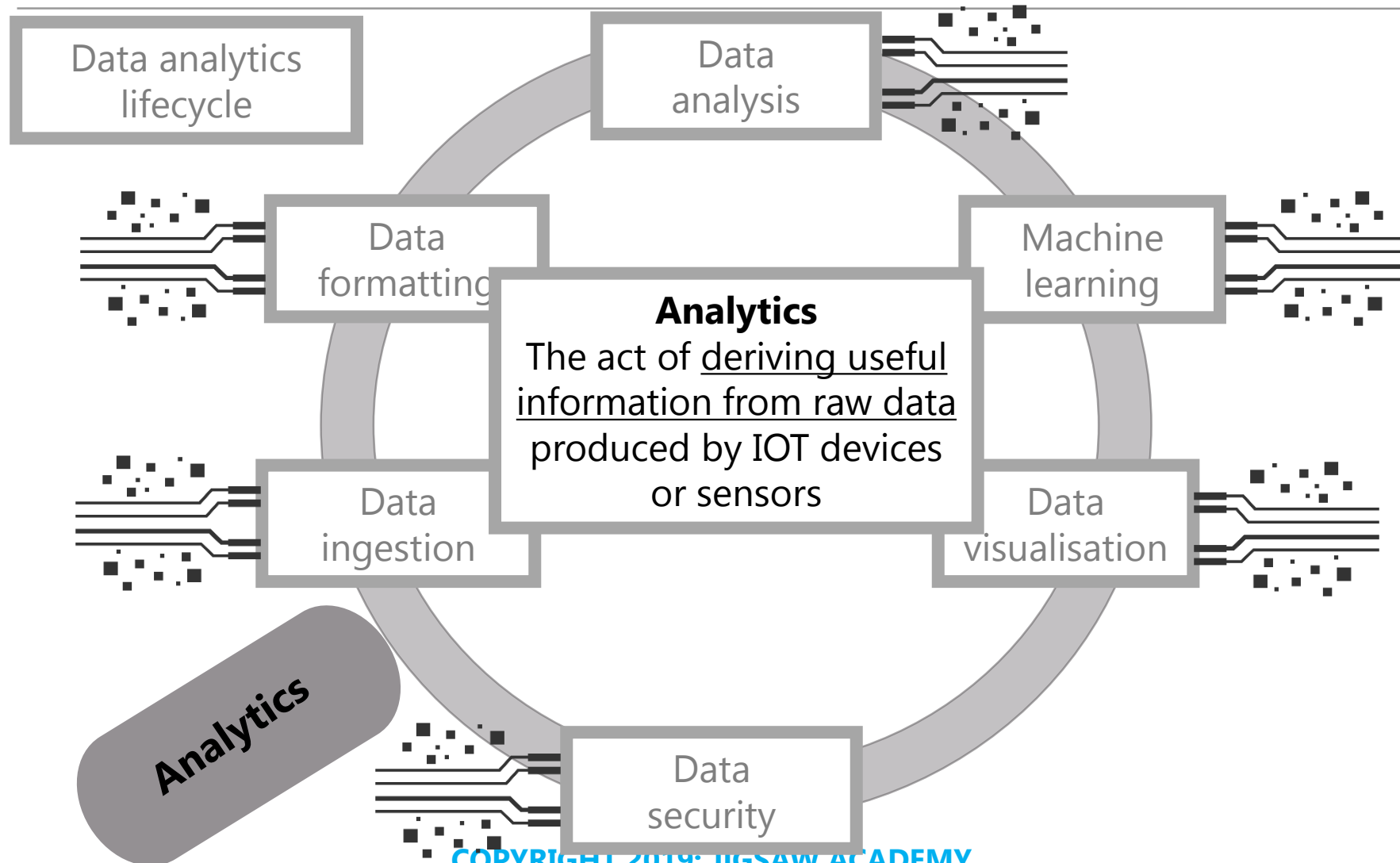


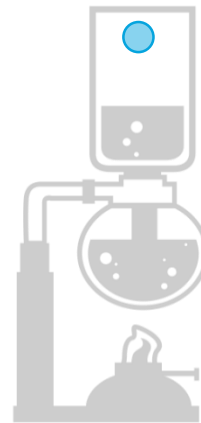


Introduction to IOT Analytics

Review



Information Extraction

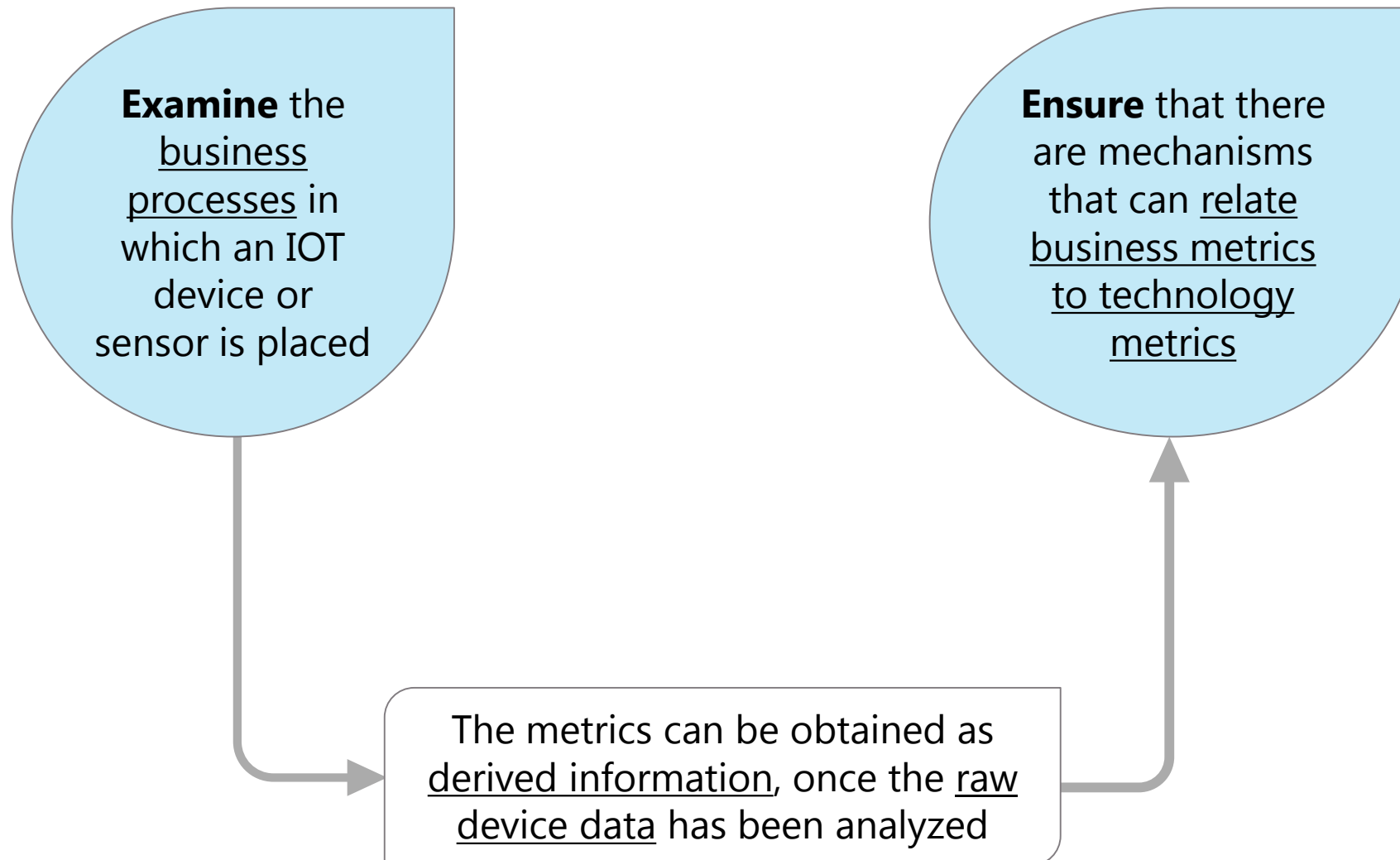


Refinement of information
abstracted from data

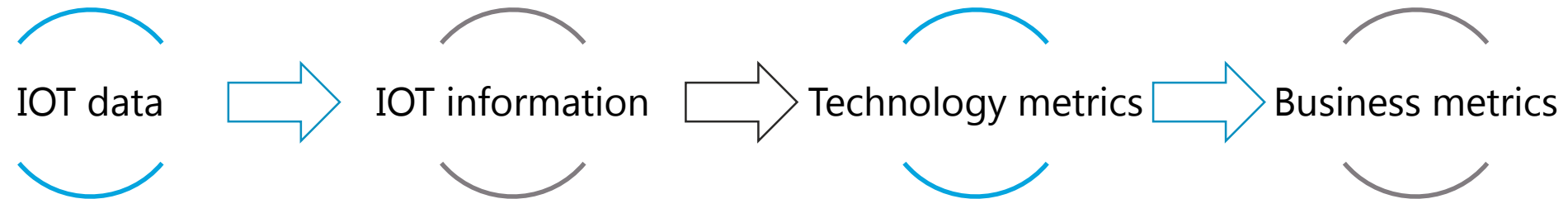
Technology
metrics

Business
metrics

Information Extraction



