

A complex network graph visualization with a central red cluster and blue periphery. The graph consists of numerous nodes and edges, forming a dense, interconnected structure. The central part of the graph is highlighted in red, while the outer parts are in blue. The background is dark, making the nodes and edges stand out.

Applications of Analytics

Stephen Downes

October 18, 2021

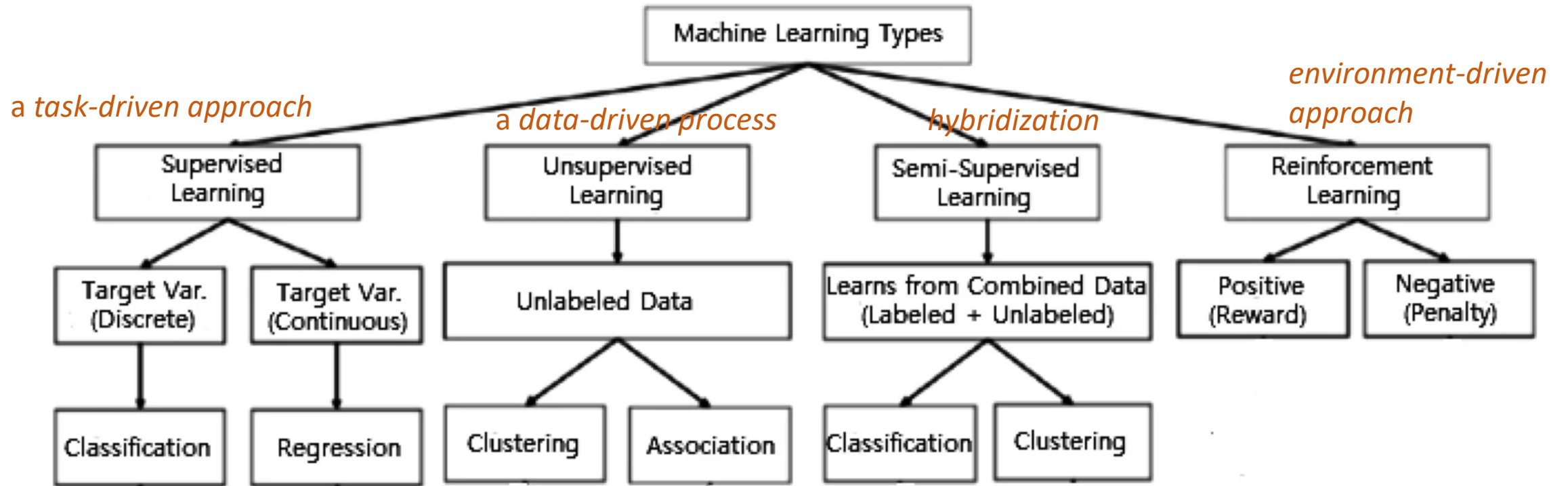
Motivations for Analytics

We can look at the *motivations* for learning analytics to develop a sense of what to expect from the technology. Institutions may desire, for example (Kay, Korn & Oppenheim, 2012):

- responses to economic and competitive pressures
- agility of analysis
- good practice in modern enterprise management.
- intelligent personalised services
- visualization of patterns and trends in large-scale data

This is not ‘technology in search of an application’. Quite the opposite.

