CHANDIGARH UNIVERSITY
Discover. Learn. Empower.

Apex Institute of Technology

Department of Computer Science & Engineering

Introduction to Data Science

Topic: Types of Analytics (Statistics)

Part-1

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Types of Analytics (Statistics)

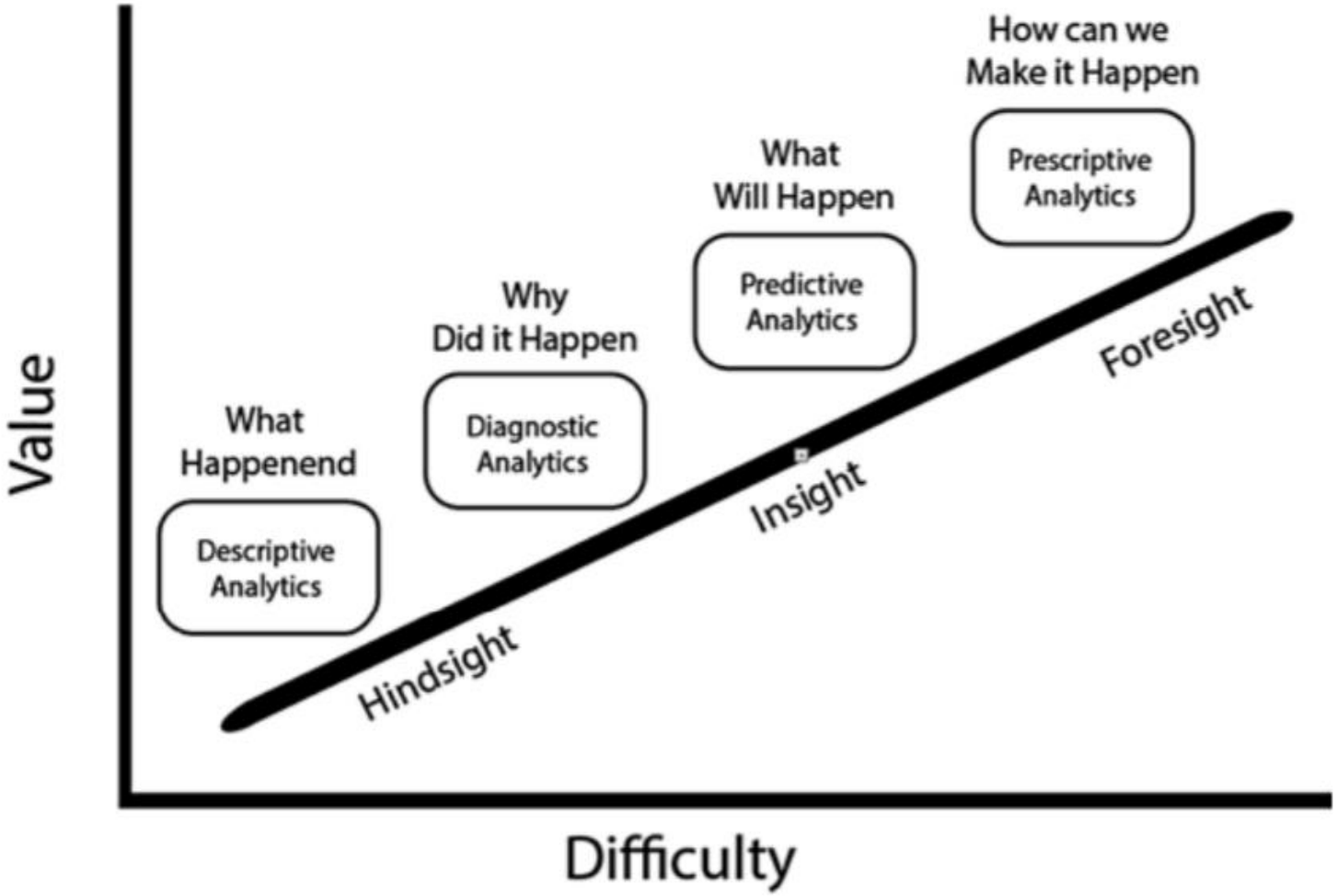


Image Source: El Morr C., Ali-Hassan H. (2019) Descriptive, Predictive, and Prescriptive Analytics. In: Analytics in Healthcare. SpringerBriefs in Health Care Management and Economics. Springer, Cham.