Information Extraction



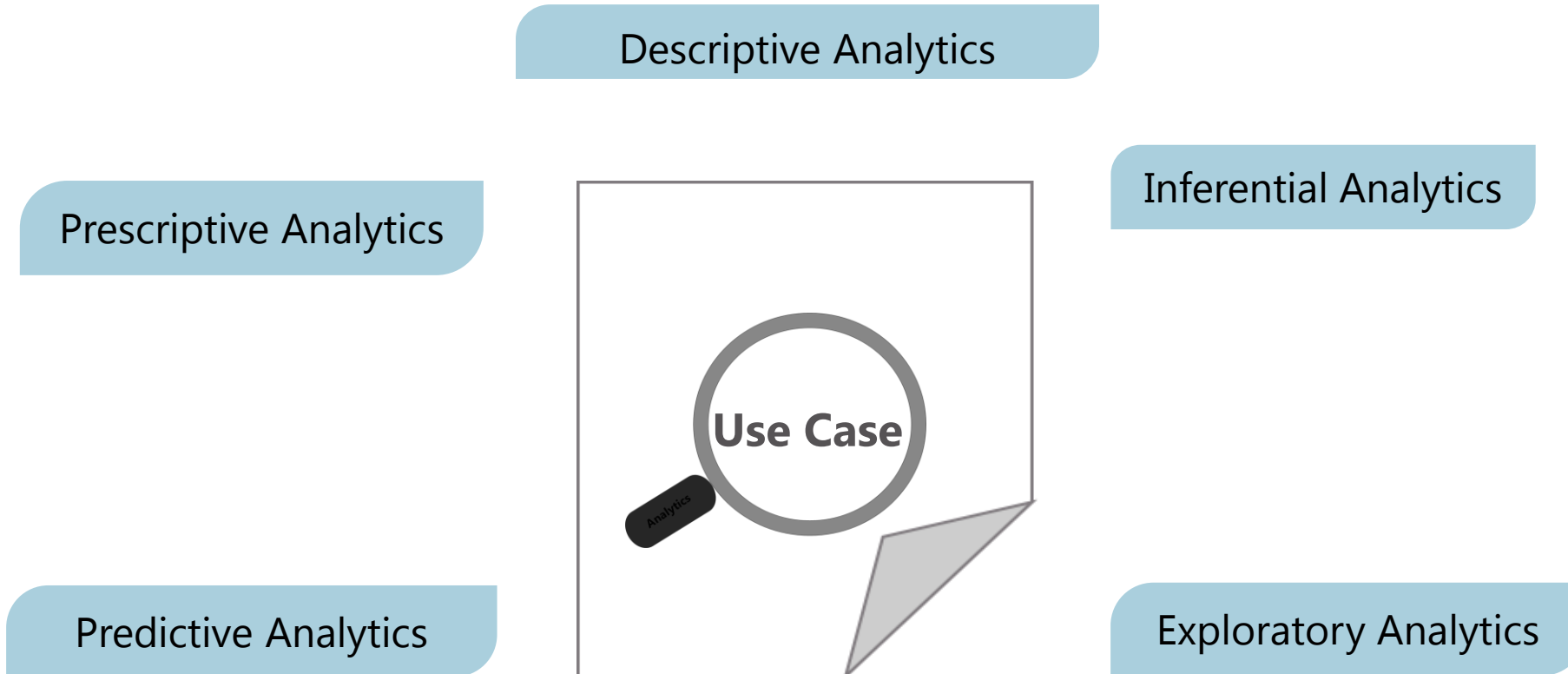
On occasion you might stop at IT technology metrics due to lack of a history of business processes

Raw data itself is useful on dimensions of derivation

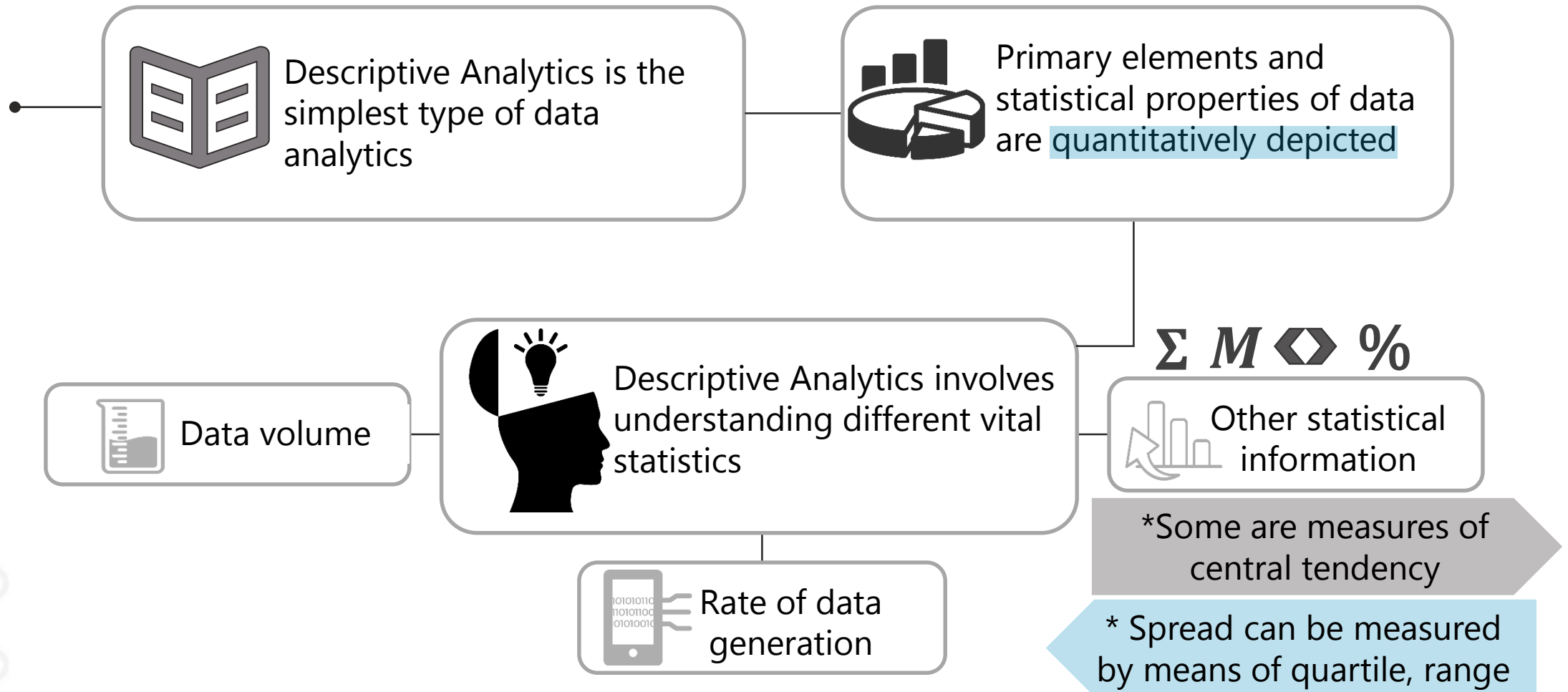
Instead it is possible to work with **derived technology metrics** from devices

