Introduction to Data Science

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Chapter 1
Overview of Data Science

Papangkorn Inkeaw, PhD

Department of Computer Science, Faculty of Science

Chiang Mai University

Outline

Overview of Data Science

- **What is the Data Science?**
- **Example Applications**
- **Data Science Process**
    1. **Business Problem**
    2. **Data Acquisition**
    3. **Data Preparation**
    4. **Exploratory Data Analysis**
    5. **Data Modeling**
    6. **Visualization & Communication**
    7. **Deploy & Maintenance**

What is the Data Science?

Overview of Data Science

Data

- Facts and statistics collected together for reference or analysis.
- A set of values of subjects with respect to qualitative or quantitative variables.

Science

A systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe.

Data Science

Uses of scientific methods, processes, algorithms and systems to extract knowledge and insights from data.

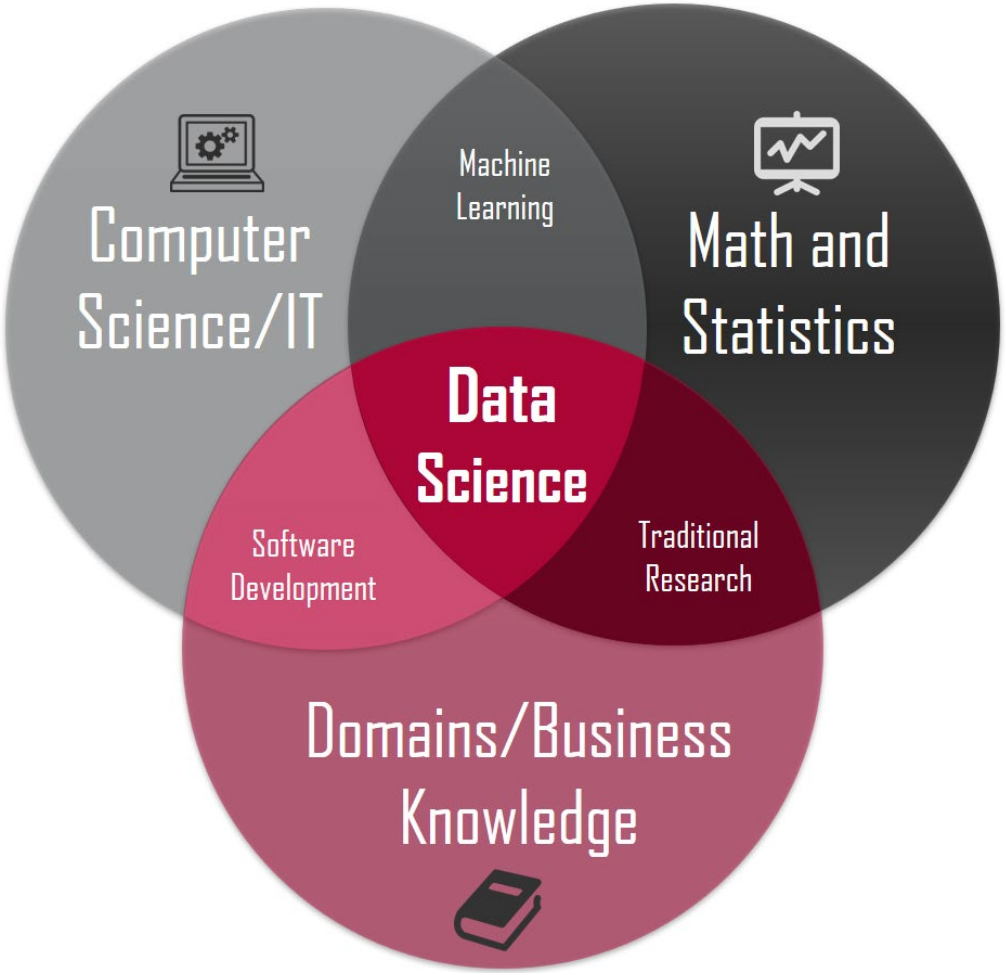
Use Science to Understand Data

What is the Data Science?

Overview of Data Science

Data Science
is a multi-disciplinary field combining

- Computer Science
- Mathematics and Statistics
- Business Knowledge



Michael Barber (2018). Data science concepts you need to know! Part 1. Retrieved from https://towardsdatascience.com/introduction-to-statistics-e9d72d818745

Example Applications

Overview of Data Science

Genomic data provides a deep understanding of genetic issues in reaction to particular drugs and diseases