Types of Analytics



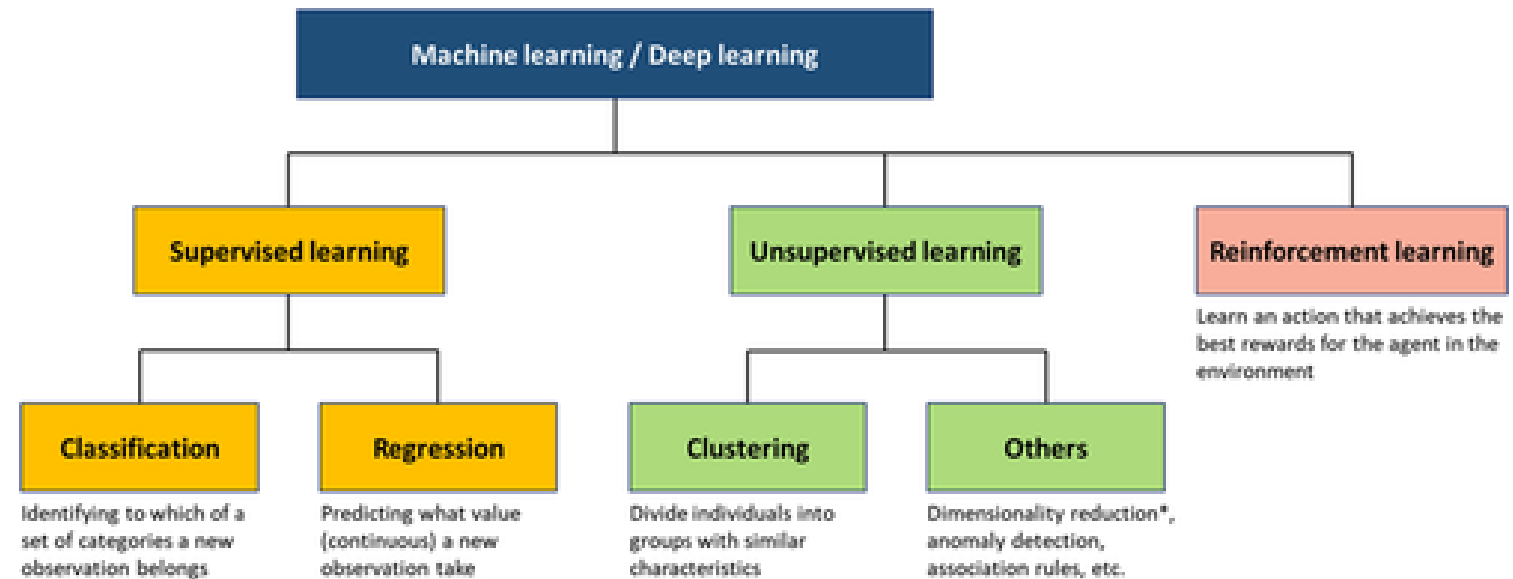
<https://link.springer.com/article/10.1007/s42979-021-00592-x/figures/2>

What AI / Analytics Can Do

- Modern analytics is based mostly in supervised machine learning and neural networks, and these in turn provide algorithms for:

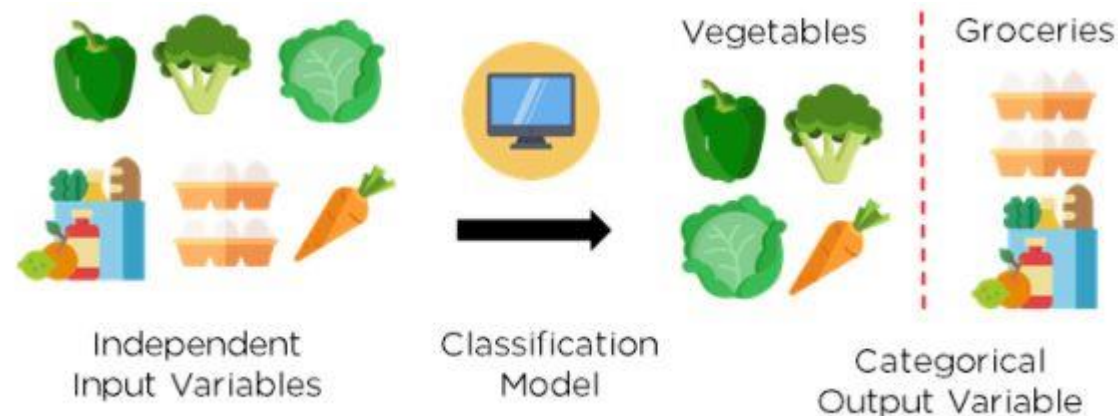
- Classification
- Regression
- Clustering
- Feature extraction
- Rule learning
- Prediction

<https://www.ahajournals.org/doi/full/10.1161/JAHA.119.012788>



Classification

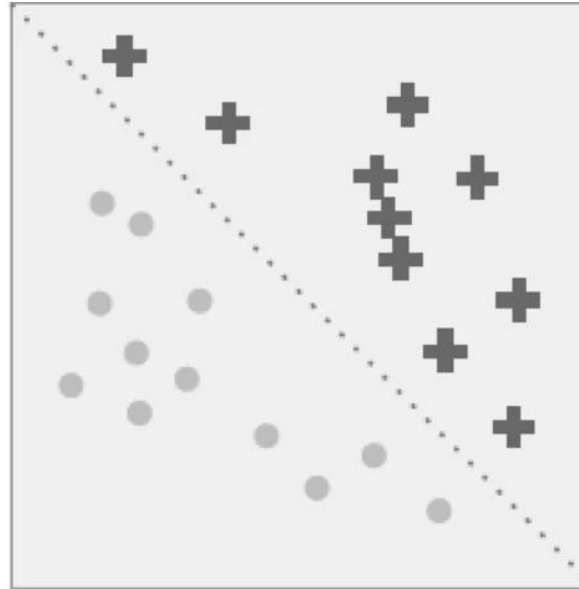
- Binary classification (true-false, yes-no)
- Multiclass classification (more than two class labels)
- Multilabel classification (more than one label per entity)