In other cases **additional inferred data** must be derived from the original data stream (typical of most analytics projects)

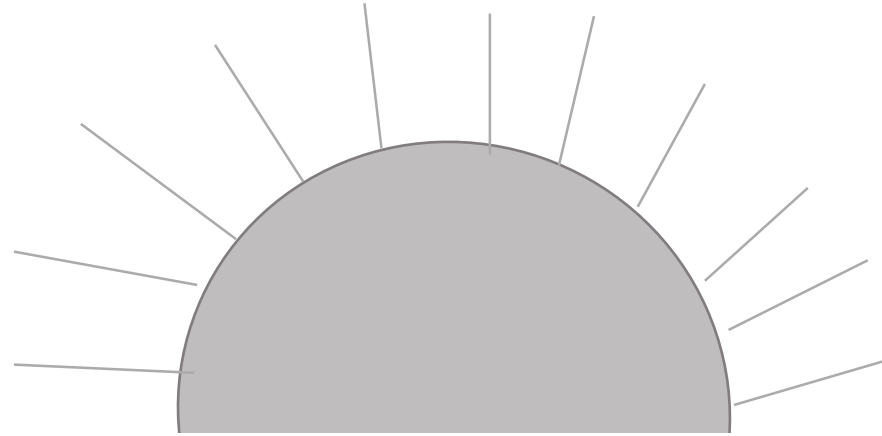
Types of Analytics



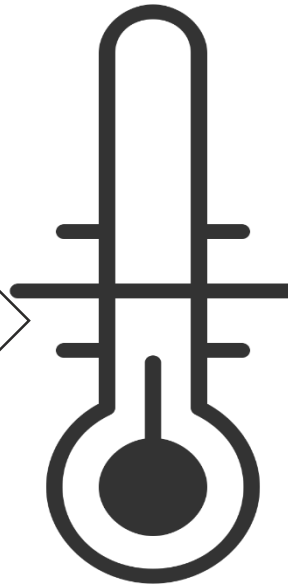
Descriptive Data Analytics



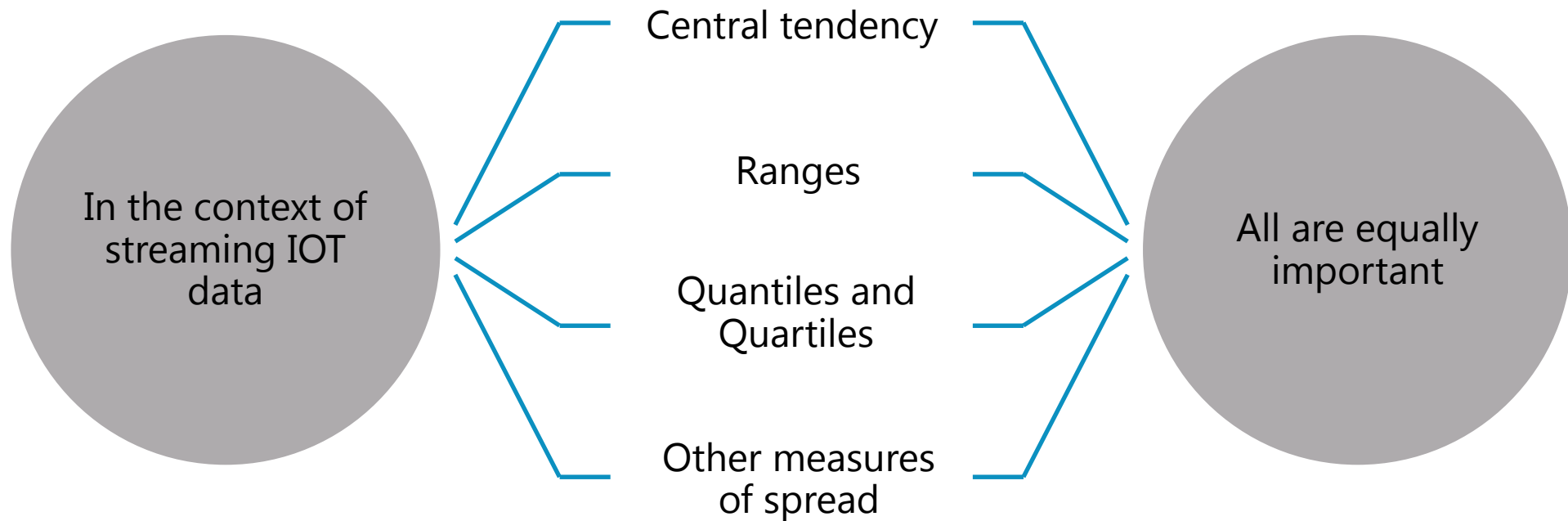
Descriptive Data Analytics: Example



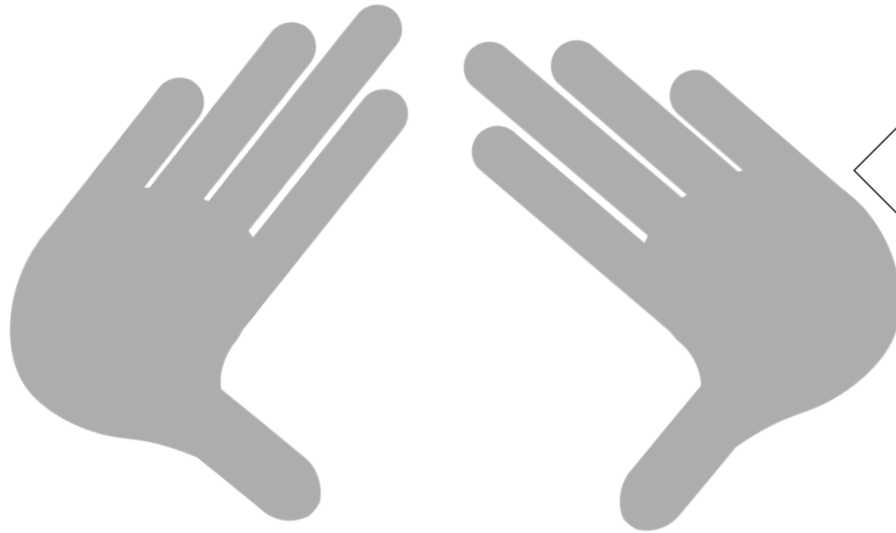
Average temperature of the day



Descriptive Data Analytics: Example



Descriptive Data Analytics



Use this measure to

- Provision additional equipment
- Fine tune existing equipment

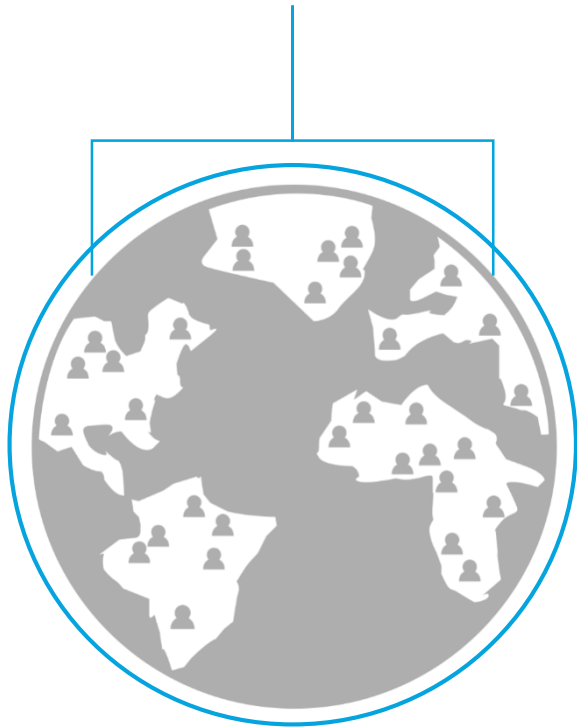
In case of outliers

- It could be a fault in the equipment
- Too much deviation from the average, can be attributed to a malfunctioning device



