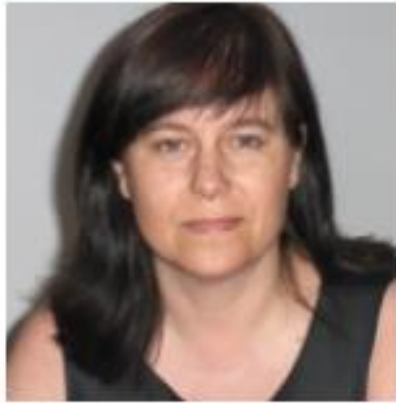


Unlocking the Algorithm of Research Methods

Keynote Speaker



Maria José Sousa
*Unlocking the
Algorithm of
Research
Methods*

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ECRM

20th European
Conference on
Research
Methodology for
Business and
Management
Studies

17 - 18 June 2021, a
Virtual Conference

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Unlocking the Algorithm of Research Methods

Algorithms in Research Methods

Unlocking the Algorithm of Research Methods

Unlocking the Algorithm of RM:

01

- ▶ involves sophisticated analysis of data.

02

- involves integrating data from different sources.

03

- ▶ involves big data analytics and machine learning techniques to collect, and analyse data.

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- ▶ **A machine learning algorithm** is a mathematical expression that represents data in the context of a problem.
- ▶ The aim is to go from data to insights.
- ▶ For example, if an online retailer wants to anticipate sales for the next quarter, they might use a machine learning algorithm that predicts those sales based on past sales and other relevant data.

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- ▶ **Supervised** ML techniques when we have a unit of data that we want to predict or explain.
 - ▶ Classification
 - ▶ Speech Recognition (software Phyton)
 - ▶ Regression
 - ▶ Predict Time Series (software EViews)
- ▶ **Unsupervised** ML techniques looks at ways to relate and group data without the use of a target variable to predict.
 - ▶ Finding clusters of the data
 - ▶ Finding interesting directions in data
 - ▶ Finding novel observations

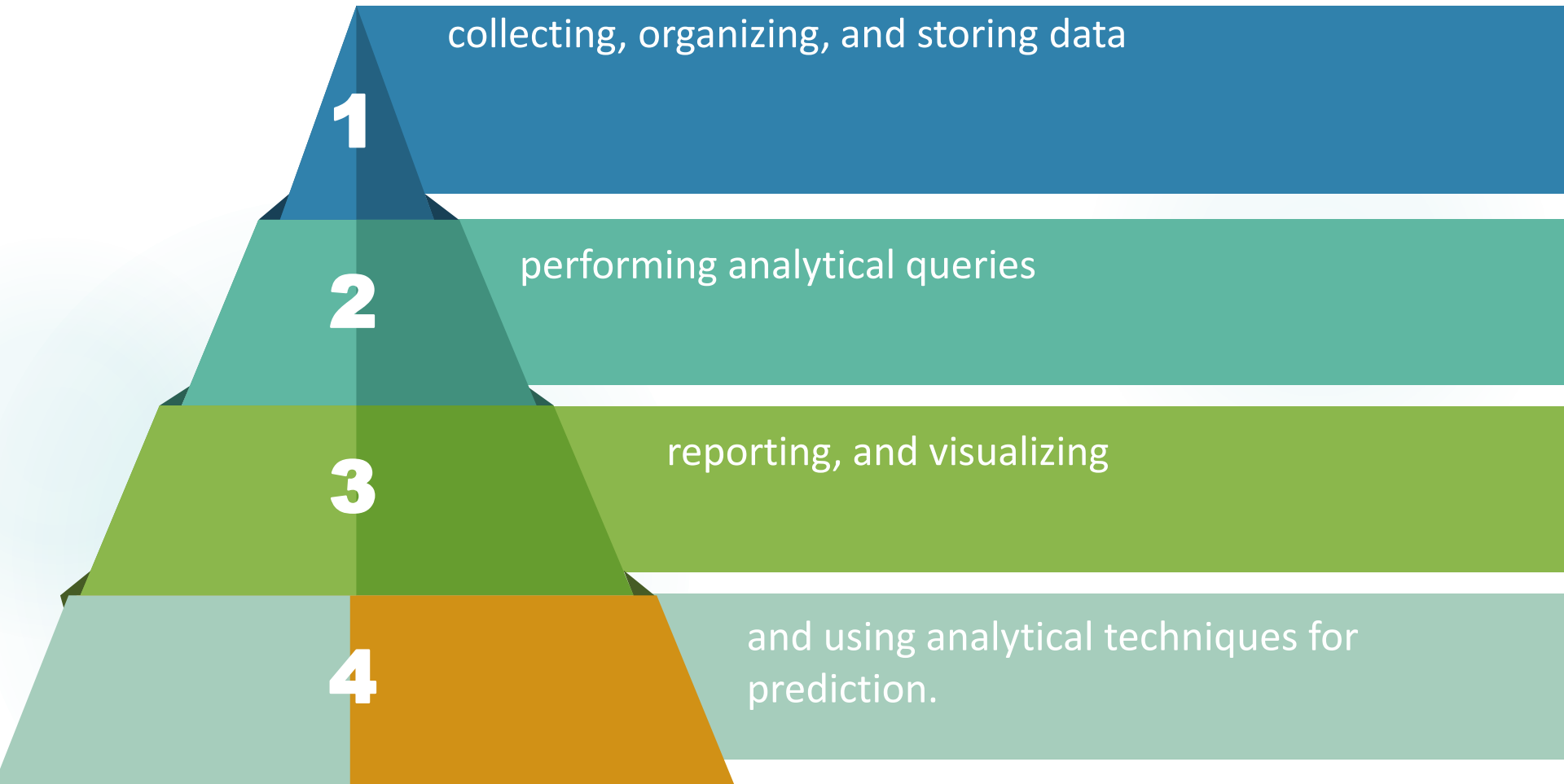
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Data Collection and Analysis