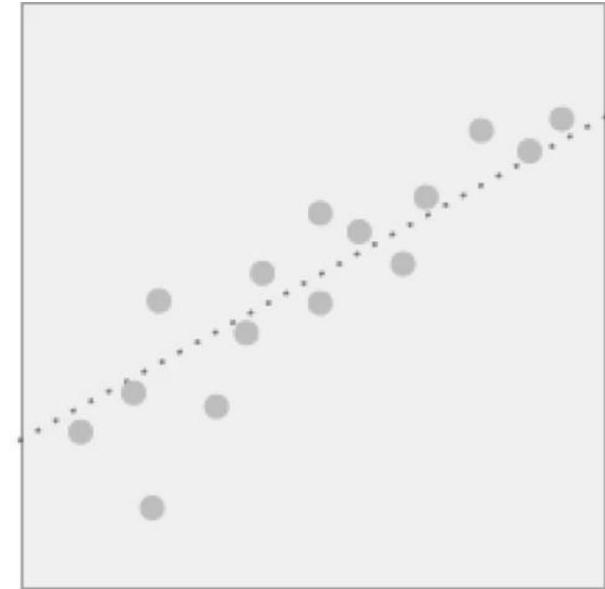
<https://www.simplilearn.com/tutorials/machine-learning-tutorial/classification-in-machine-learning>

Regression

- Simple and linear regression
- Non-linear or polynomial
- LASSO (least absolute shrinkage and selection operator) and Ridge regression



Classification



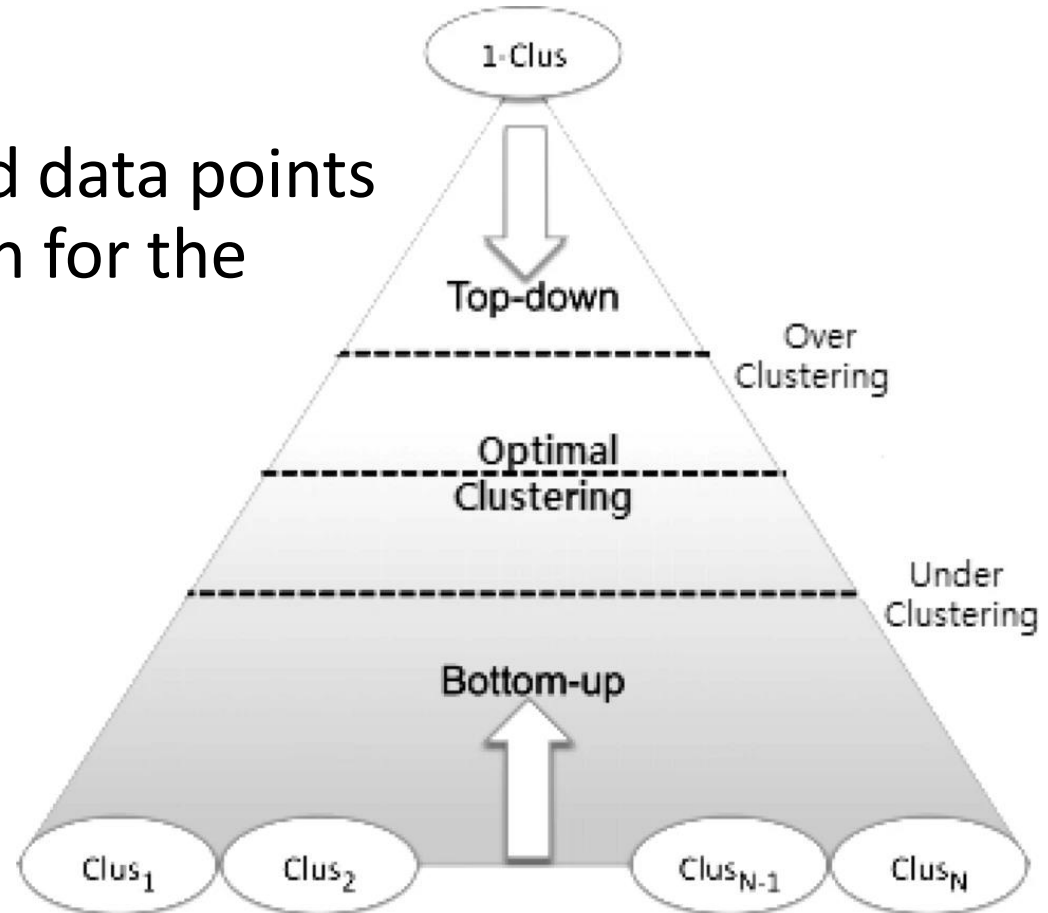
Regression

Clustering

“Identifying and grouping related data points in large datasets without concern for the specific outcome” (Sarker, 2021)

Methods:

- Partitioning (features, similarity)
- Density (eliminates noise)
- Hierarchy & tree structure
- Grids, models, constraints
- more...