Descriptive Data Analytics

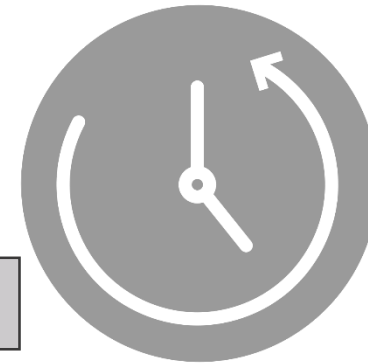
Descriptive Data Analysis works on the entire population of the data



1 hr

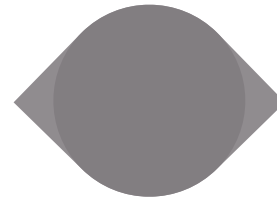
1 day

100 sliding entries

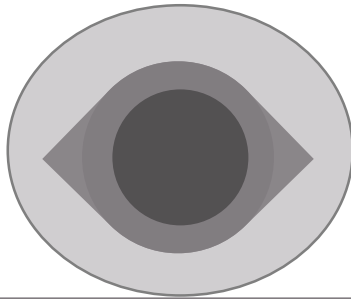


Consider a window of a data on which you could perform this kind of measure

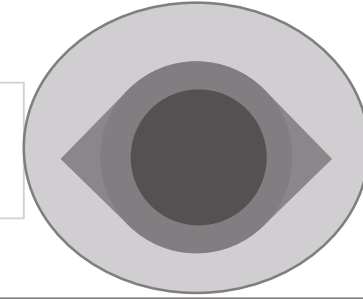
Inferential Data Analytics



No attempt to obtain data
related to the entire population



- Test hypothesis on a smaller set of data
- Generalize to the entire population



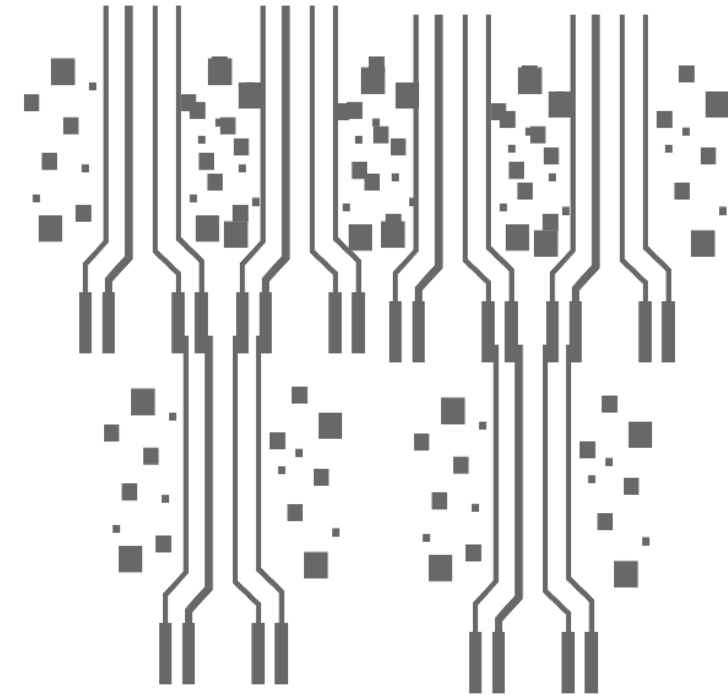
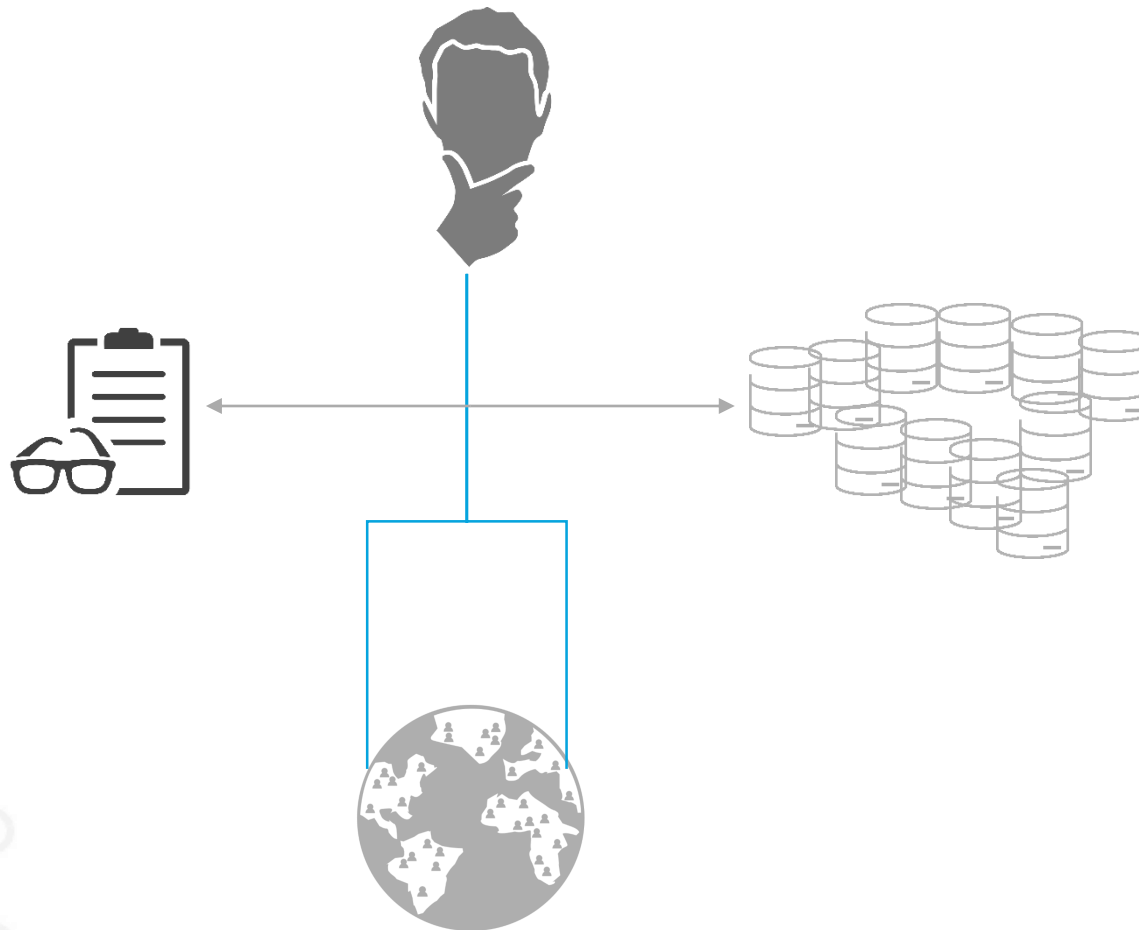
Aim

