Unlocking the Algorithm of Research Methods

Keynote Speaker

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Unlocking the Algorithm of Research Methods

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Unlocking the Algorithm of Research Methods

Algorithms in Research Methods
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Unlocking the Algorithm of RM:

1. involves sophisticated analysis of data.
2. involves integrating data from different sources.
3. 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:

1. collecting, organizing, and storing data
2. performing analytical queries
3. reporting, and visualizing
4. and using analytical techniques for prediction.
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Methodologies and techniques:

<table>
<thead>
<tr>
<th>Predictive models</th>
<th>Forecasting; Scenarios; Trends; Foresight; Simulations</th>
<th>Statistical Analysis: Scenarios Manager, Solver, What-if-analysis; Artificial Intelligence Models</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Regressions; Associations; and Correlations.</td>
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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.
3. Clustering

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

Content Analysis
- Count frequency of categories
- Develop categories
- Code

Thematic Analysis
- Combine categories into themes
- Develop categories
- Code

Grounded Theory
- Generate theory/model for how themes relate
- Combine categories into themes
- Develop categories
- Code
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** - Al-driven analysis tool to gain insights into opinions, attitudes, trends and tendencies.
  https://ensomnia.dk/

- **Melingo** - Intelligent content analysis
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Applications of Algorithms to Data Analysis
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

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<thead>
<tr>
<th>Level 4</th>
<th>Optimized Talent Acquisition</th>
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<tbody>
<tr>
<td></td>
<td>Strategic Enabler of the Business • Ability to Predict External Forces &amp; Remain Agile</td>
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<tr>
<td></td>
<td>Development of predictable models, scenario planning</td>
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<td>Risk analysis and mitigation, integration with strategic planning</td>
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<thead>
<tr>
<th>Level 3</th>
<th>Strategic Analytics</th>
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<tr>
<td></td>
<td>Full Integration with HR &amp; Talent Management</td>
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<td>Segmentation, statistical analysis, development of people models</td>
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<td>Analysis of dimensions to understand cause and delivery of actionable solutions</td>
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<th>Level 2</th>
<th>Proactive – Advanced Reporting</th>
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<tr>
<td></td>
<td>Operational reporting for benchmarking and decision making</td>
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<tr>
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<td>Multidimensional analysis and dashboards</td>
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<tr>
<th>Level 1</th>
<th>Reactive – Operational Reporting</th>
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<tr>
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<td>Ad hoc operational reporting to improve HR Service models based on big data pipeline</td>
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<td></td>
<td>Reactive to healthcare management business demands for people management, data in isolation for specific HR models or functions and difficult to analyse</td>
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