Feature Extraction

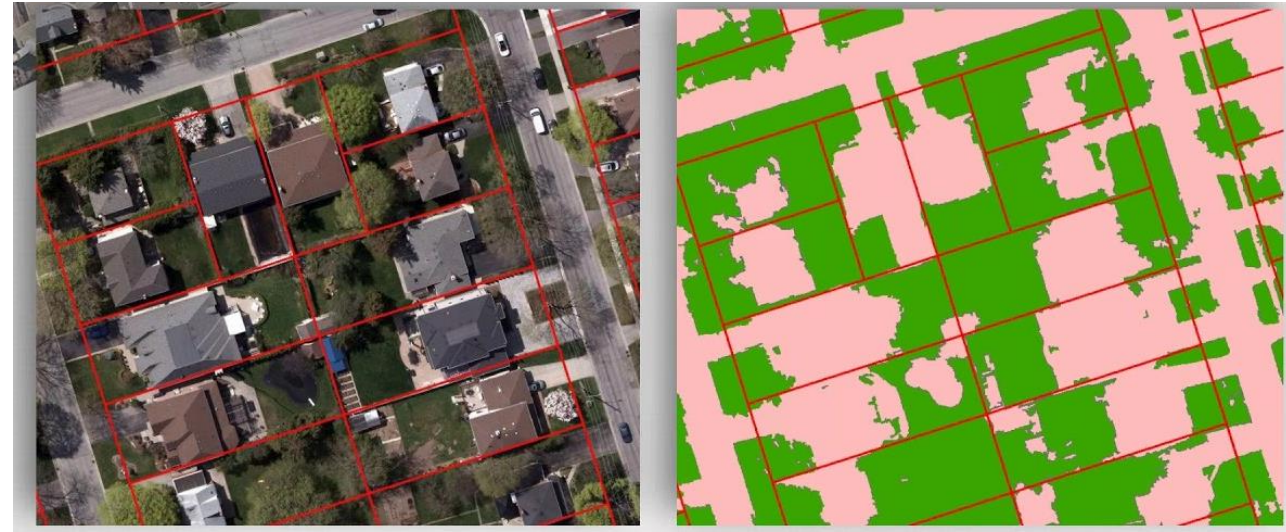
All Features



Feature Selection



Final Features

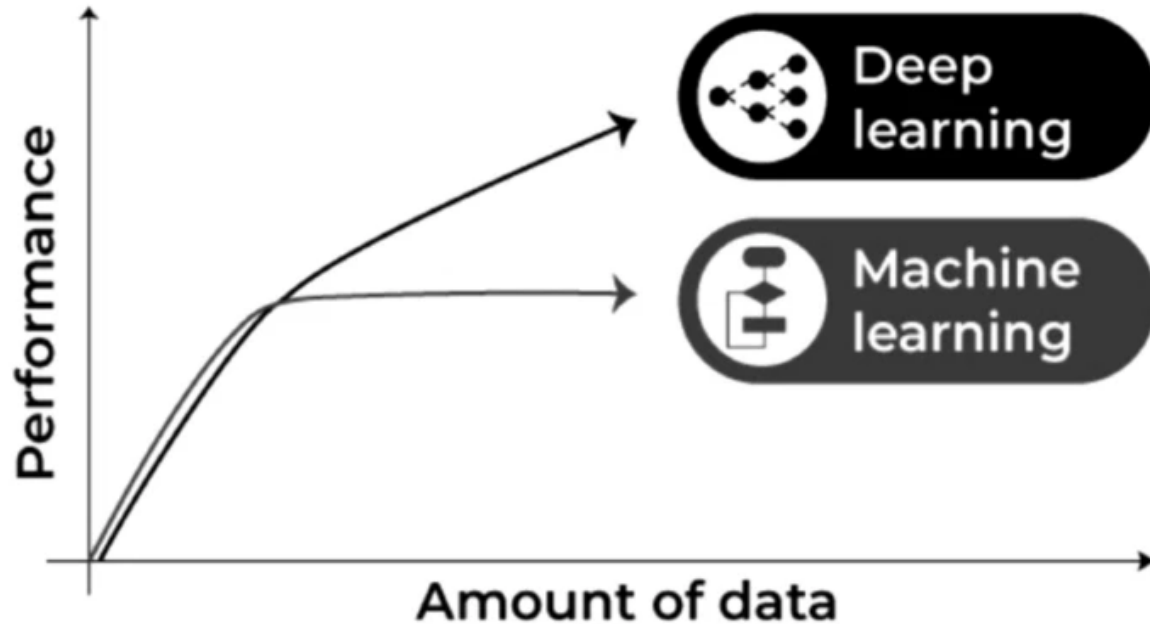


- Feature selection – choosing a set of unique, relevant or salient features
- Feature extraction – reduce the number of features in a dataset