- Estimate **properties** of entirety of data
- Utilize a **summary** of the properties of a subset of the data to do this

Methodology

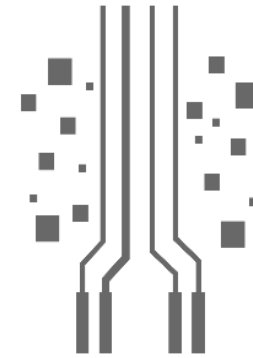
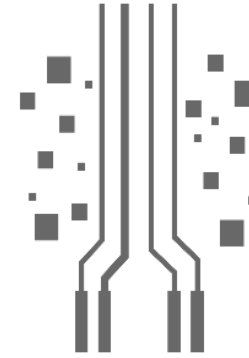
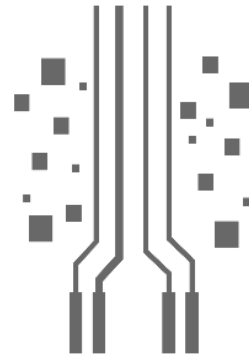
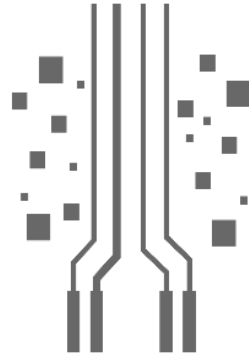
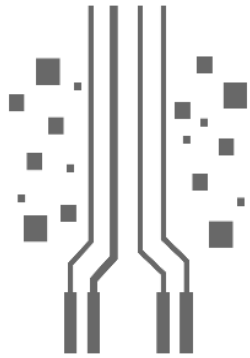
- Identify samples of the original data
- Generalize findings to entire population of data

Inferential Data Analytics



A Descriptive Data Analysis of large volume, high velocity data, is time consuming

Inferential Data Analytics



With large, streaming, high velocity data
simple and **fast** approximation
methods are needed

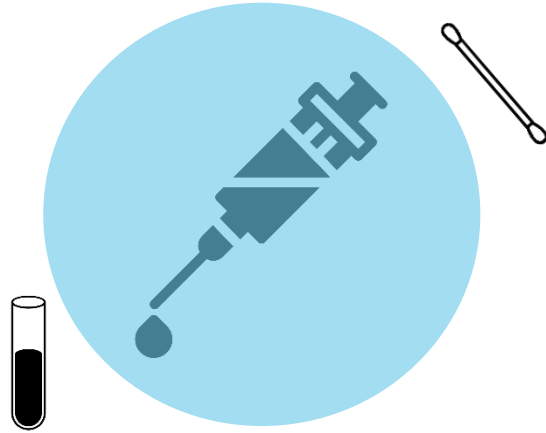
In IOT there are **two** approaches

- Sampling
- Sketching

Both are used to test hypotheses

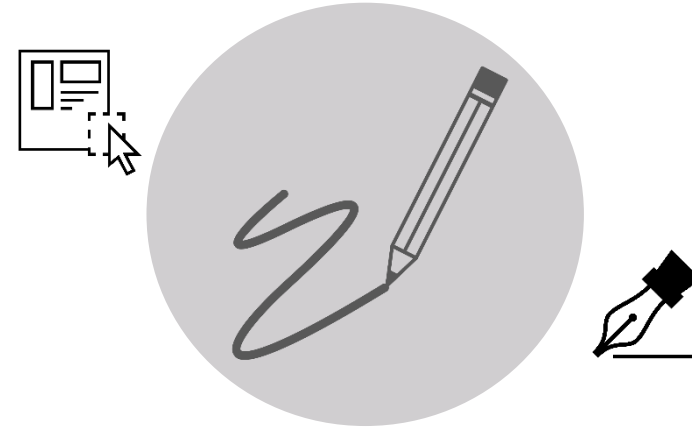
This gives us an idea of a smaller subset of data
rather than of the entire
body of data

Inferential Data Analytics



Sampling

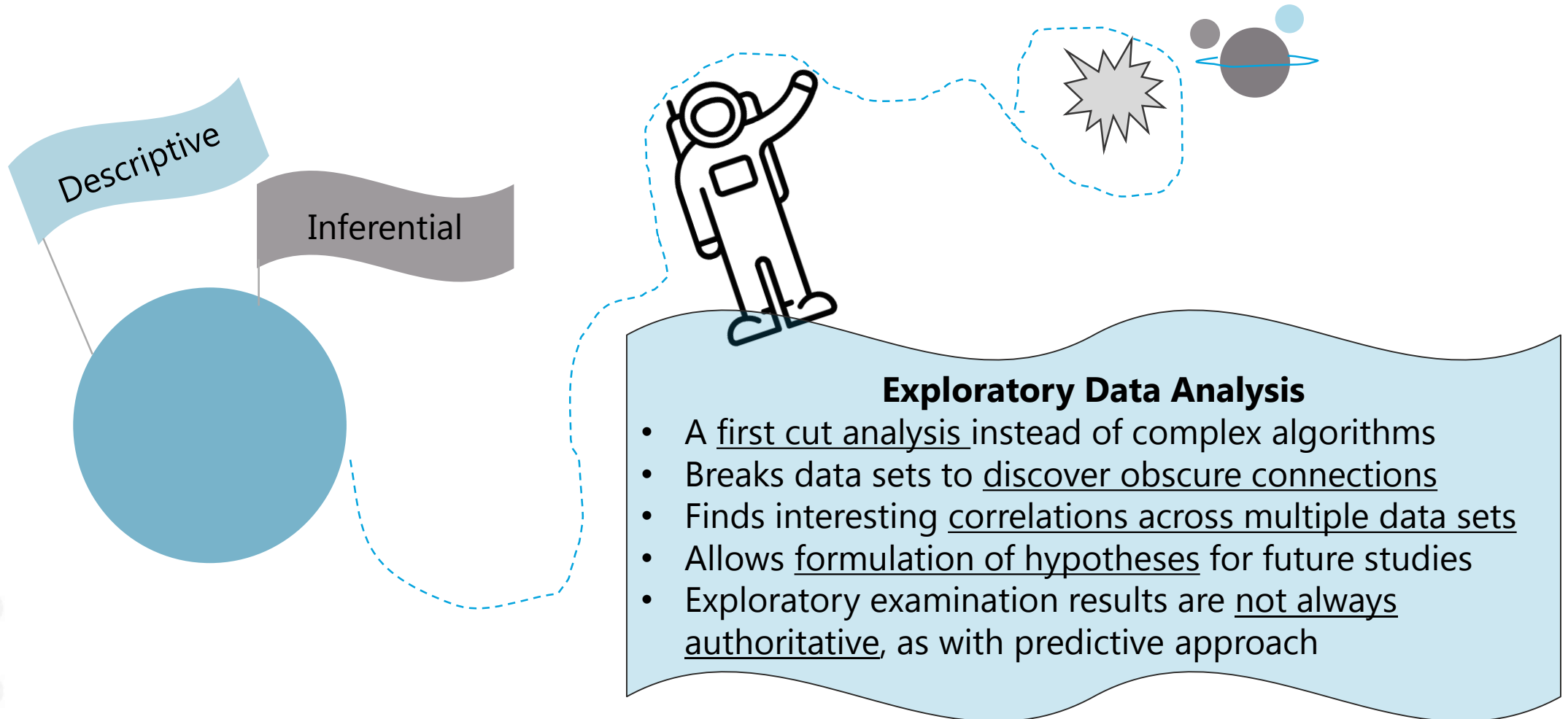
- Applicable to random subsets of the larger population of data
- Utilizes smaller subsets