- ▶ Collect data using IoT, Sensors, Machine Learning
- ▶ Describe and prepare the data for Analysis using Big Data Analytics and AI Techniques;
- ▶ Measure the relationships between data/variables;
- ▶ Compare the expected results with those observed;
- ▶ Search for the meaning of differences.

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- ▶ Data collecting and analysis includes:



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► Methodologies and techniques:

Predictive models

Forecasting; Scenarios;
Trends; Foresight;
Simulations

Statistical Analysis:
Scenarios Manager,
Solver, What-if-analysis;
Artificial Intelligence
Models

Regressions;
Associations; and
Correlations.

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Quantitative Methods & Data Analysis

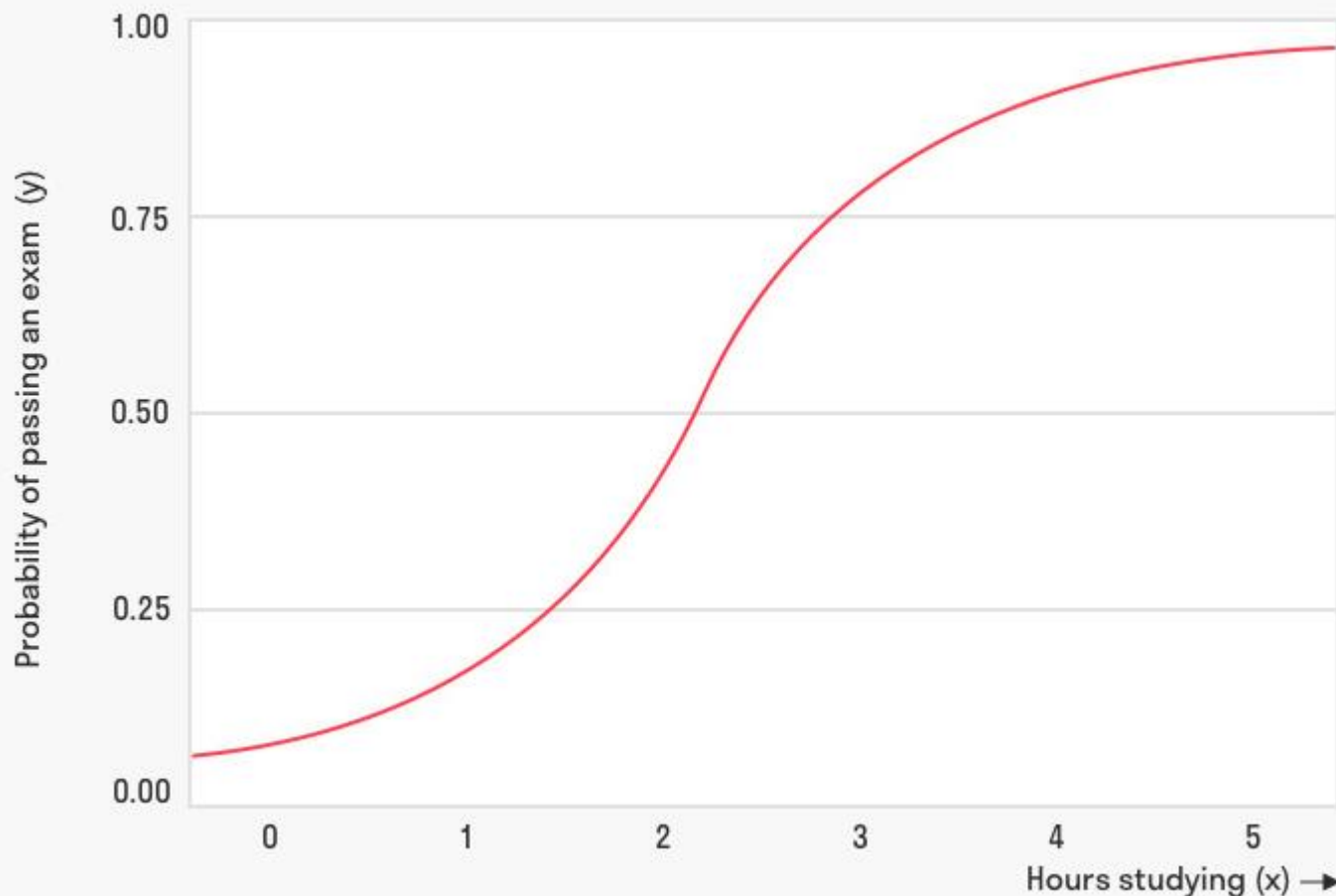
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▶ Machine Learning Main Research Methods

1. Regression
2. Classification
3. Clustering
4. Dimensionality Reduction
5. Ensemble Methods
6. Neural Network

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▶ 1. Logistic Regression

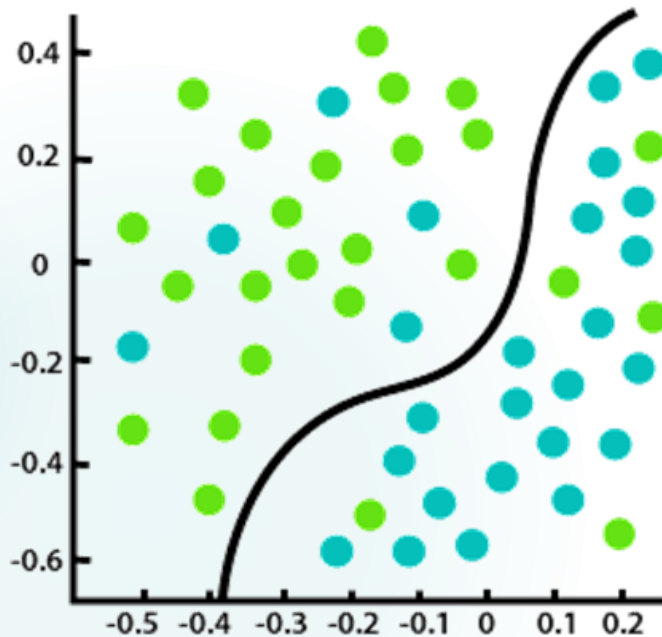


Regression algorithms are used to **predict continuous** values such as price, salary, age.

