AI Applications: A Taxonomy

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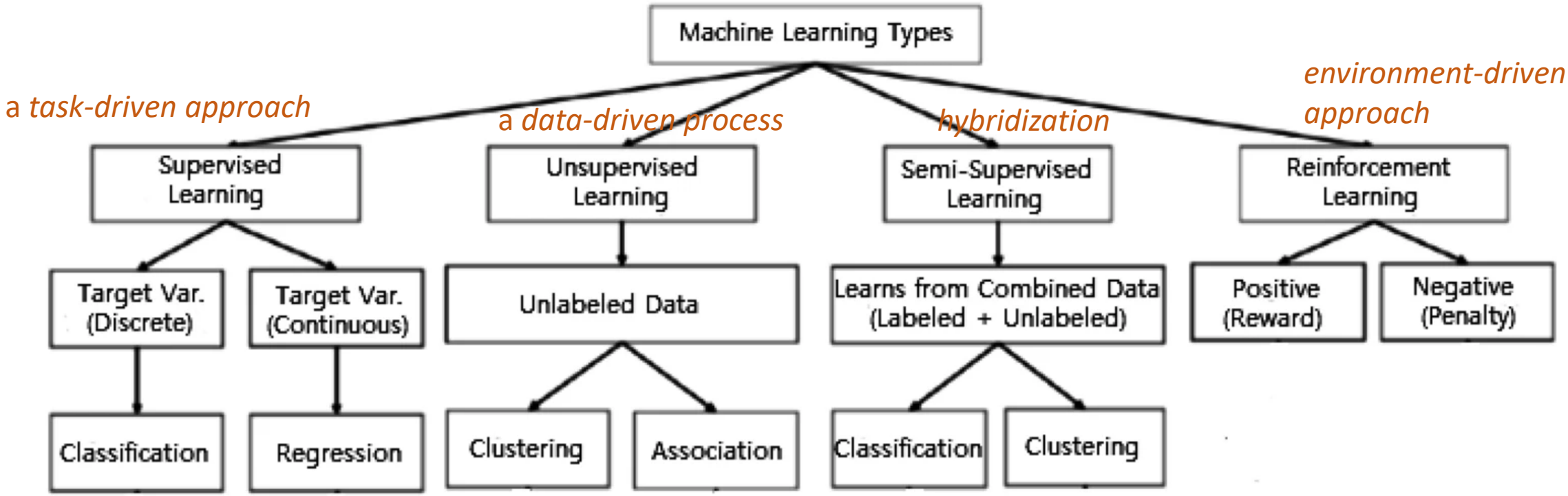
Motivations for Analytics

