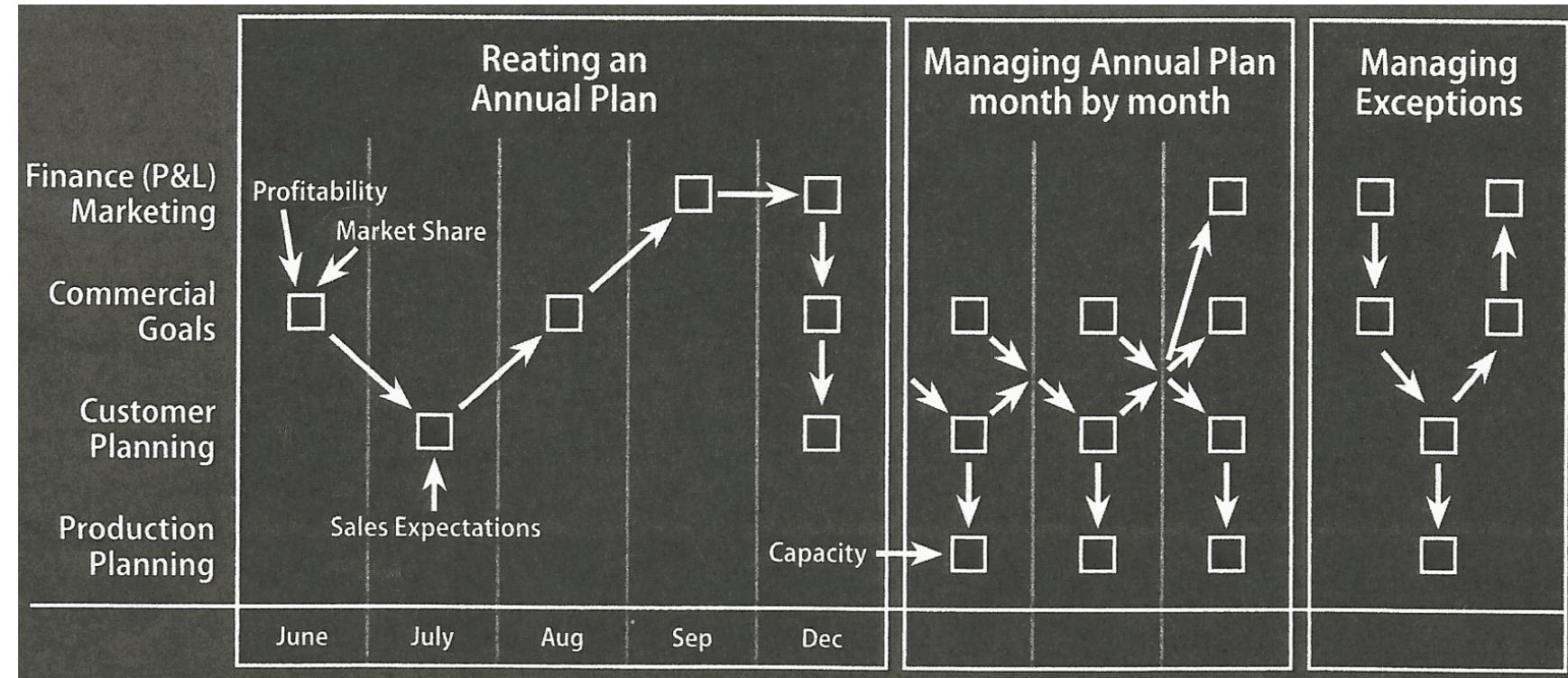
Example Inventory Planning



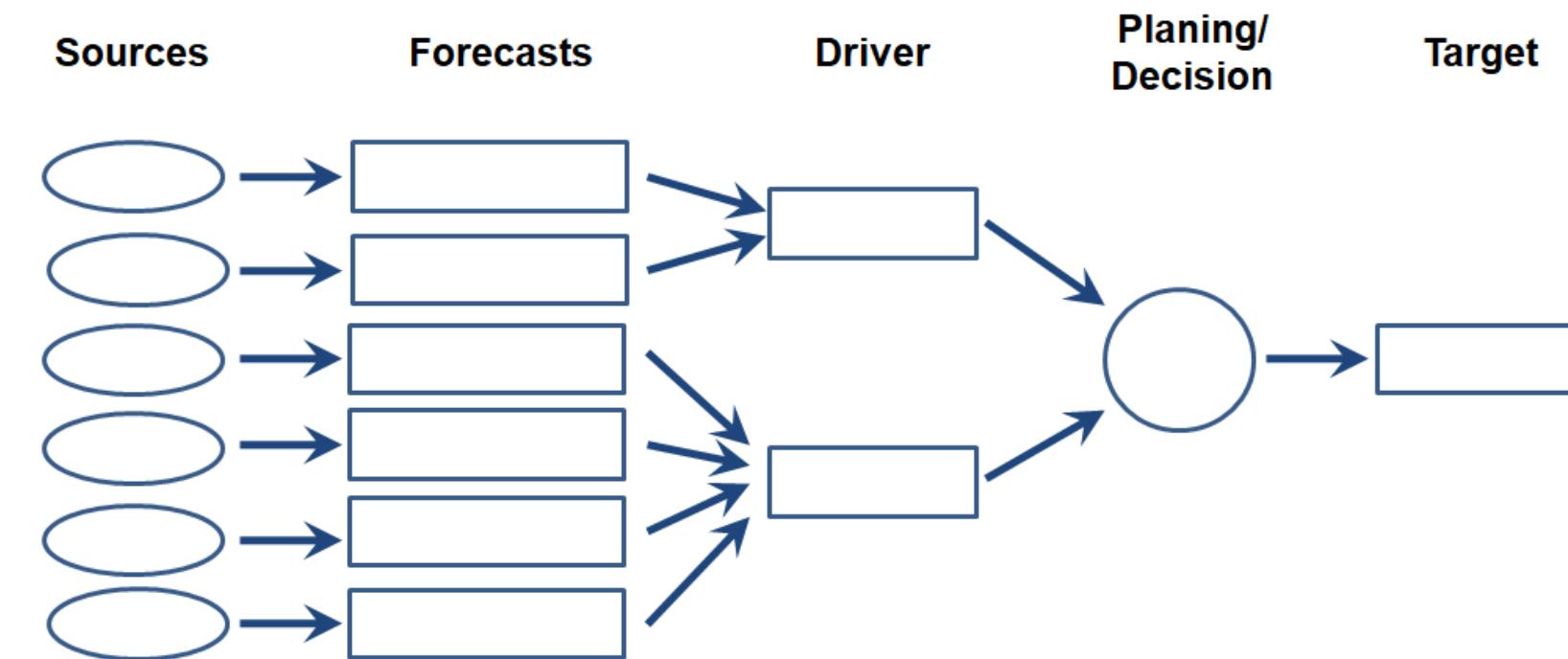
On the basis of more than 300 million data records per week, Otto makes more than one billion forecasts per year on the sales development of individual articles for the next days and weeks. Such forecasts allow Otto to reduce its own inventories by up to 30% on average.

Source: http://www.bvl.de/misc/filePush.php? mimeType=application/pdf& fullPath=/files/441/442/777/1015/DLK12_C3-3_Praesentation_Stueben.pdf

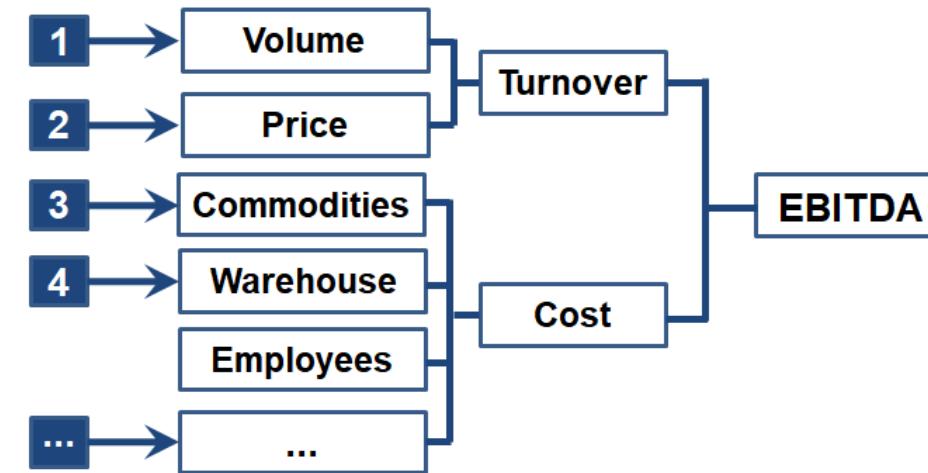
Classical Corporate Planning



Example Driver-based Planing (I)



Example Driver-based Planning (II)



1. Sales forecasts based on market and social media data
2. Automated pricing based on market and competitor analyses
3. Early detection of price changes and adjustment of purchasing behavior
4. Optimization of inventory management based on customers' current purchasing preferences

Summary

- Modern analytics is driven by data availability, computing power, and new methods.
- Analytics evolves from descriptive to predictive and prescriptive insights.
- Modern processes rely on automation, scalability, and data-driven decision making.