Regression Analysis can help a manager predict short-term or long-term sales,

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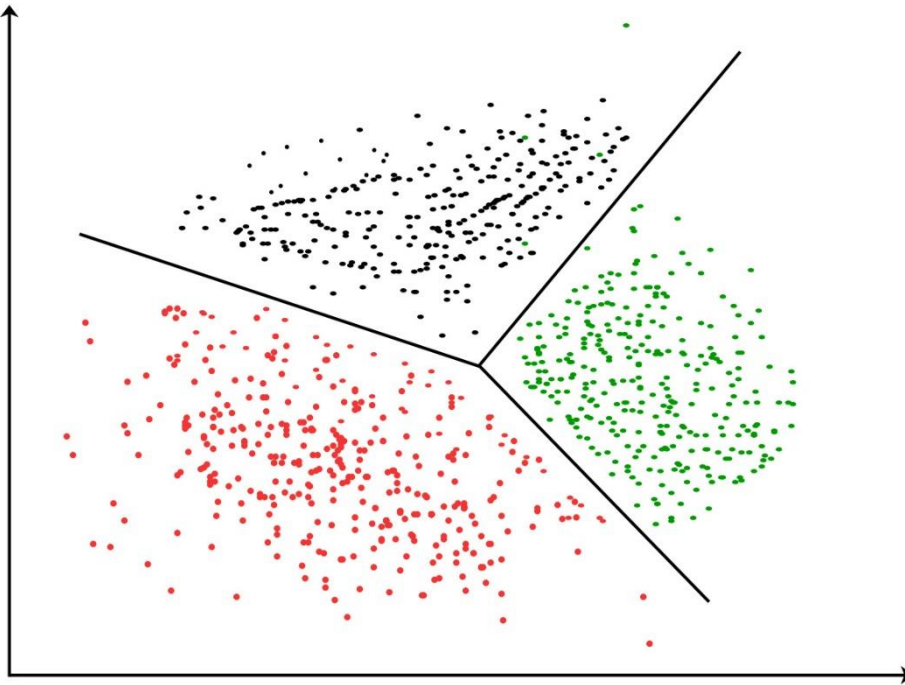
► 2. Classification



Classification algorithms are used to **predict/Classify the discrete values** such as Male or Female, True or False, Spam or Not Spam

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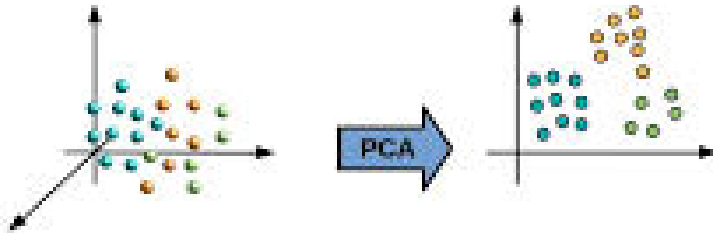
▶ 3. Clustering



Clustering is the set of data mining techniques that aim to automatically group data according to their degree of similarity.

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► 4. Dimensionality Reduction