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

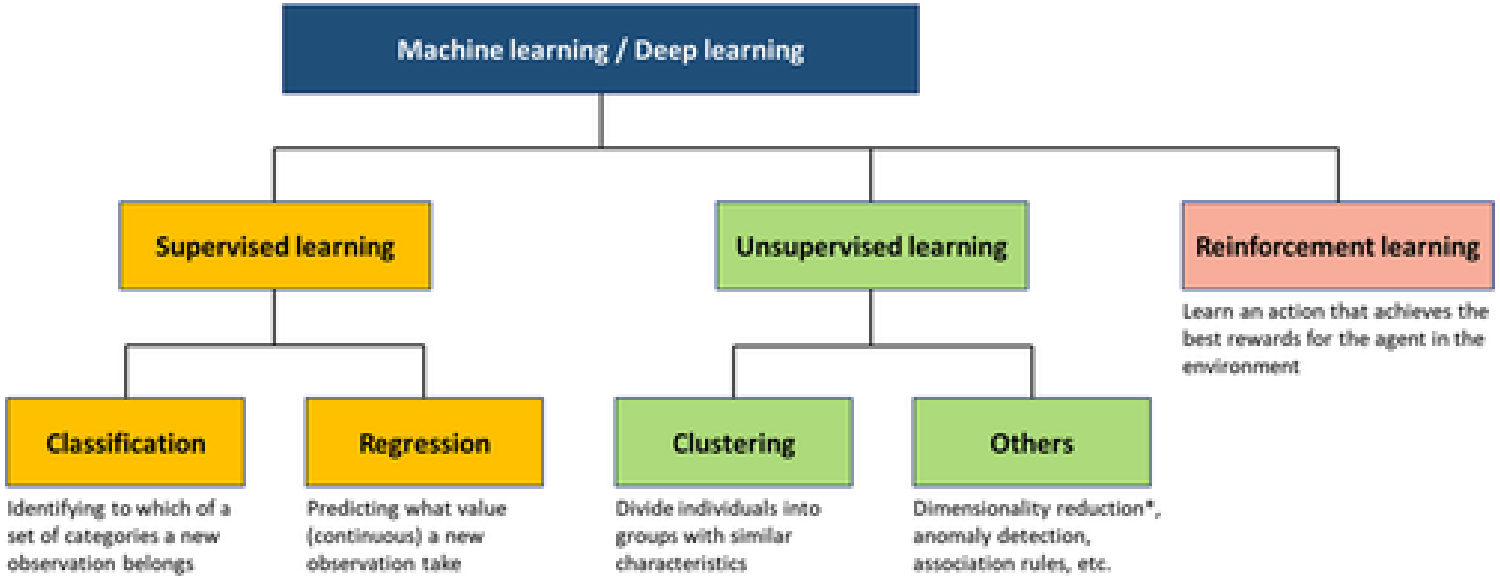


https://link.springer.com/article/10.1007/s42979-021-00592-x/figures/2

What AI / Analytics Can Do

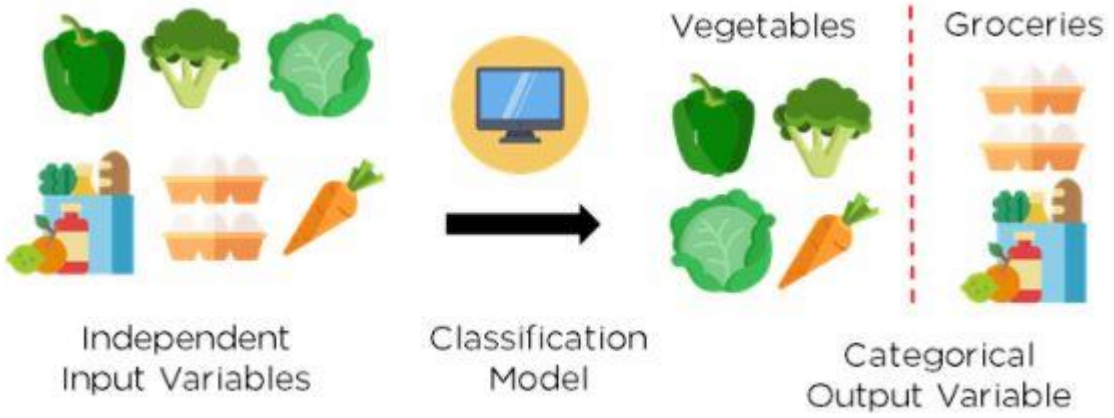
- Modern analytics is based mostly in supervised machine learning and neural networks, and these in turn provide algorithms for:
  - Classification
  - Regression
  - Clustering
  - Feature extraction
  - Rule learning
  - Prediction

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



Classification

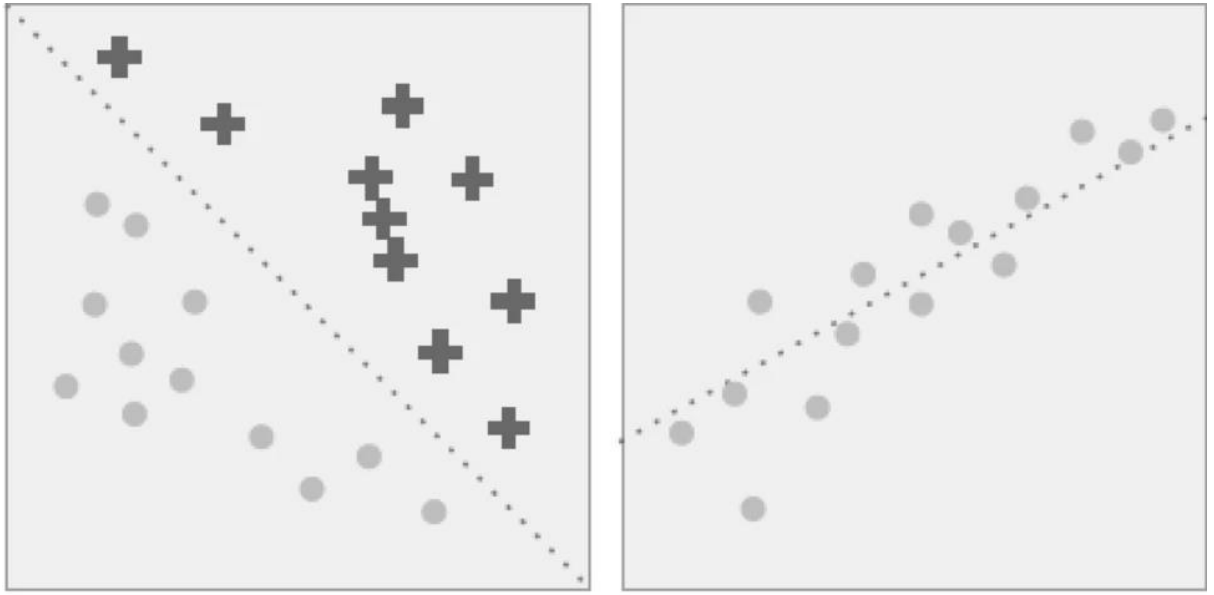
- Binary classification (true-false, yes-no)
- Multiclass classification (more than two class labels)
- Multilabel classification (more than one label per entity)



