Module 1: Introduction to Data Science

CSCI1360

Outline

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Reasons Behind Data Growth

Applications

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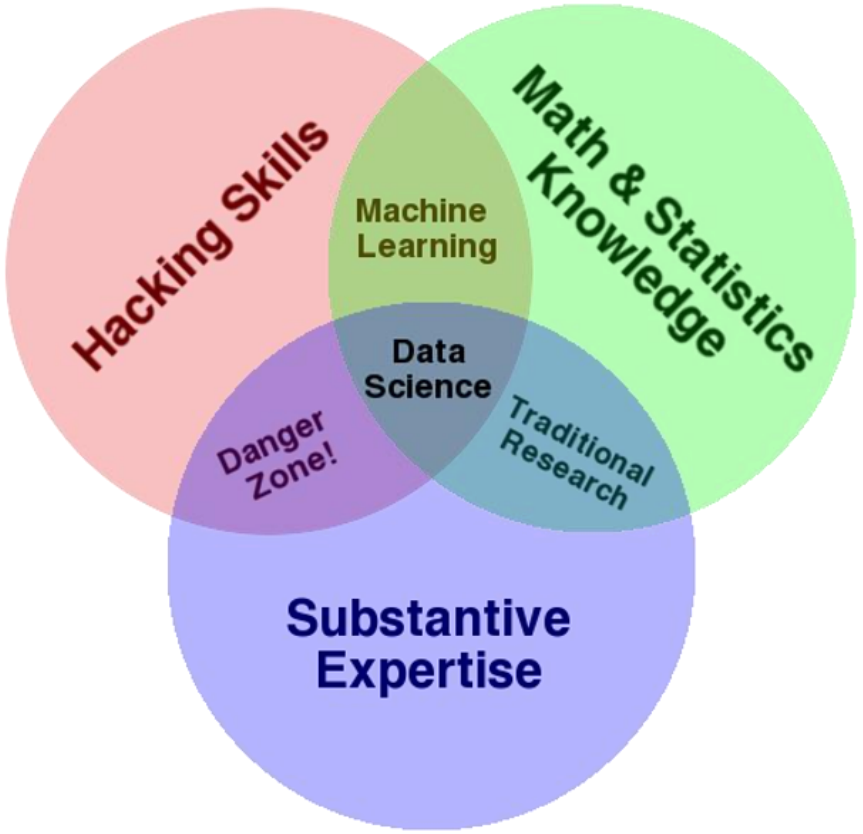
Data Science

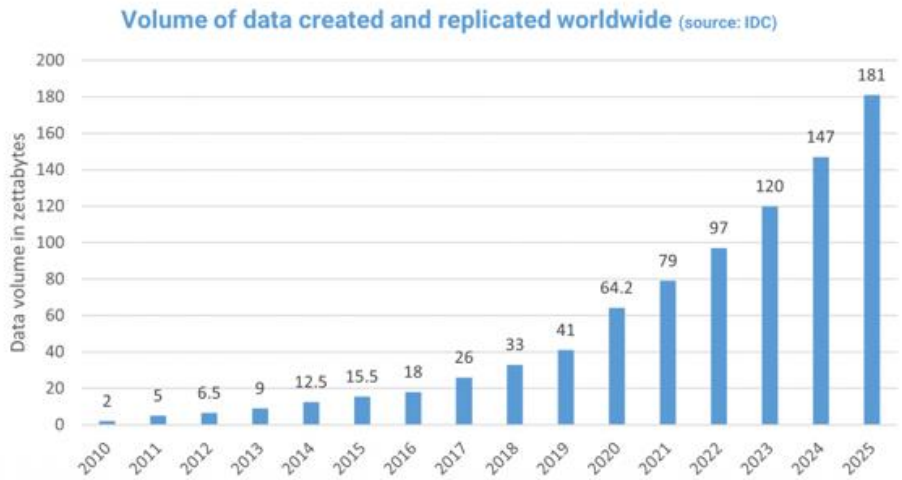


Definition

- Data Science as a proper field of study is the confluence of three major aspects:
  - Hacking skills: the ability to code, and knowledge of available tools.
  - Math and statistics: strong quantitative skills that can be implemented in code.
  - Substantive expertise: some specialized area of emphasis.