Sketching

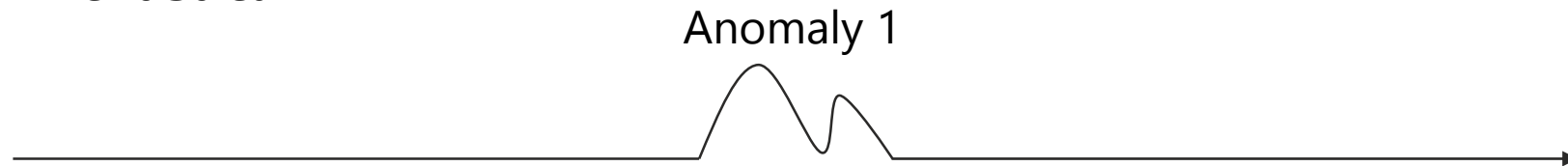
- An approximation technique for the entire population
- Fast
- Uses metrics that visualize the entire population, even when not working with them
- Uses efficient approximation algorithms

Exploratory Data Analytics

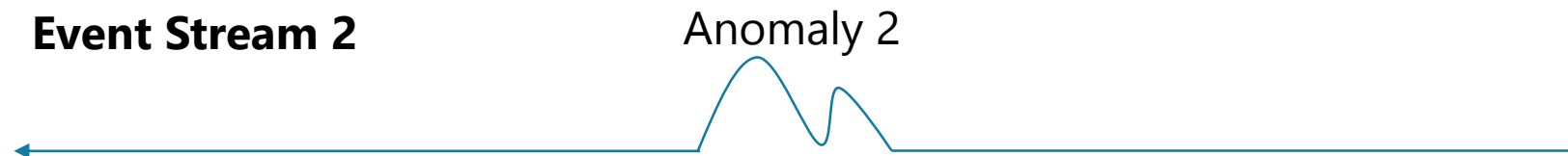


Exploratory Data Analytics

Event Stream 1

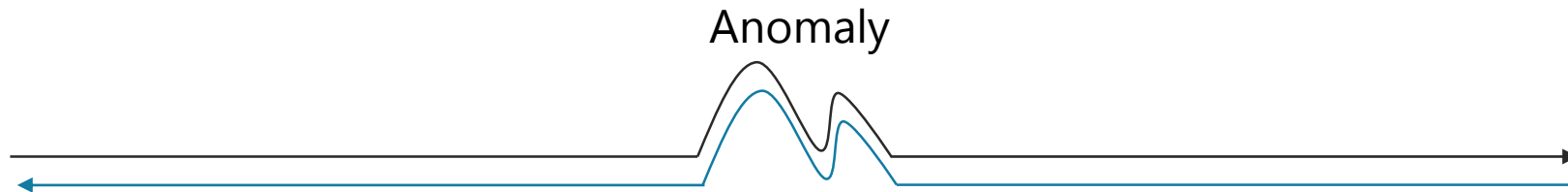


Event Stream 2



Exploratory Data Analytics

Event Stream 1



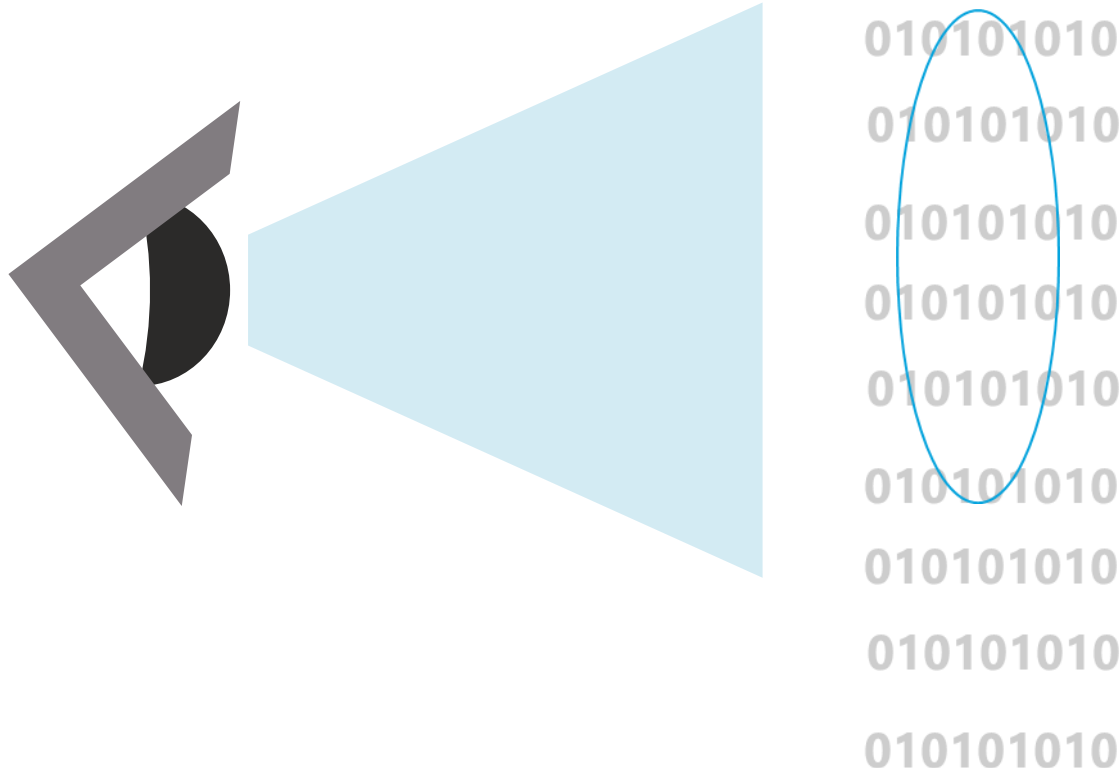
Event Stream 2

This occurrence is a sign that there is

- A common root cause of failure/fault
- A need for a detailed analysis of the corresponding data

Exploratory Data Analytics

Exploratory Data Analysis does not involve running **complex algorithms** on the entire data... Instead data is examined for **correlations**, **associations**, or any **rough heuristic ideas** based on the visual identification of correlated behaviour



Exploratory Data Analytics

- The key is not to do detailed data analysis with complex algorithms
- It is to get cues on what the patterns or hypothesis could be