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



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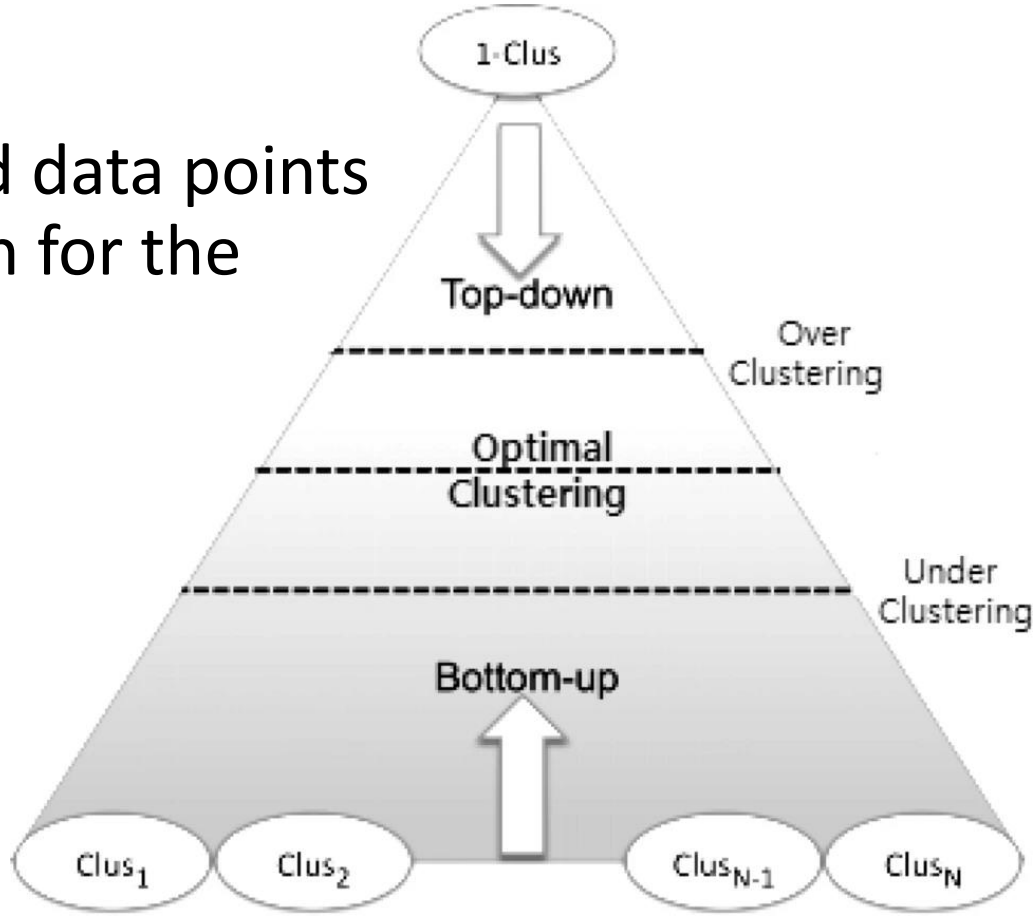
Clustering

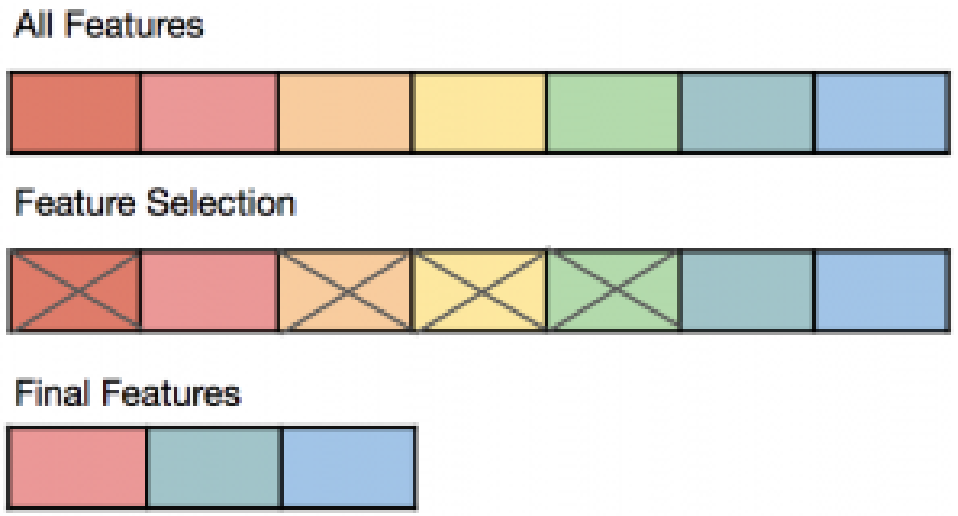
"Identifying and grouping related data points in large datasets without concern for the specific outcome" (Sarker, 2021)