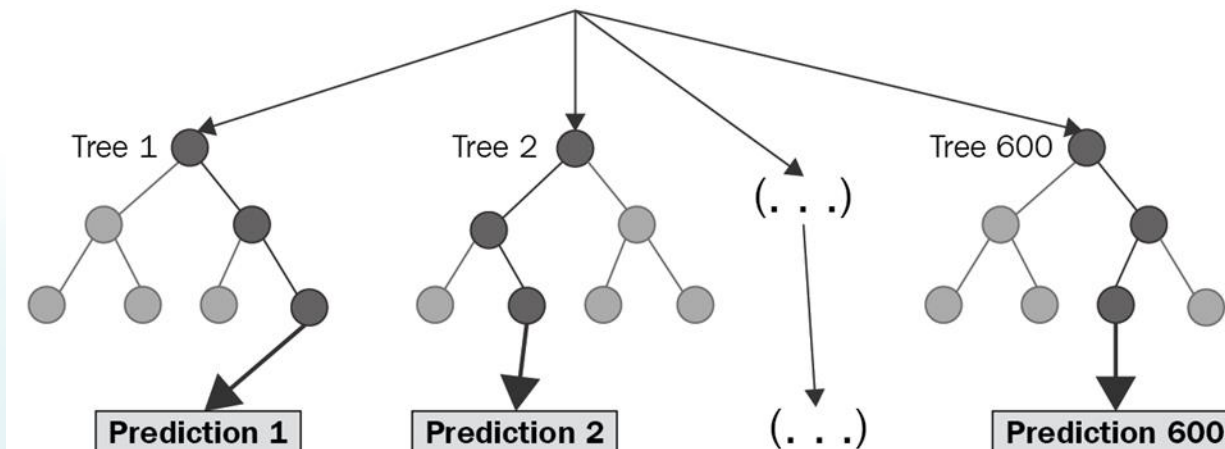


Dimensionality reduction is the transformation of data from a high-dimensional space into a low-dimensional space so that the low-dimensional representation retains some meaningful properties of the original data.

Example PCA

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► 5. Ensemble Methods



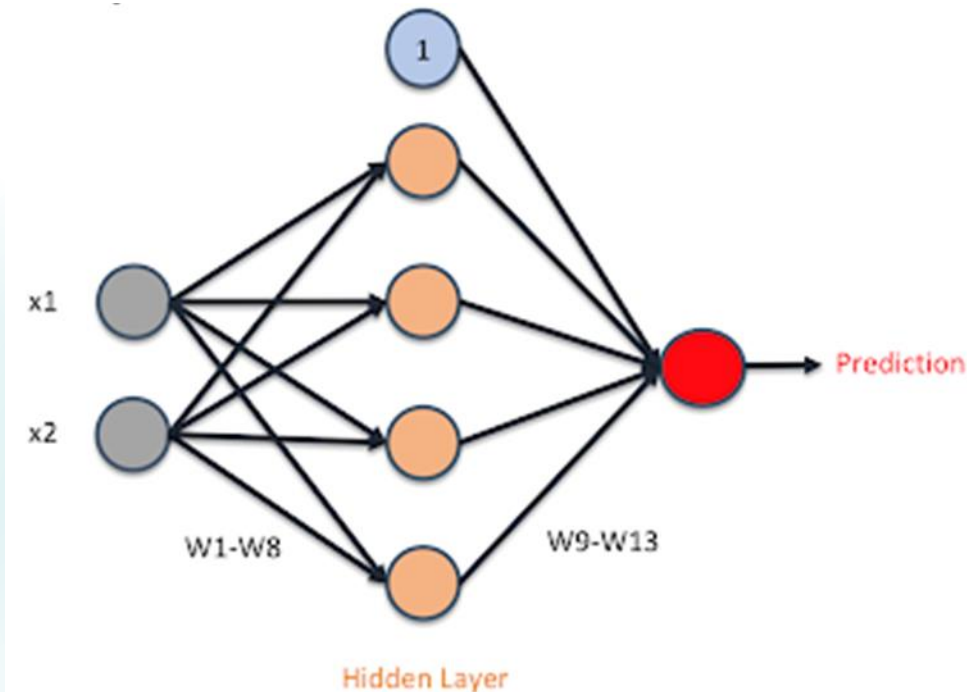
Ensemble methods is a machine learning technique that combines several base models in order to produce one optimal predictive model.

Example:
Decision-tree

IBM SPSS Statistics Professional edition in the forecasting and decision trees add-on.

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▶ 6. Neural Network



Neural networks are a series of algorithms that recognize relationships between vast amounts of data.

They are used in a variety of applications in financial services, from forecasting and marketing research to fraud detection and risk assessment.