<https://vitalflux.com/machine-learning-feature-selection-feature-extraction/>

<https://www.youtube.com/watch?v=4XyRg4PrRjA>

Types of Learning

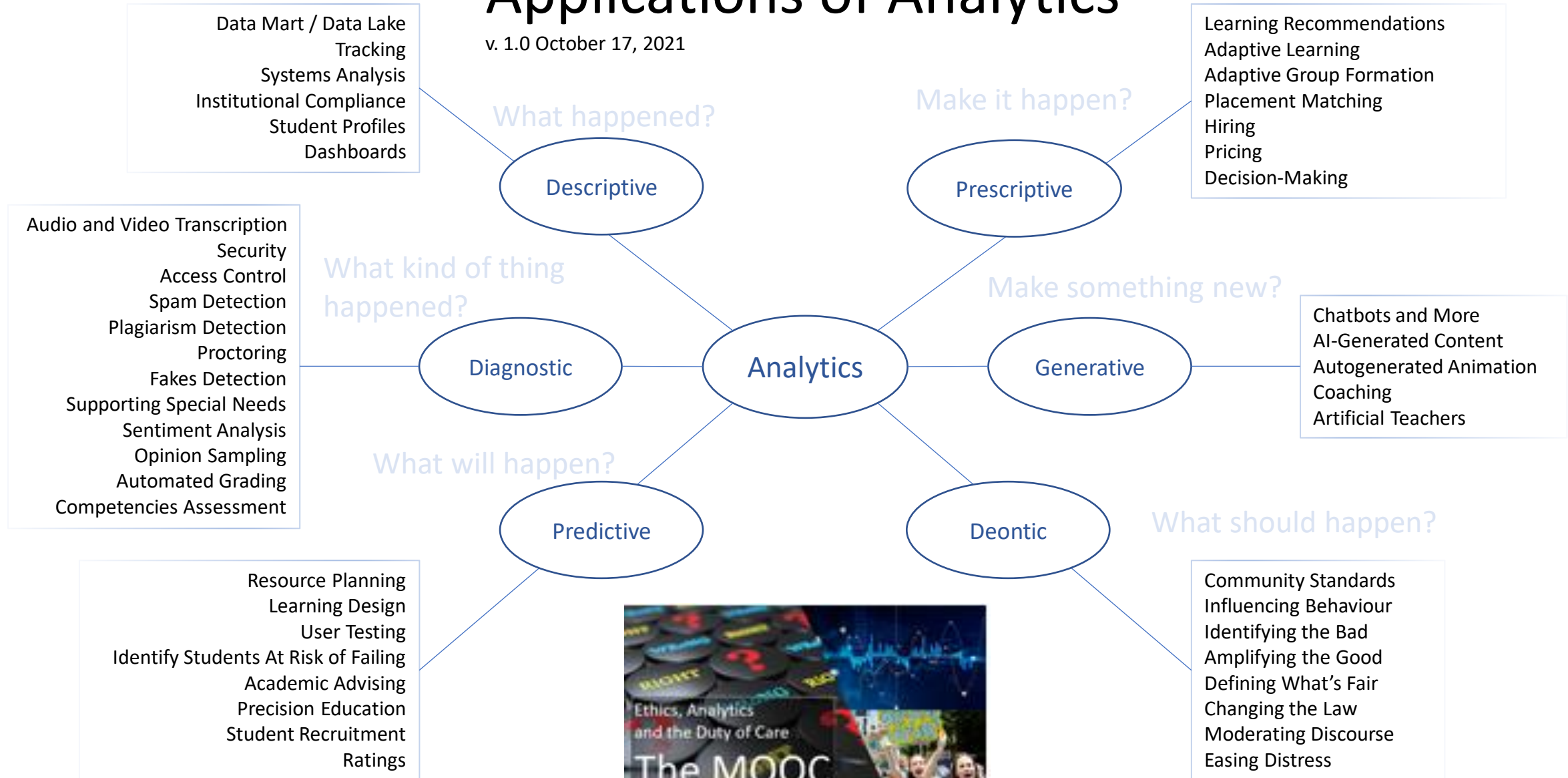


- Rule-learning – “to discover interesting relationships, if-then statements”
- Reinforcement learning – “to learn by trial and error in an interactive environment”
- Deep learning - machine learning approaches with representation learning