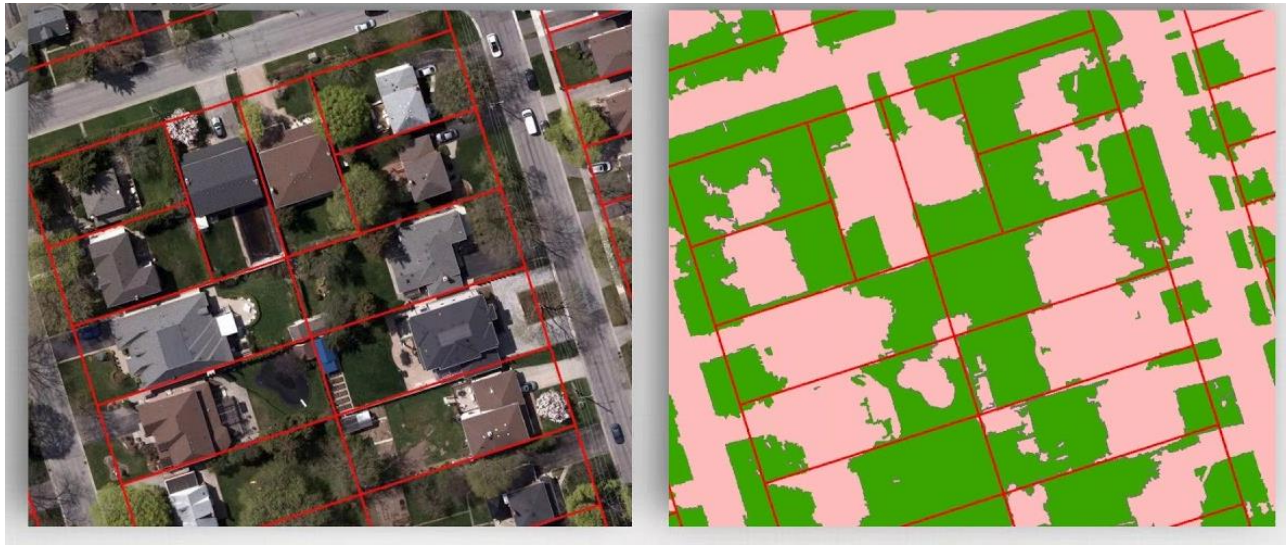


Methods:

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

Feature Extraction





- 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

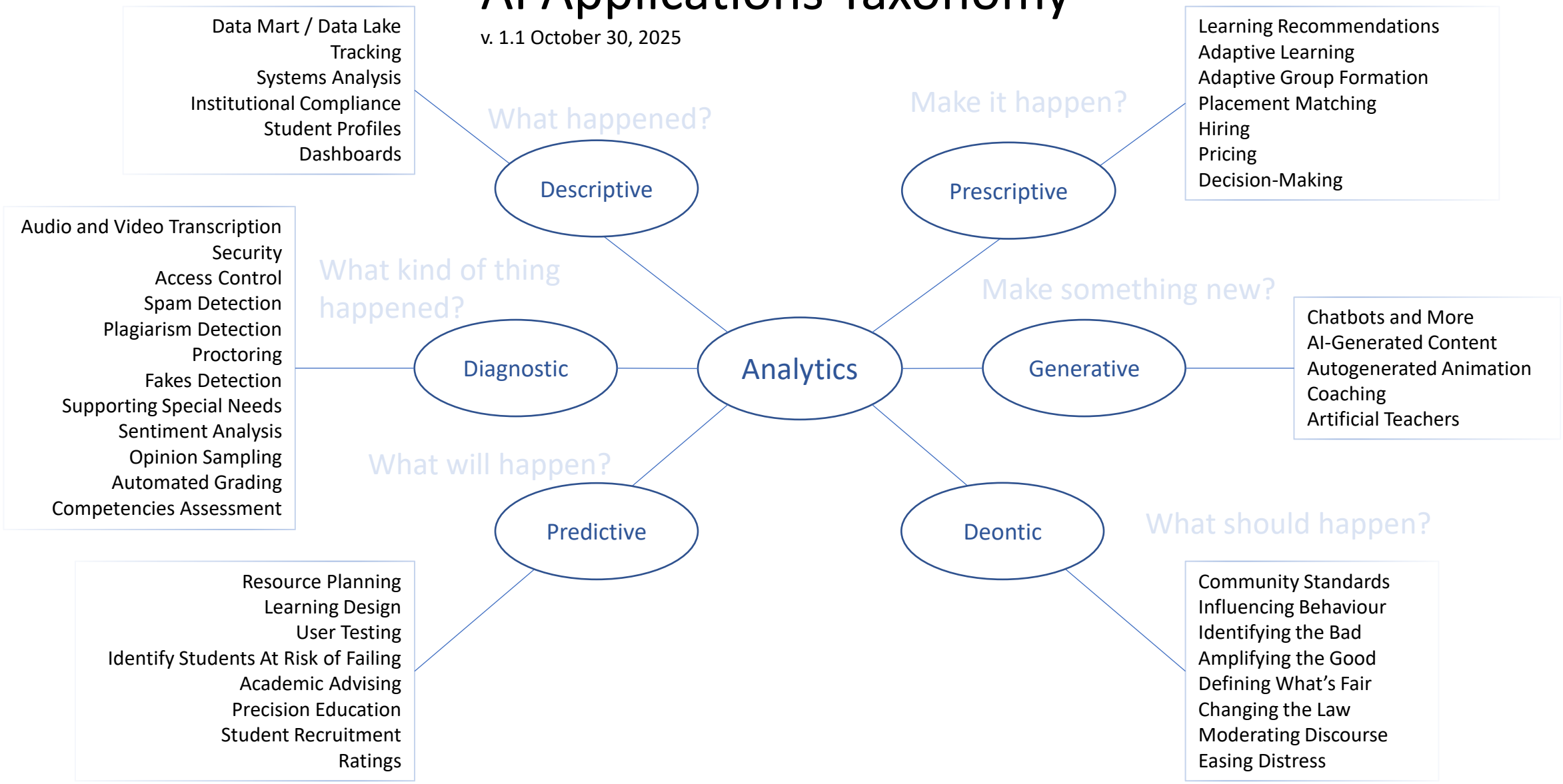
Types of Learning

- 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

AI Applications Taxonomy

v. 1.1 October 30, 2025



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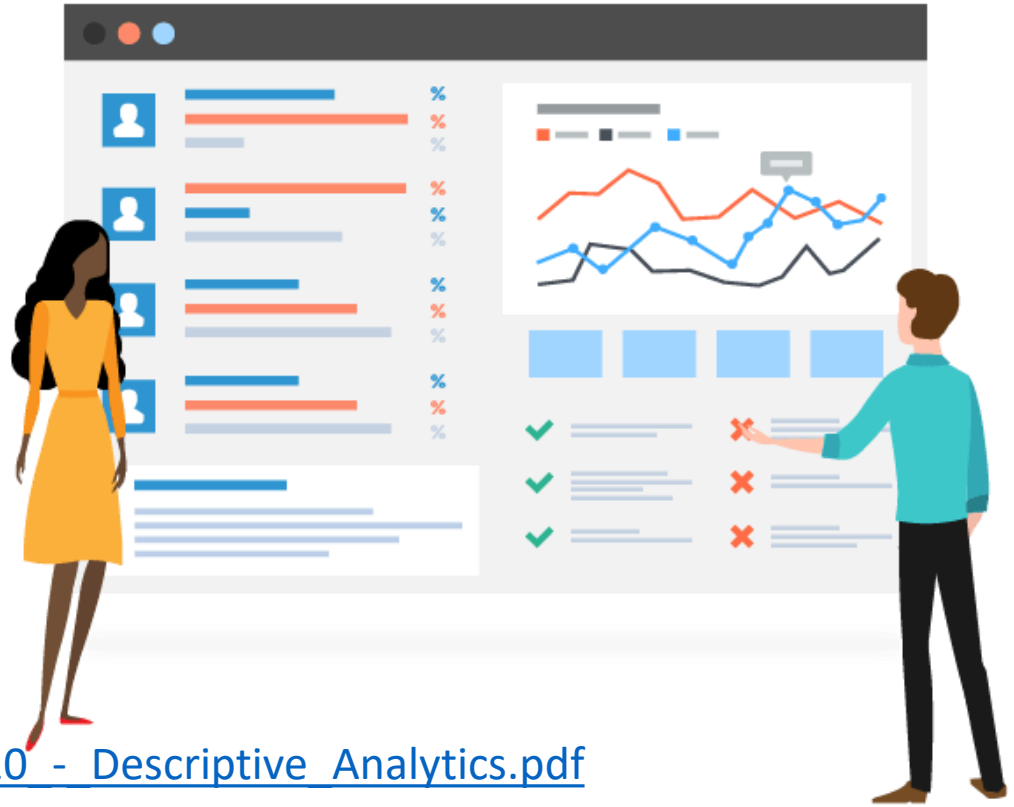
https://www.downes.ca/aitaxonomy.png

Descriptive Analytics

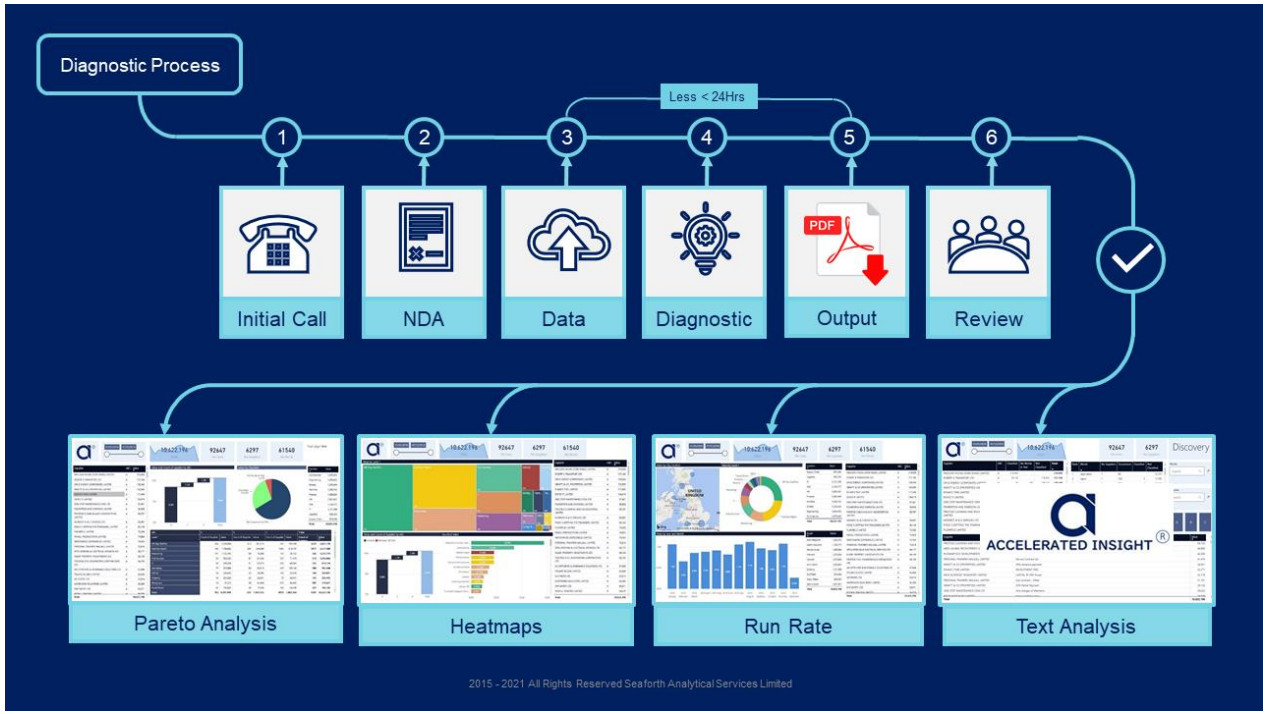
- Description, detection and reporting, including mechanisms to pull data from multiple sources, filter it, and combine it.
- Data aggregation and data mining are two techniques used