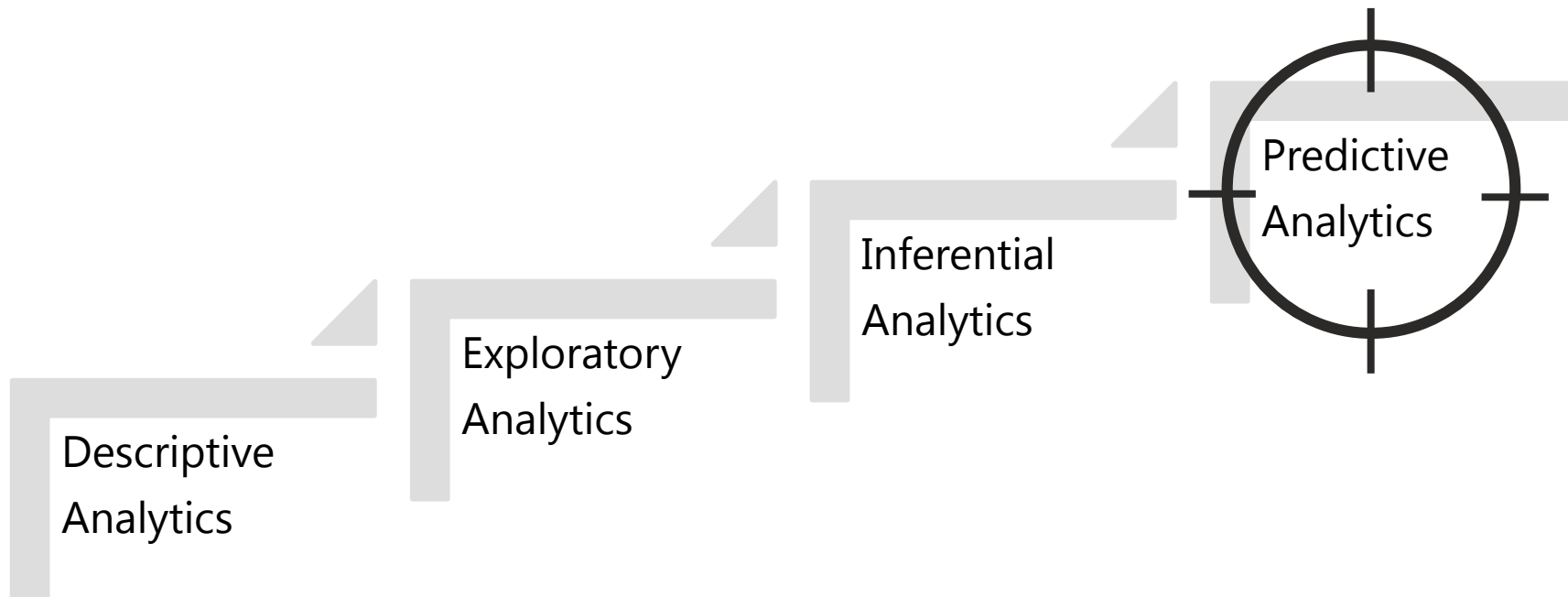


These cues involve

- Correlations
- Elementary visualizations
- Understanding the simultaneous occurrence of anomalies

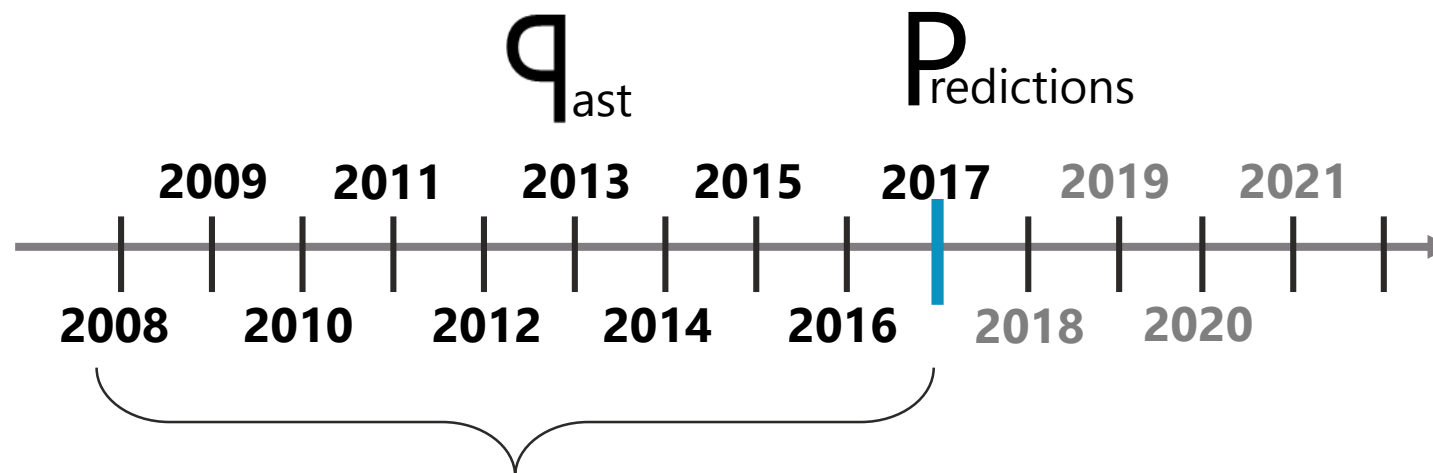
Predictive Data Analytics

- Predictive Data Analytics is at the crux of data analytics
- It deals with complex algorithms applied to data streaming from IOT devices



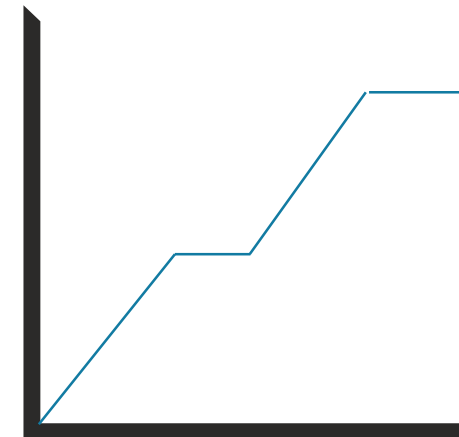
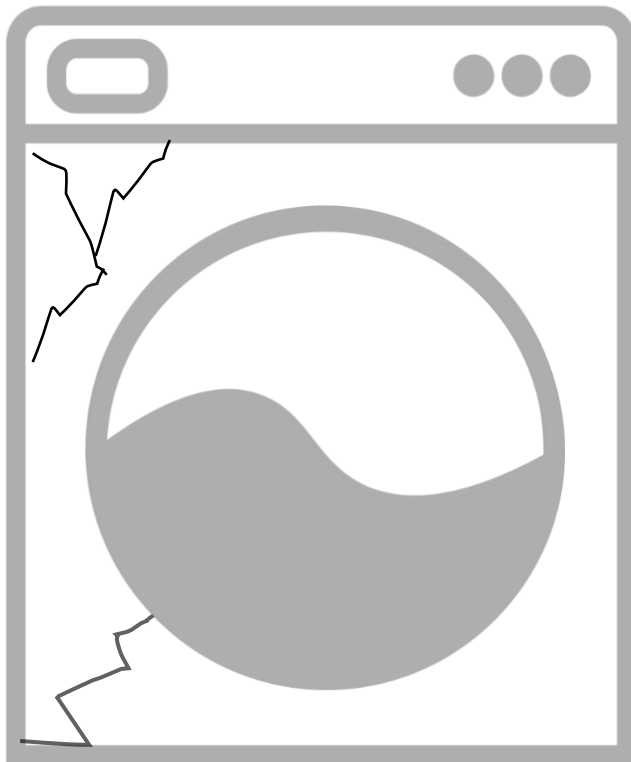
Predictive Data Analytics

- Utilize data to predict **values/behaviour/patterns** of data for future scenarios
- May not be always an accurate prediction at first
- Reiterate different factors which the generated model may perfect
- The prediction algorithm improves over time with more and more of data
- The more past information there is, the higher the predictability of the model



Predictive Data Analytics - Examples

- **Develop** a model of stress patterns that affect the machine
- **Determine** which patterns indicate a potential fault
- **Decide** on a prescriptive course of action that includes preventive maintenance



Historical pattern of stress

Predictive Data Analytics

Look at the temperature range for today...



Predictive Data Analytics

Predict the temperature range for tomorrow...