<https://link.springer.com/article/10.1007/s42979-021-00592-x/figures/9>

Applications of Analytics

v. 1.0 October 17, 2021



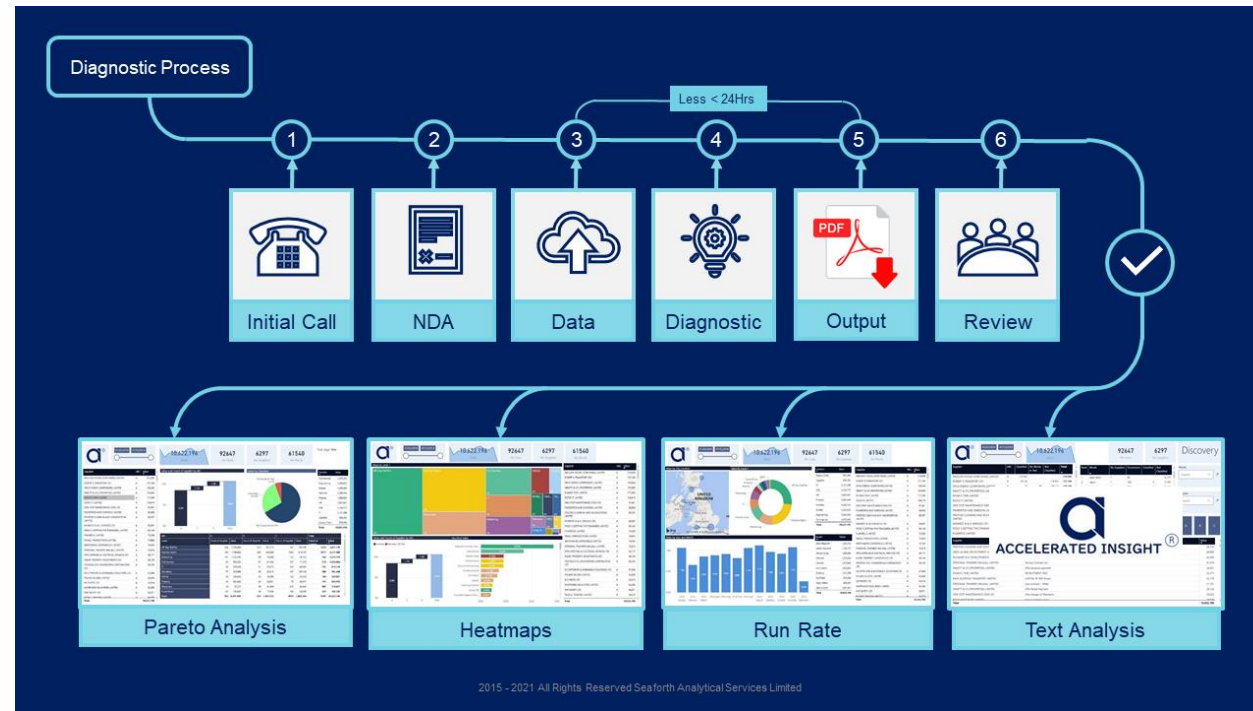
<https://ethics.mooc.ca/>

Descriptive Analytics

- Description, detection and reporting, including mechanisms to pull data from multiple sources, filter it, and combine it.
- Data aggregation and data mining are two techniques used