VALUE

1

Descriptive

Based on Live Data, Tells what's happening in real time

Accurate & Handy for Operations management

Easy to Visualize

2

Diagnostic

Automated RCA – Root Cause Analysis

Explains "why" things are happening

Helps trouble shoot issues

3

Predictive

Tells What's likely to happen?

Based on historical data, and assumes a static business plans/models

Helps Business decisions to be automated using algorithms.

4

Prescriptive

Defines future actions – i.e., "What to do next?"

Based on current data analytics, predefined future plans, goals, and objectives

Advanced algorithms to test potential outcomes of each decision and recommends the best course of action

Complexity

1. Descriptive Statistics

- **90% of organizations** today use descriptive analytics which is the most basic form of analytics.
- The simplest way to define descriptive analytics is that it **answers the question, "What has happened?"**.
- This type of analytics analyses the data coming in **real-time and historical data** for insights on how to approach the future.
- The **main objective of descriptive analytics is to find out the reasons behind precious success or failure in the past**.

1. Descriptive Statistics

- The **'Past'** here, refers to any particular time in which an event had occurred and this could be a month ago or even just a minute ago.
- The vast **majority of big data analytics** used by organizations falls into the category of **descriptive analytics**.
- A business **learns from past behaviors to understand how they will impact future outcomes**.
- Descriptive analytics is leveraged when a business needs to **understand the overall performance of the company** at an aggregate level and describe the various aspects.