Data analysis simulators: Emergent; Spike Net

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Qualitative Methods & Data Analysis

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Qualitative Data Analysis

► Data Preparation and Data Analysis

1. Getting familiar with the data
2. Revisiting research objectives
3. Developing a framework.
4. Identifying patterns and connections

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Qualitative Data Analysis

Object / Analysis Unit

- Documents
- Field Diary
- Interview
- Video
- Articles
- Speeches
- Opinions

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Qualitative Data Analysis

- ▶ **A sample of population units is selected**, be it the random selection of documents or a stratified sample that may be more consistent in certain cases (when we analyze daily and weekly newspaper articles, for example);
- ▶ Processes are established for **encoding the variables to be measured**, that is, it is decided what will be the unit of text to be encoded, whether words, phrases, themes, paragraphs.

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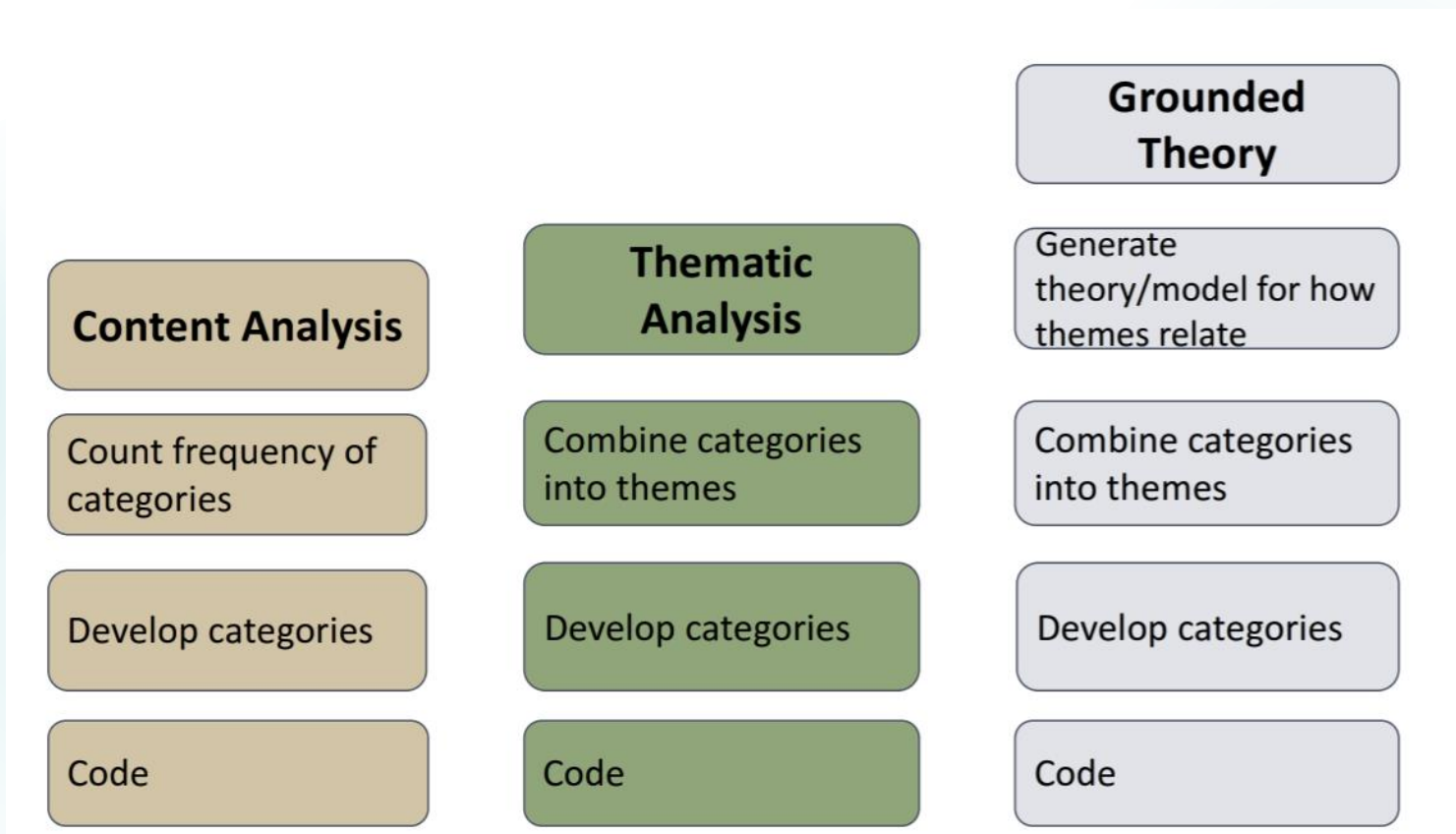
Qualitative Data Analysis