Diagnostic Analytics

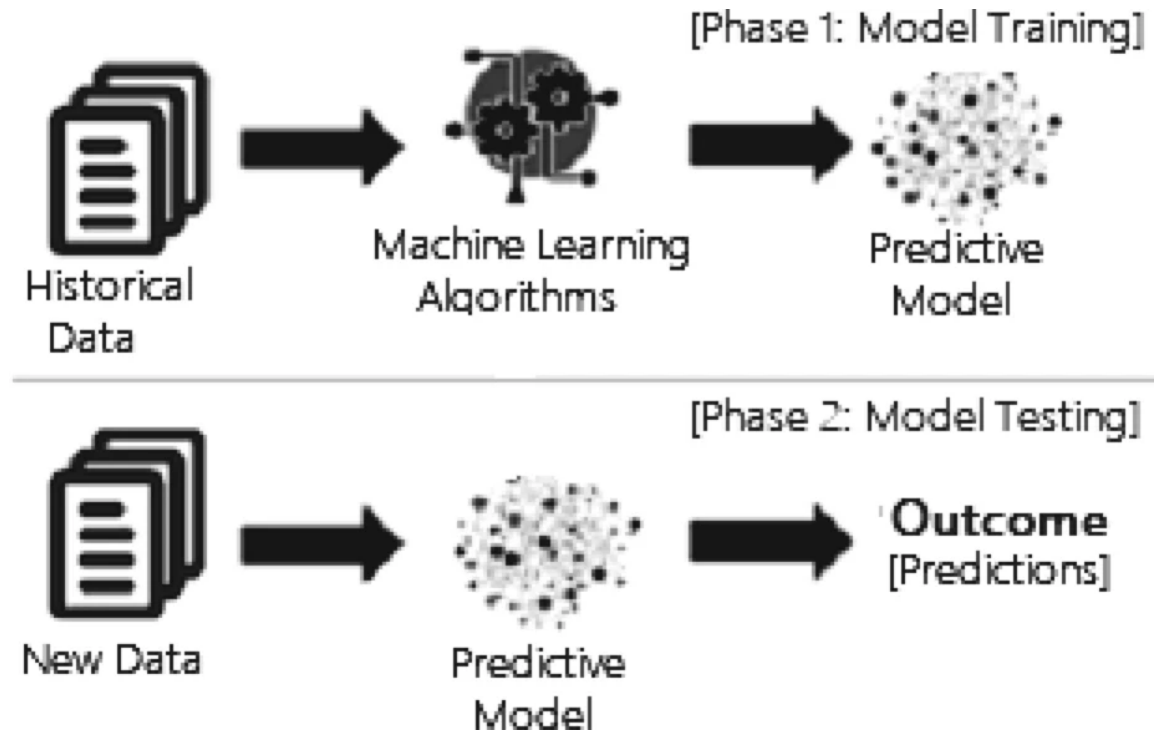


- Looks more deeply into data in order to detect patterns and trends.
- For example, to perform recognition, classification or categorization tasks.

<https://www.accelerated-insight.com/spend-analytics-diagnostics>

Predictive Analytics

Answer the question, what will (probably) happen, based on an identification of patterns and trends in existing data, and an extrapolation of that pattern or trend to probably future states.



<https://link.springer.com/article/10.1007/s42979-021-00592-x/figures/3>

Prescriptive Analytics



Foundational capabilities

- Have a quantified view of the market opportunity across current and prospective customers
- Understand revenue potential for key offerings at the customer level



Work this deal, not that one

- Invest in the right sales opportunities



Sell this, not that

- Focus on specific offerings



Do this next

- Take specific sales actions



Send this, not that

- Deliver specific sales messages



Improved sales outcomes

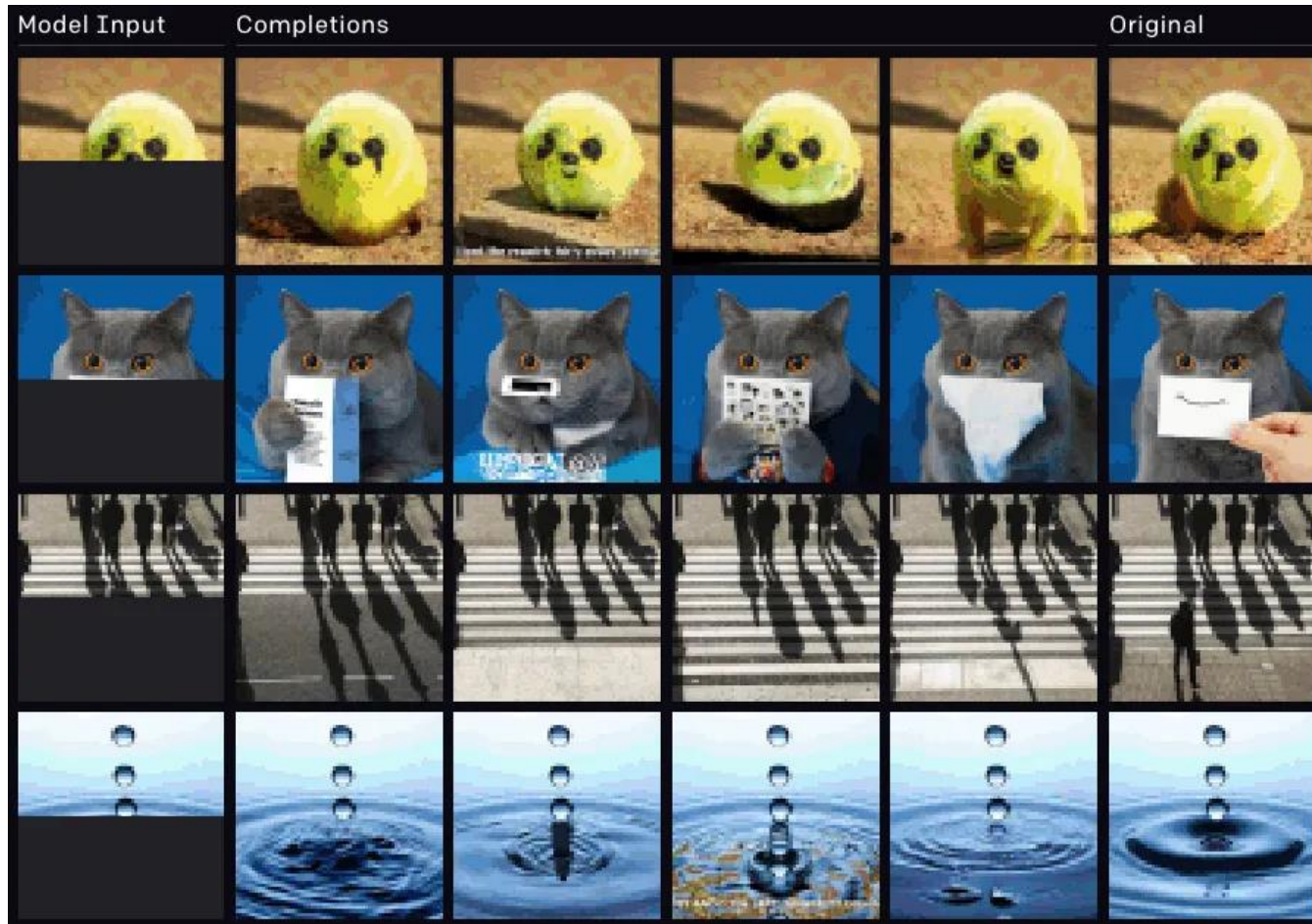
- 15% increase in win rates
- 95% accuracy on forecasted deal closures
- Optimal deployment of sales resources
- Higher return on sales investment