https://ethics.mooc.ca/files/documents/2021_10_20_-_Descriptive_Analytics.pdf

https://www.valamis.com/hub/descriptive-analytics

Diagnostic Analytics



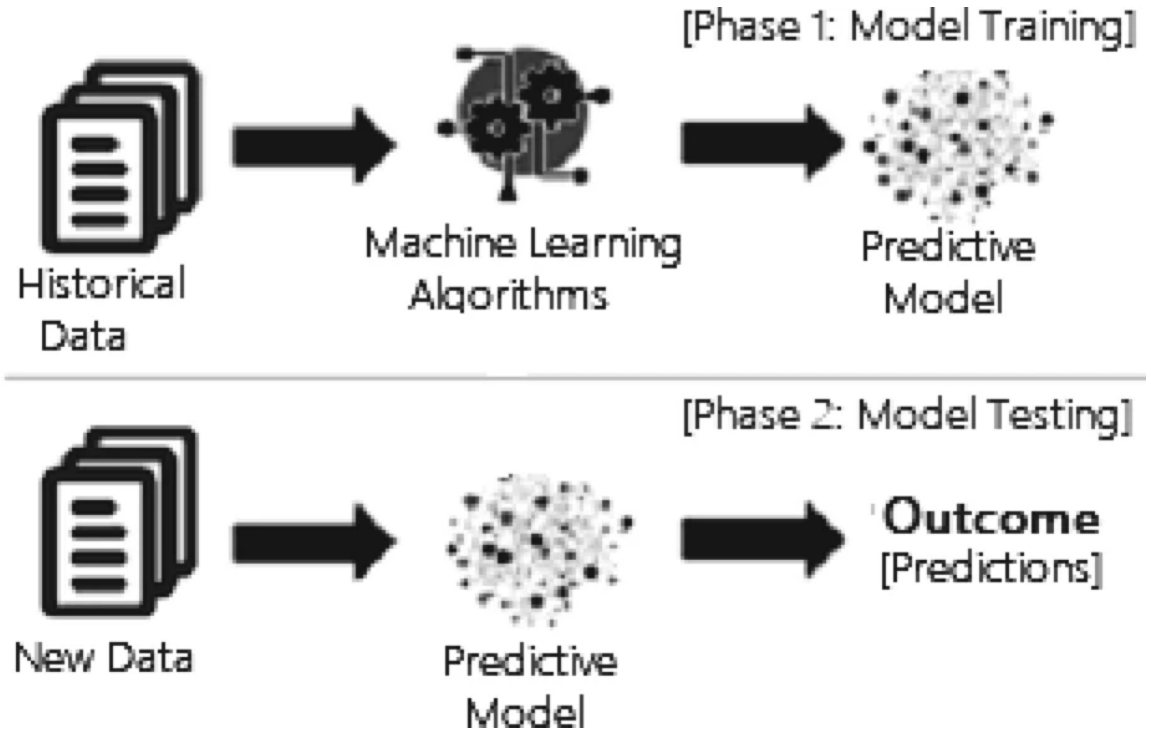
- Looks more deeply into data in order to detect patterns and trends.
- For example, to perform recognition, classification or categorization tasks.

https://ethics.mooc.ca/files/documents/2021_10_21_-_Diagnostic_Analytics.pdf

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://ethics.mooc.ca/files/documents/2021_10_22_-_Predictive_Analytics.pdf