Predictive Data Analytics

Predictive Data Analytics uses several statistical regression and machine learning algorithms for such predictions

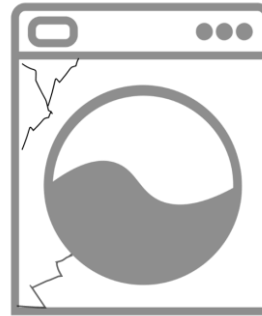


Predictive Data Analytics

Predictive data analytics has the richest class of algorithms utilizing analytics



In machinery it could be predicting a fault

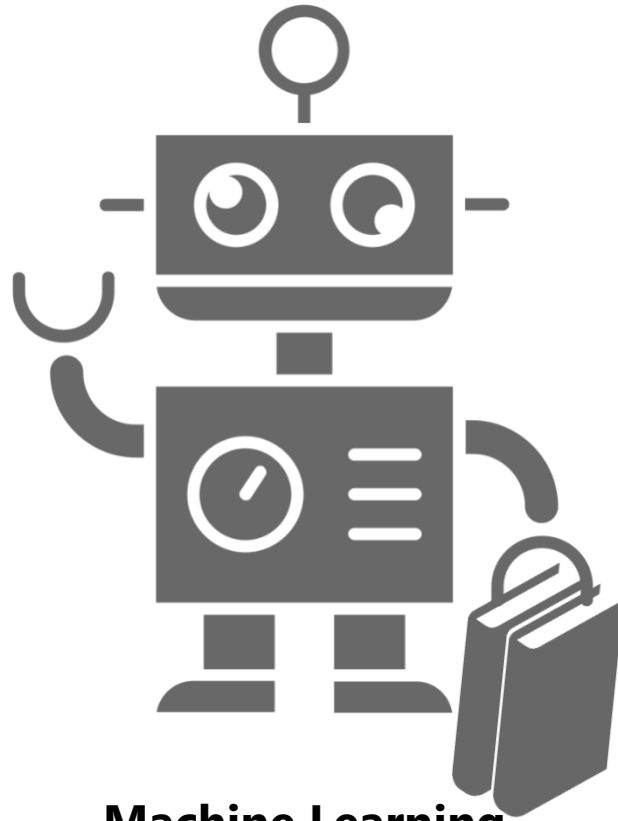


It could be predicting a certain weather condition

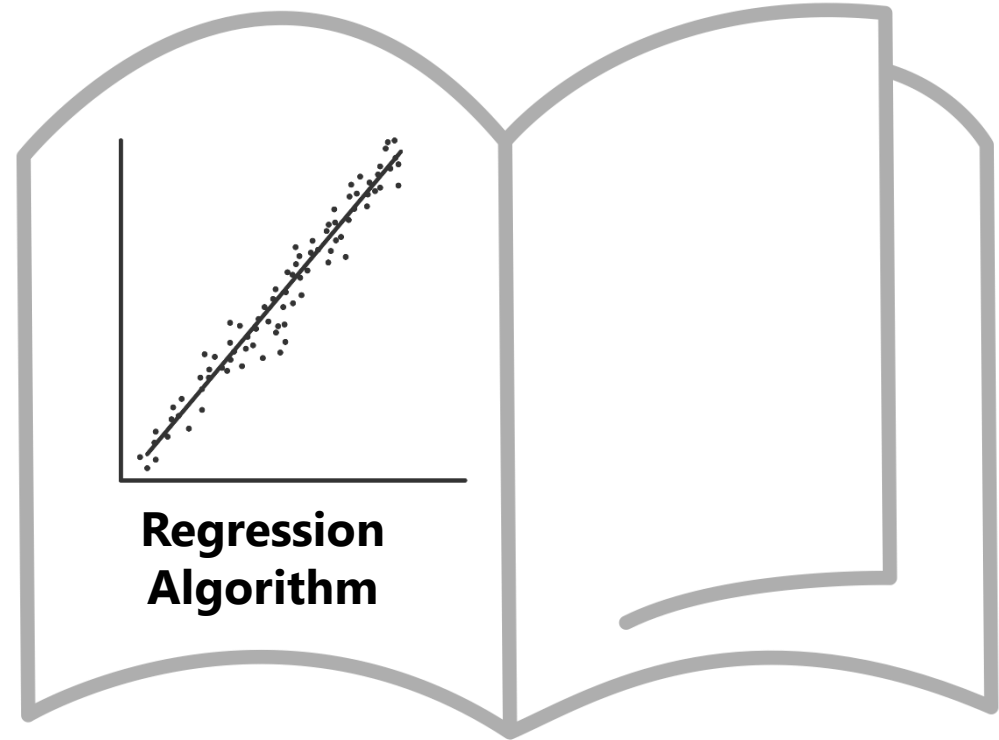


Depending upon the domain the prediction task could vary

Predictive Data Analytics

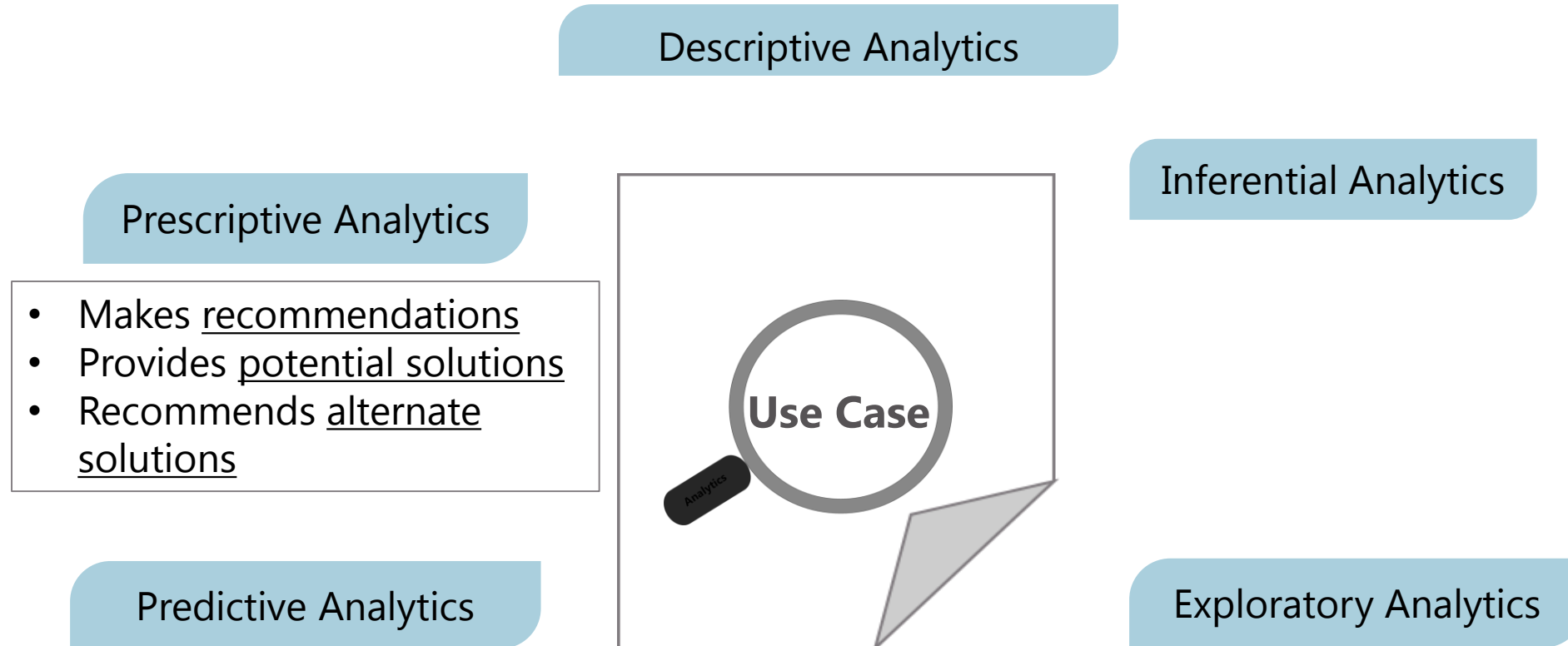


Machine Learning



The factors used to provide data to regression models are also responsible for generating accurate predictive models

Prescriptive Data Analytics



Prescriptive Data Analytics

"People who bought this, also bought..."



Prescriptive Data Analytics **offers** personalized recommendations based on previous purchases

Upselling and cross-selling recommendations are examples of Prescriptive Data Analytics



Predictive analytics **determines**

- An individual's past behaviour
 - That of people who buy similar things
- And then makes a recommendation