Descriptive Statistics

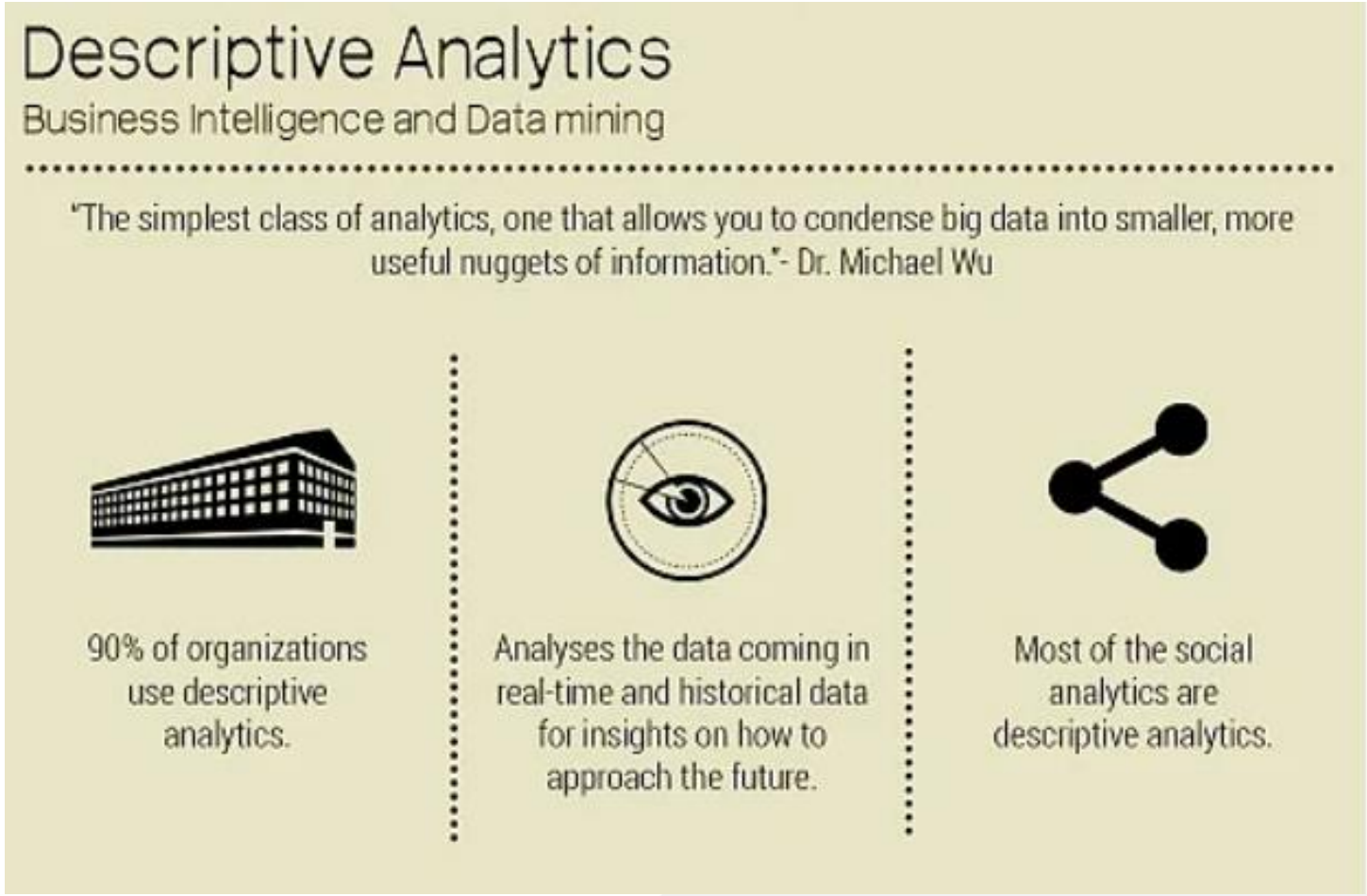


Image Source: https://www.projectpro.io/article/types-of-analytics-descriptive-predictive-prescriptive-analytics/209

Descriptive Statistics

- *Dr. Michael Wu, chief scientist of San Francisco-based Lithium Technologies describes descriptive analytics as* ***-"The simplest class of analytics, one that allows you to condense big data into smaller, more useful nuggets of information."***

Descriptive Statistics

- Descriptive analytics are based on standard aggregate functions in databases, which just require knowledge of basic school math.
- Most of the social analytics are descriptive analytics.
- They summarize certain groupings based on simple counts of some events.
- The number of followers, likes, posts, fans are mere event counters.
- These metrics are used for social analytics like average response time, the average number of replies per post, %index, number of page views, etc. that are the outcome of basic arithmetic operations.

Tools of descriptive statistics

- Descriptive analytics involves using descriptive statistics such as **arithmetic operations on existing data**. These operations make raw data **understandable to investors, shareholders, and managers**. Thus, the clarity of data can help individuals as well as industries **in analyzing key areas.**
- **For example**, companies analyze consumer behaviors and engagements with their businesses by mining historical data. For this reason, it is helpful in service improvement and targeted marketing. Above all, it is used to identify and address the areas of strengths and weaknesses. This consequently helps in better planning.
- This type of analytics importantly uses tools like **MS Excel, MATLAB (MaTrix LABoratory), STATA**, etc.

Examples of Descriptive Statistics

- Analyzing assessment grades and assignments
- Tracking the use of learning resources
- Comparing the test results of learners
- Analyzing the time taken by the learner to complete the course
- Use of social media and engagement data (Facebook and Instagram likes)
- Summarizing past events such as marketing campaigns and sales.
- Collating survey results
- Reporting general trends