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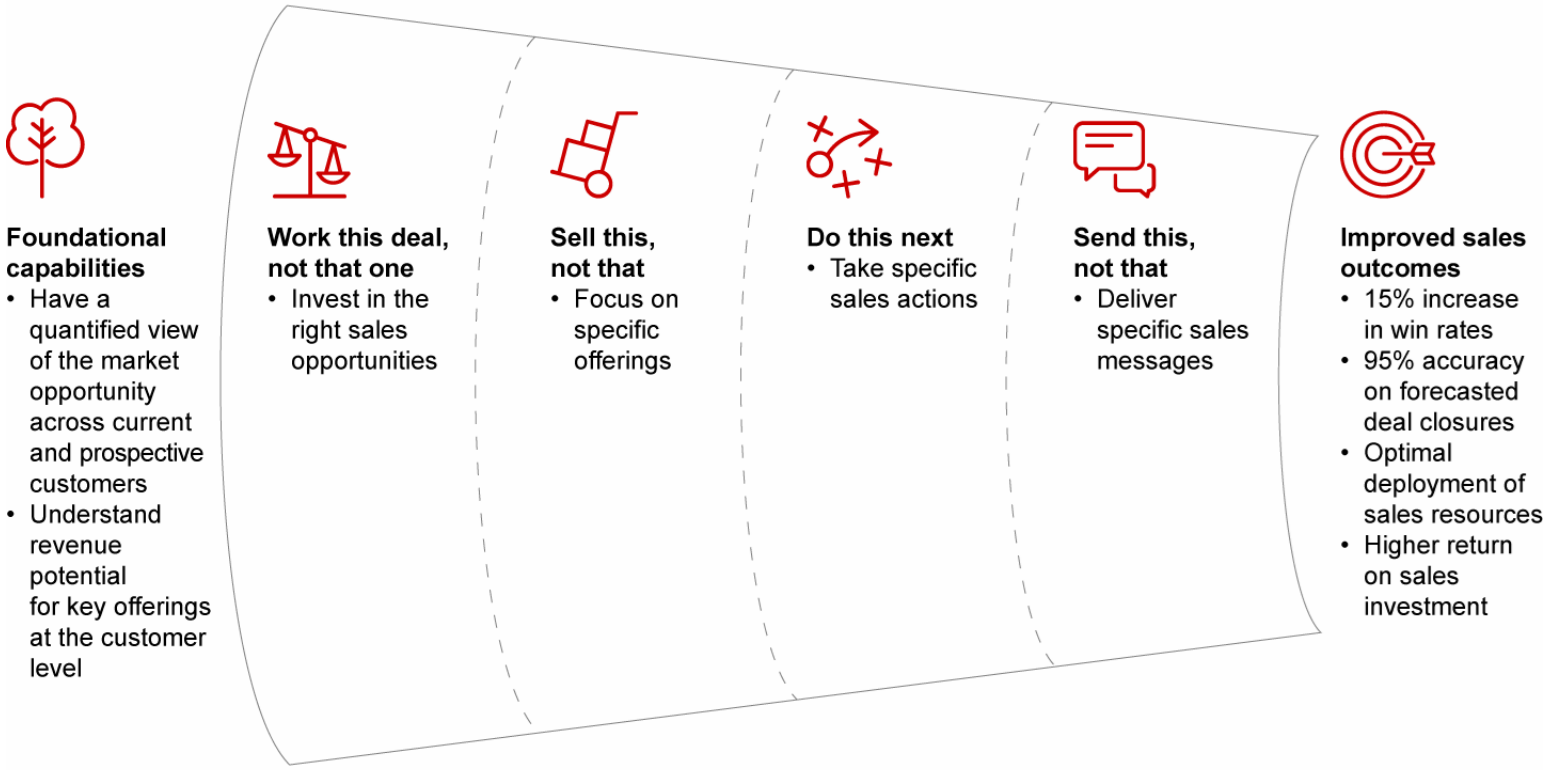
Prescriptive Analytics