The **deductive** coding begin with a set of **pre-established codes** and apply them to the data set (for example, a set of interview transcripts).

Inductive coding on the other hand, works in reverse, as you create the set of codes **based on the data itself**

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Qualitative Data Analysis



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ICA is made up of three levels of analytics—descriptive, predictive, and prescriptive. Descriptive analytics typically provides quantifiable and precise interpretations on current data. Predictive analytics uses statistical algorithms and historical data to draw trends and patterns for the likelihood of future cases. Prescriptive analytics builds on the insight from predictive analytics and recommends actionable steps moving forward.

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Software

- ▶ **Rayyan** – Intelligent content analysis

<https://www.rayyan.ai/>

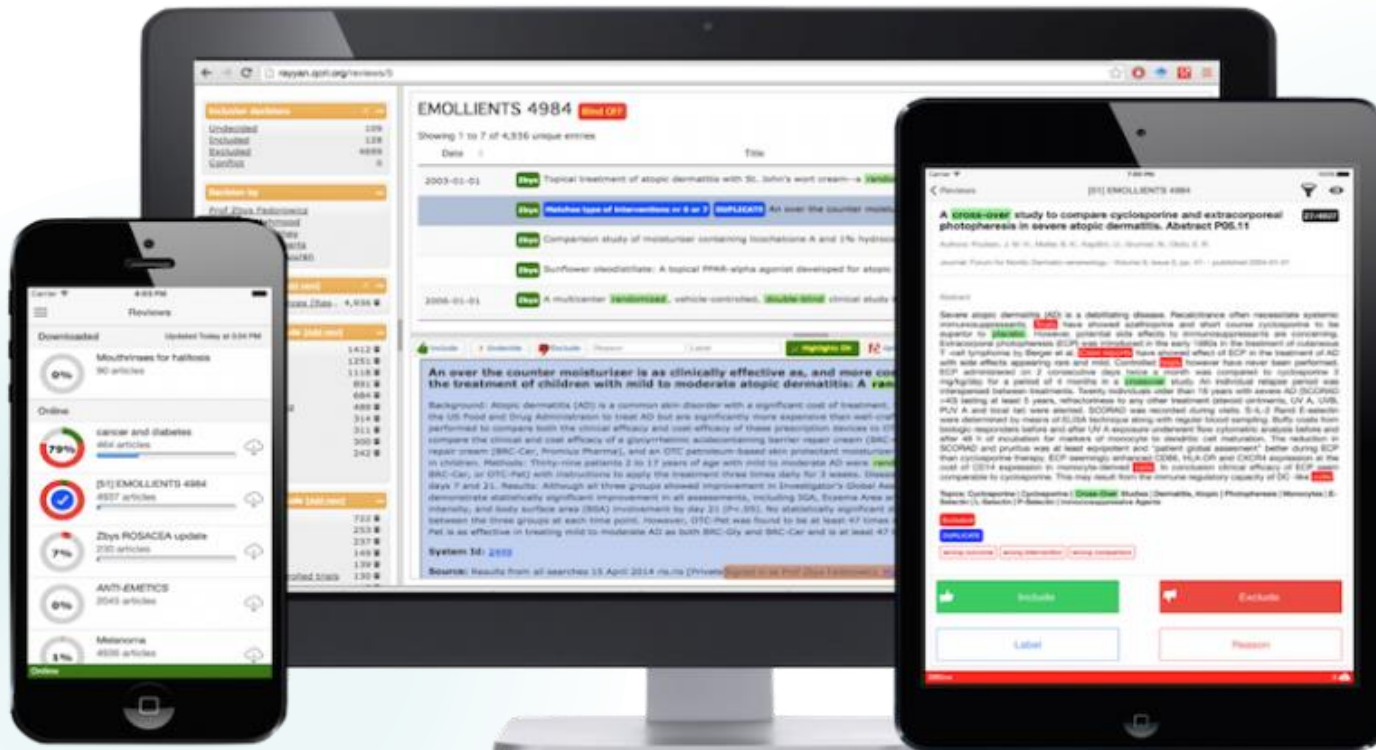
- ▶ **Ensomnia** - AI-driven analysis tool to gain insights into opinions, attitudes, trends and tendencies.