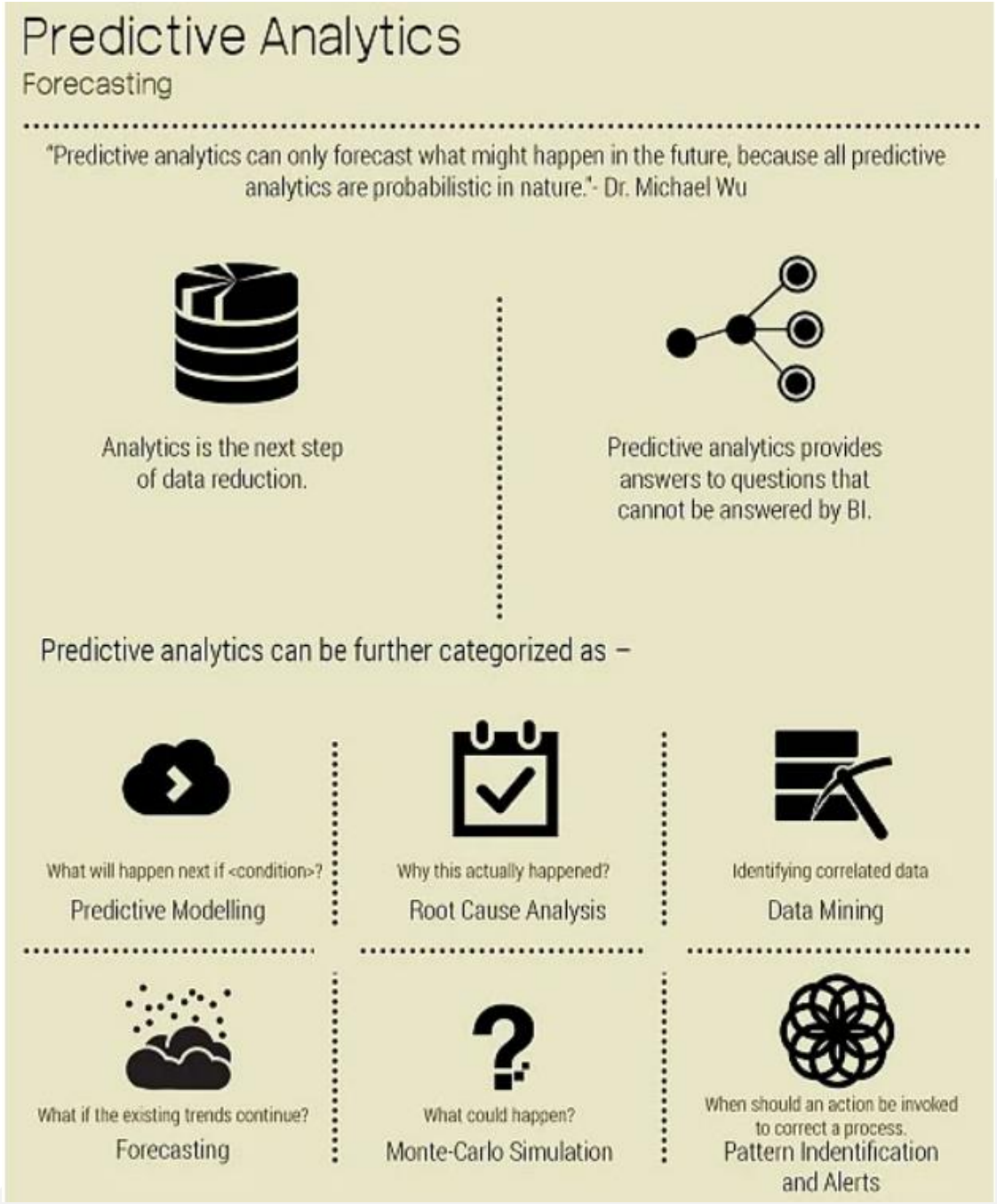
2. Predictive Statistics

- The subsequent step in **data reduction is predictive analytics**.
- **Analyzing past data patterns and trends** can accurately inform a business about **what could happen in the future**.
- This **helps in setting realistic goals for the business, effective planning, and restraining expectations**.
- Predictive analytics is used by businesses to study the data and ogle into the crystal ball to find answers to the question, **“What could happen in the future based on previous trends and patterns?”**

2. Predictive Statistics

- *Dr. Michael Wu, chief scientist of San Francisco-based Lithium Technologies said* ***-"The purpose of predictive analytics is NOT to tell you what will happen in the future. It cannot do that. In fact, no analytics can do that. Predictive analytics can only forecast what might happen in the future because all predictive analytics are probabilistic in nature."***