Prescriptive analytics recommend solutions.

Source: Bain & Company

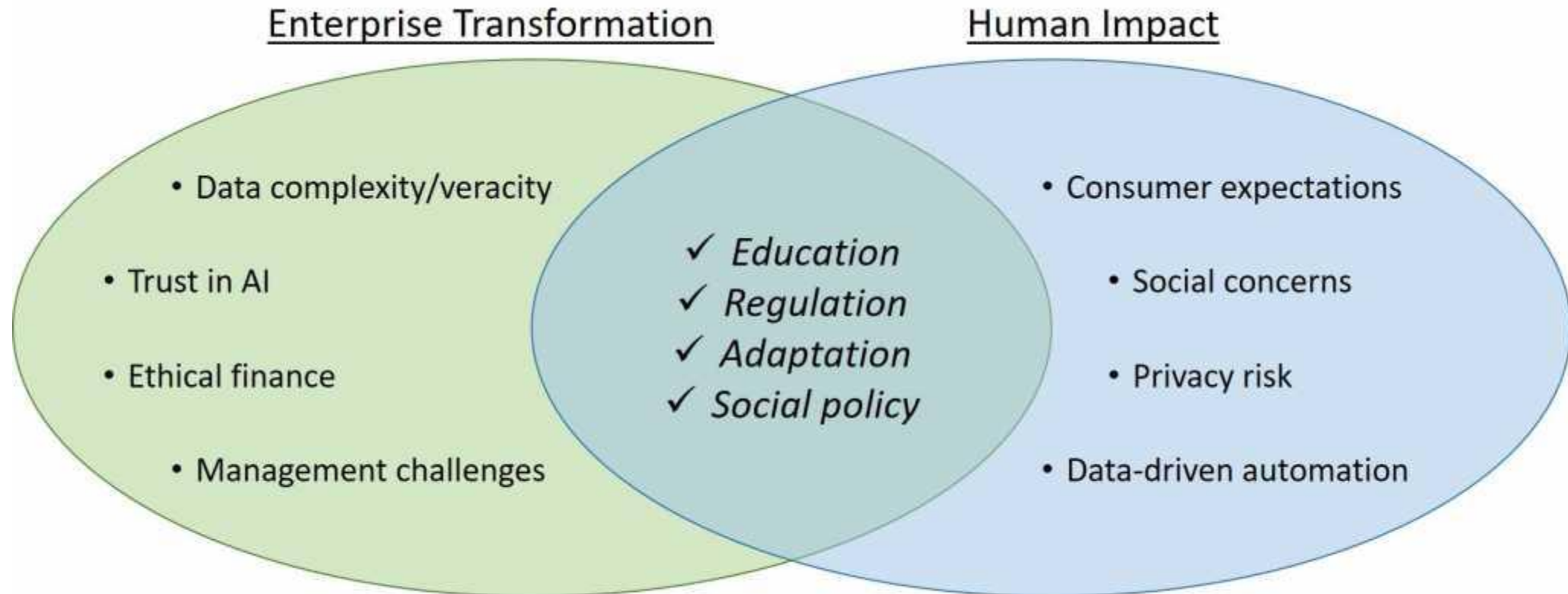
<https://www.bain.com/insights/do-this-not-that-prescriptive-analytics-in-sales-and-marketing/>

Generative Analytics



Generate original content based on parameters or properties of the data studied, combined with predictions or requirements for future data.

Deontic Analytics



<https://insightaas.com/new-research-ai-and-advanced-analytics-connecting-culture-ethics-and-society-in-a-machine-age/>

Analytics that look at expressions of sentiments, needs, desires, and other such factors in order to determine what sort of outcome would be best