Why Data Science is Important?

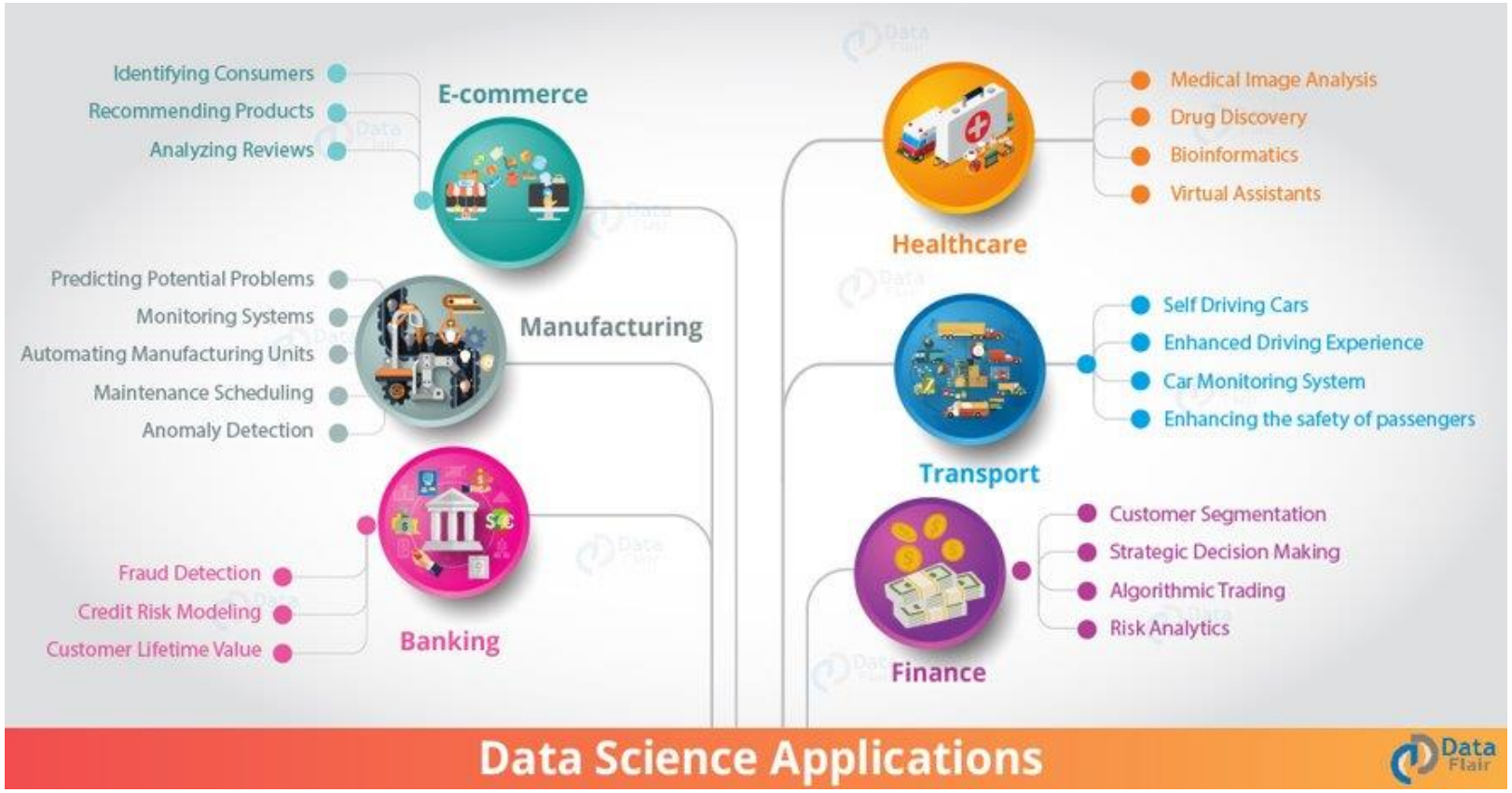
- Observe data growth
- Zettabyte = 1 Billion Terabyte
- Data Science is important because:
  - Helps extracting meaningful information from data
  - Enhances decision making
  - Process automation