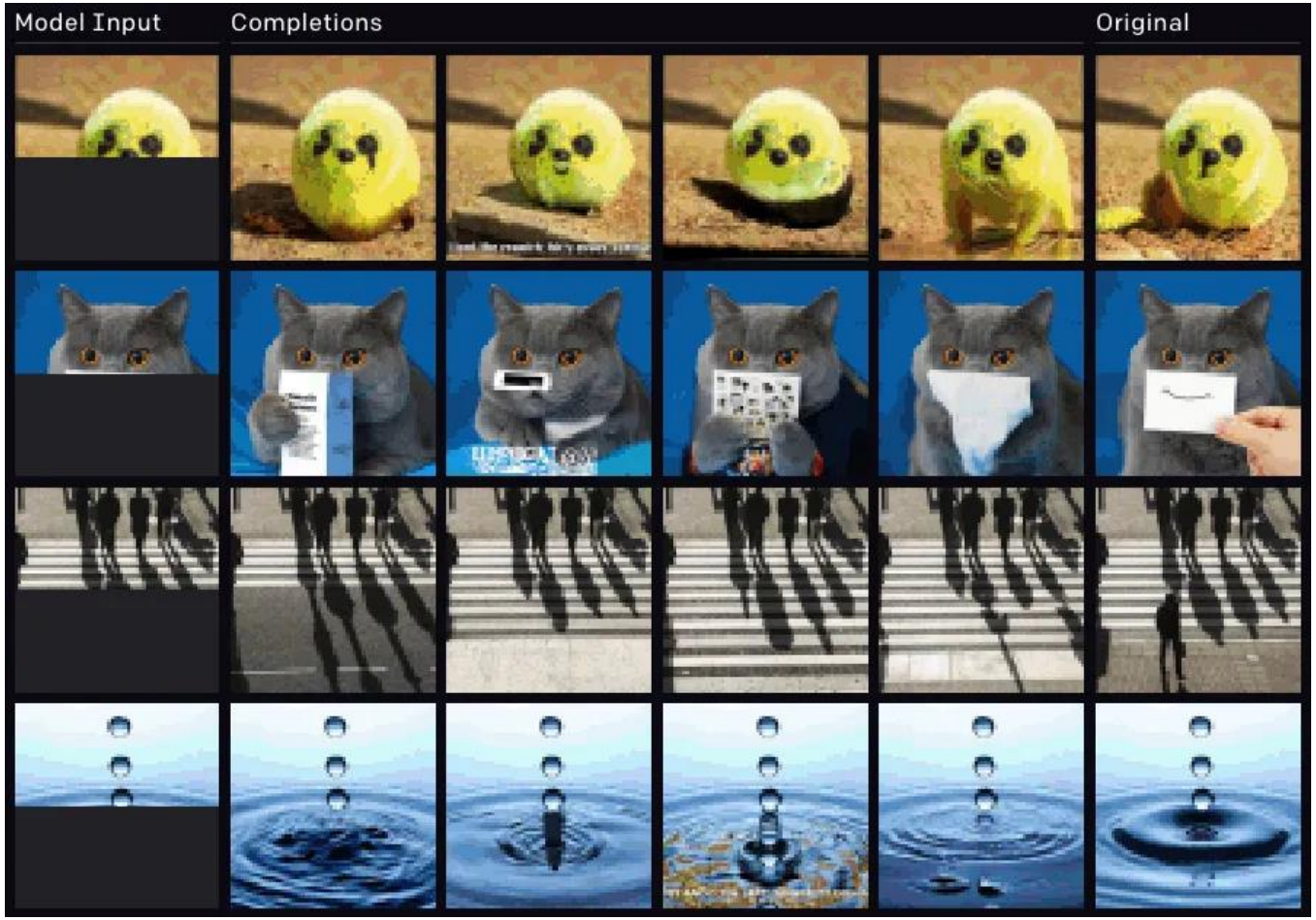


Source: Bain & Company

Prescriptive analytics recommend solutions.

https://ethics.mooc.ca/files/documents/2021_10_22_-_Predictive_Analytics.pdf
https://www.bain.com/insights/do-this-not-that-prescriptive-analytics-in-sales-and-marketing/

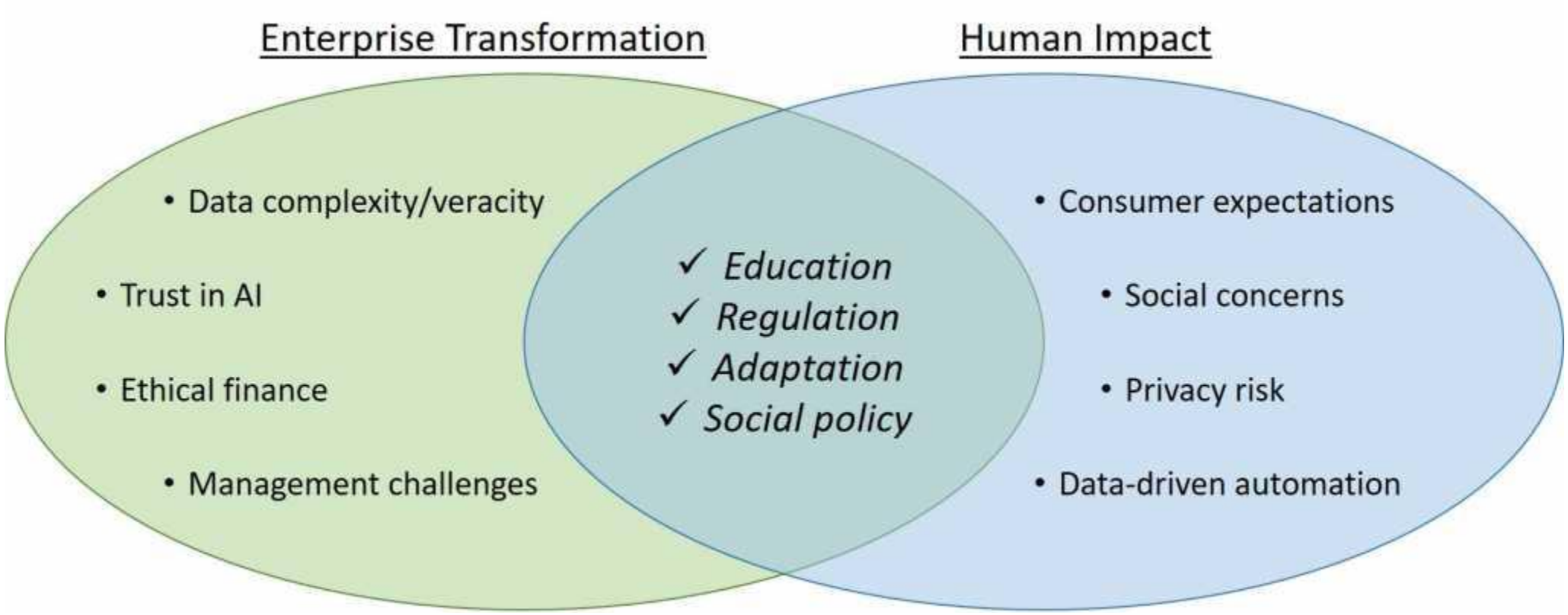
Generative Analytics



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

https://ethics.mooc.ca/files/documents/2021_10_24_-_Generative_Analytics.pdf
https://www.theverge.com/21346343/gpt-3-explainer-openai-examples-errors-agi-potential

Deontic Analytics



https://insightaas.com/new-research-ai-and-advanced-analytics-connecting-culture-ethics-and-society-in-a-machine-age/
https://ethics.mooc.ca/files/documents/2021_10_26_-_Deontic_Analytics.pdf

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