Predictive Statistics



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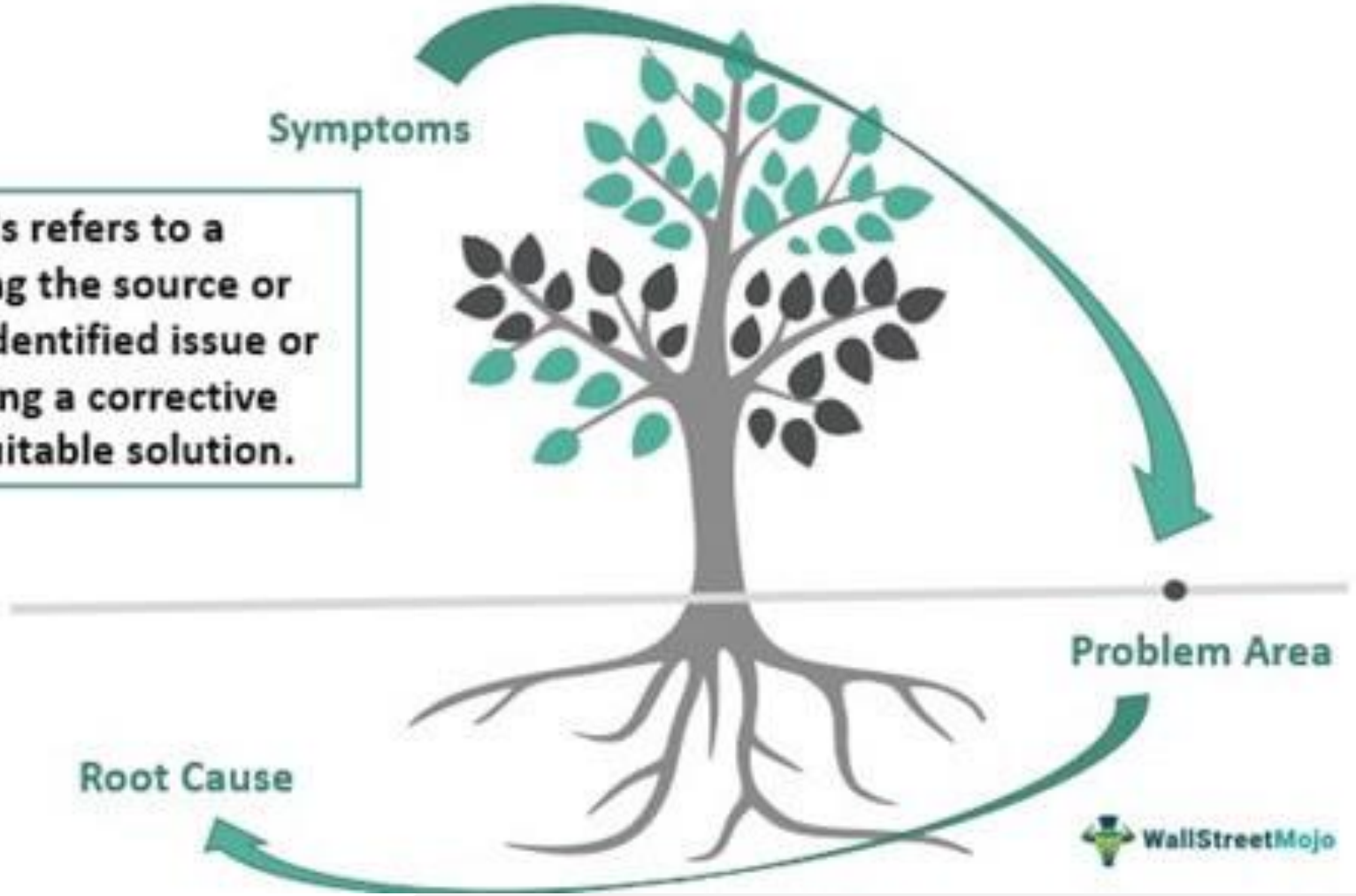
Root Cause Analysis

Root cause analysis refers to a process of decoding the source or base cause of an identified issue or event for developing a corrective mechanism or a suitable solution.



Tools of Predictive Analysis

- Predictive analytics helps predict the likelihood of a future outcome by using various **statistical and machine learning algorithms** but the accuracy of predictions is not 100%, as it is based on probabilities.
- To make predictions, algorithms take data and fill in the missing data **with the best possible guesses.**
- This **data is pooled with historical data** present in the CRM (Customer Relationship Management) systems, POS Systems, ERP (Enterprise Resource Planning), and HR systems to look for data patterns and identify relationships among various variables in the dataset.
- Organizations should capitalize on hiring a **group of data scientists** who can **develop statistical and machine learning algorithms** to leverage **predictive analytics and design** an effective business strategy.

Categories of Predictive Statistics

1. Predictive Modelling –What will happen next, if?
2. Root Cause Analysis-Why this actually happened?
3. Data Mining- Identifying correlated data
4. Forecasting- What if the existing trends continue?
5. Monte-Carlo Simulation (*is a mathematical technique, which is used to estimate the possible outcomes of an uncertain event.*) – What could happen?
6. Pattern Identification and Alerts –When should action be invoked to correct a process.

Homework

- List out the various predictive models of data mining.
- How does descriptive analysis help in social networking?

References

- **Text Books:**
  - Principles of Data Science by Sinan Ozdemir, (2016) PACKT.
  - Data Science from Scratch: First Principles with Python 1st Edition by Joel Grus
  - https://www.projectpro.io/article/types-of-analytics-descriptive-predictive-prescriptive-analytics/209
  - El Morr C., Ali-Hassan H. (2019) Descriptive, Predictive, and Prescriptive Analytics. In: Analytics in Healthcare. SpringerBriefs in Health Care Management and Economics. Springer, Cham.
- **Reference Books:**
  - R1. Data Science For Dummies by Lillian Pierson (2015)
- **Journals:**
  - http://www.ijsmsjournal.org/ijsms-v4i4p137.html
  - https://mail.premierpublishers.org/ijsm/051120195187

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