Reasons Behind Data Growth

- Storage Technologies and Prices
  - Fast on-premise storage
  - Cheap cloud storage
- Computation Technologies and Prices
  - CPUs and GPUs capabilities
- Data Collection Technologies
  - Wide usage of IoT device: Sensors and Cameras
  - Social Media Usage

Data Science Applications



https://data-flair.training/blogs/data-science-applications/

Data Types and Sources

- Data types:
  - Structured: Excel Spreadsheet
  - Un-structured: Audio
  - Semi-structured: Log file

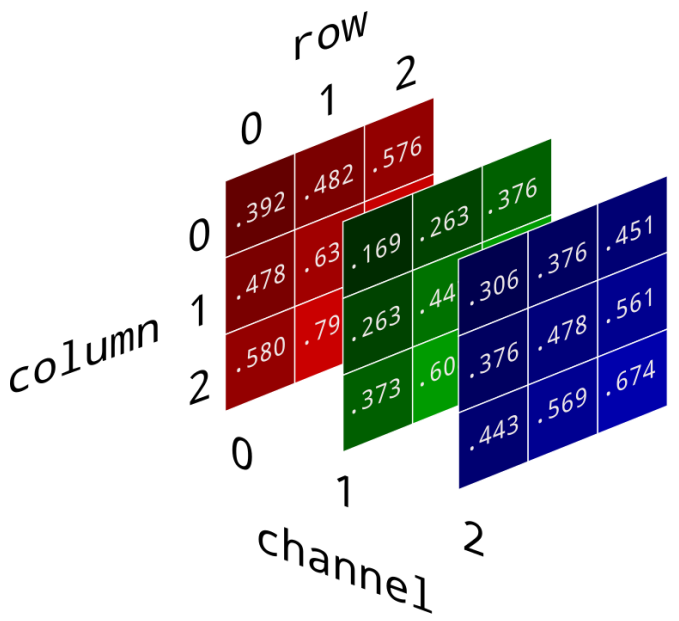
- Data types by format examples:
  - Numerical Data: Bank transactions
  - Text: Movie reviews
  - Images: X-Ray images

Data Preprocessing

- Data cleaning is an important step before running data science algorithms
- Preparing data for analysis incorporates:
  - Removing corrupted values
  - Imputing or removing missing values
  - Transforming data to a numerical format
  - Scaling values

Data Transformation

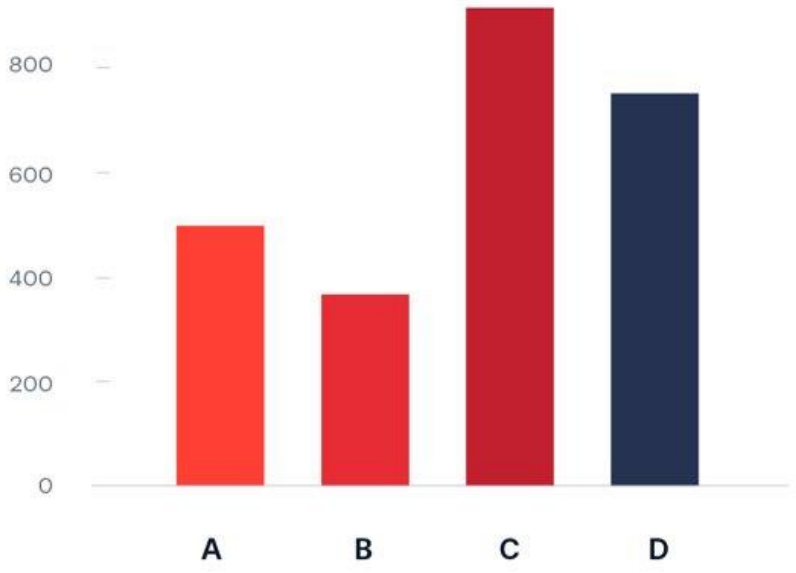
- Computers can process data in the form of numbers
- Images can be represented in the Red-Green-Blue (RGB) format
- Text data can be represented using the bag of words model