<https://ensomnia.dk/>

- ▶ **Melingo** - Intelligent content analysis

<https://melingo.com/en/text-analysis/ica/>

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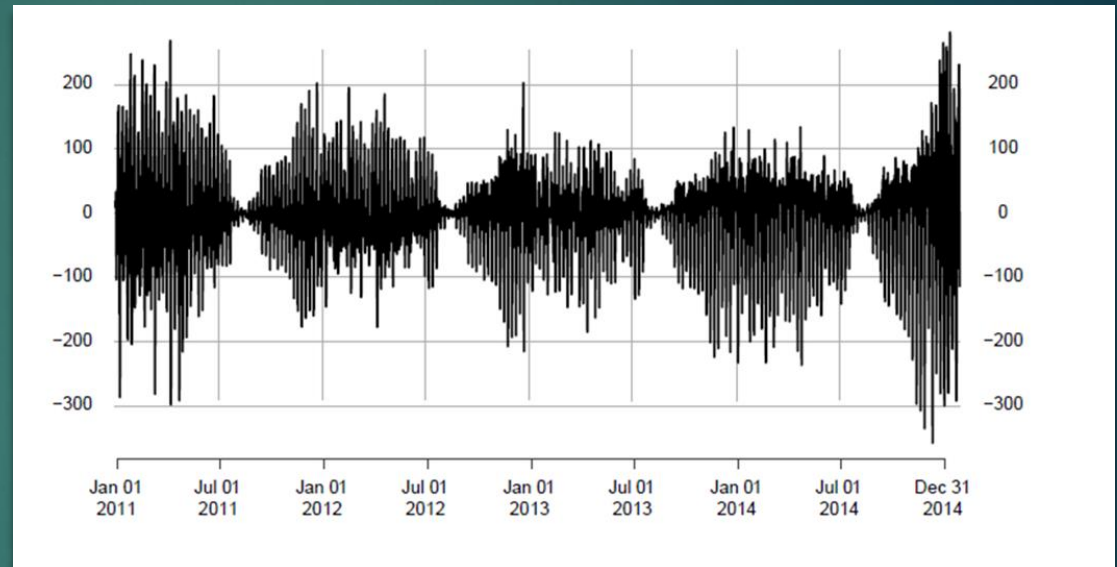


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Applications of Algorithms to Data Analysis

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► Figure: Processed time series of number of rooms occupied after stabilizing variance and removing seasonal and trend components.



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Application Big Data Analytics in HR

Level 4

Optimized Talent Acquisition

*Strategic Enabler of the Business • Ability to Predict External Forces & Remain Agile
Development of predictable models, scenario planning
Risk analysis and mitigation, integration with strategic planning*

Level 3

Strategic Analytics

*Full Integration with HR & Talent Management
Segmentation, statistical analysis, development of people models
Analysis of dimensions to understand cause and delivery of actionable solutions*

Level 2

Proactive – Advanced Reporting

*Operational reporting for benchmarking and decision making
Multidimensional analysis and dashboards*

Level 1

Reactive – Operational Reporting

*Ad hoc operational reporting to improve HR Service models based on big data pipeline
Reactive to healthcare management business demands for people management, data in isolation for specific HR models or functions and difficult to analyse*