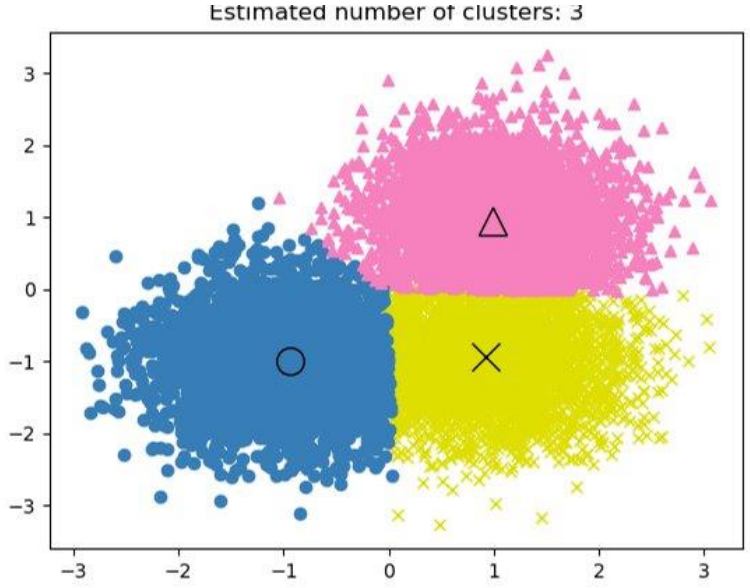
Data Visualization

- Why visualization is important?
  - To understand data
  - To share data easily
  - To visualize patterns

Visualization Examples



Bar Chart

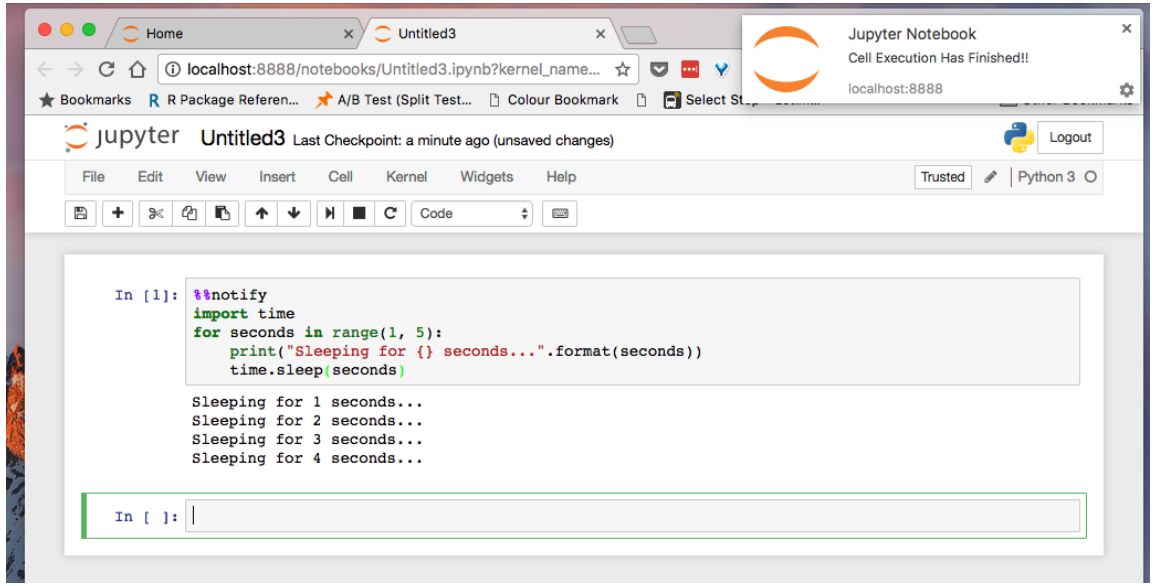


Scatter Plot

Visualization Examples

Word Cloud

Image Segmentation



Data Science Tools

- Programming language:
  - Python, R
- Code Editor:
  - Jupyter Notebook, Visual Studio Code
- Algorithm packages:
  - Scikit Learn, Pandas, Numpy
- Visualization:
  - Matplotlib

Ethical Considerations

Privacy

- Anonymizing sensitive data to prevent the identification of individuals.

Data Ownership

- Clarifying who owns the data

Bias and Fairness

- Mitigating algorithms bias to certain group

Data Modeling

- Discriminative modeling
  - Learn the boundaries between data samples
- Generative modeling (beyond the scope of the course)