Example Applications

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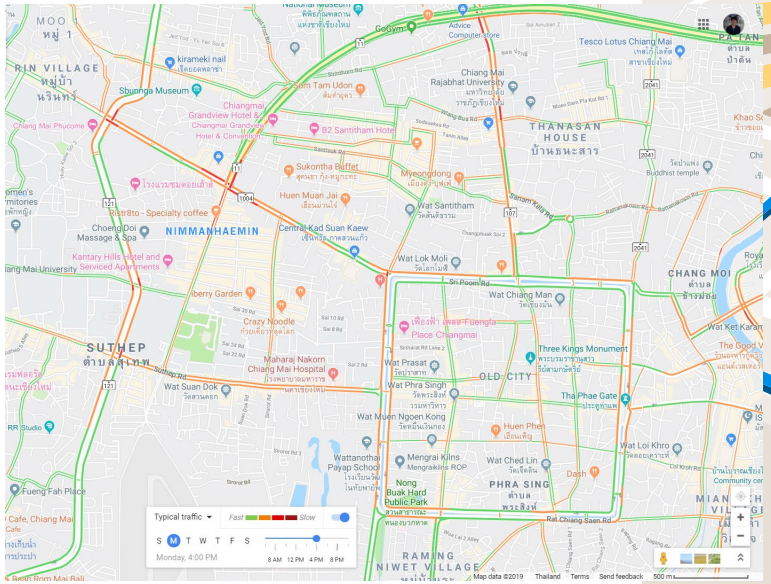
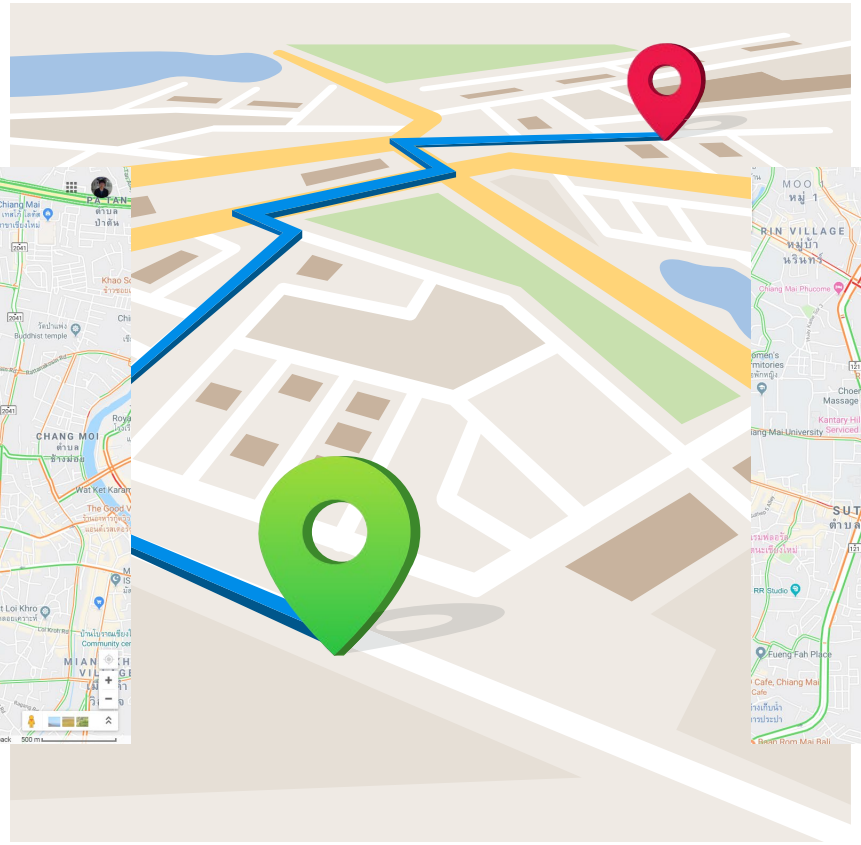
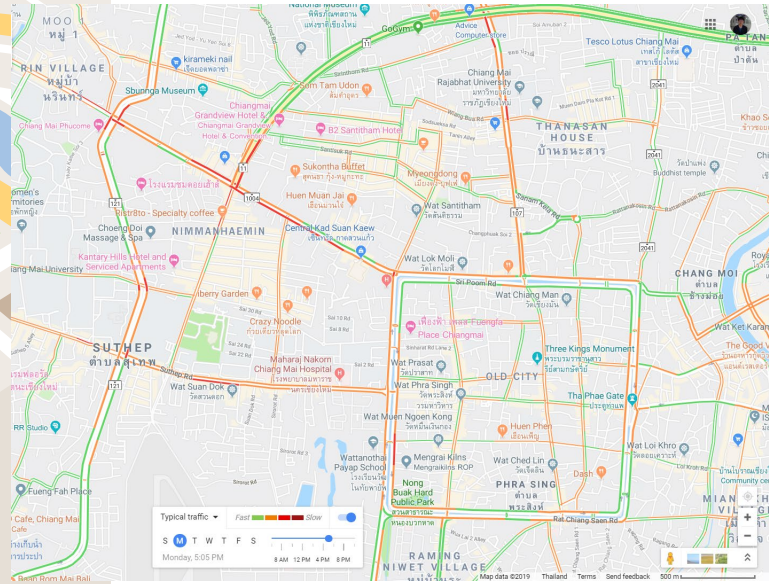
We use traffic data to discover the best time and route to go back to home.







Example Applications

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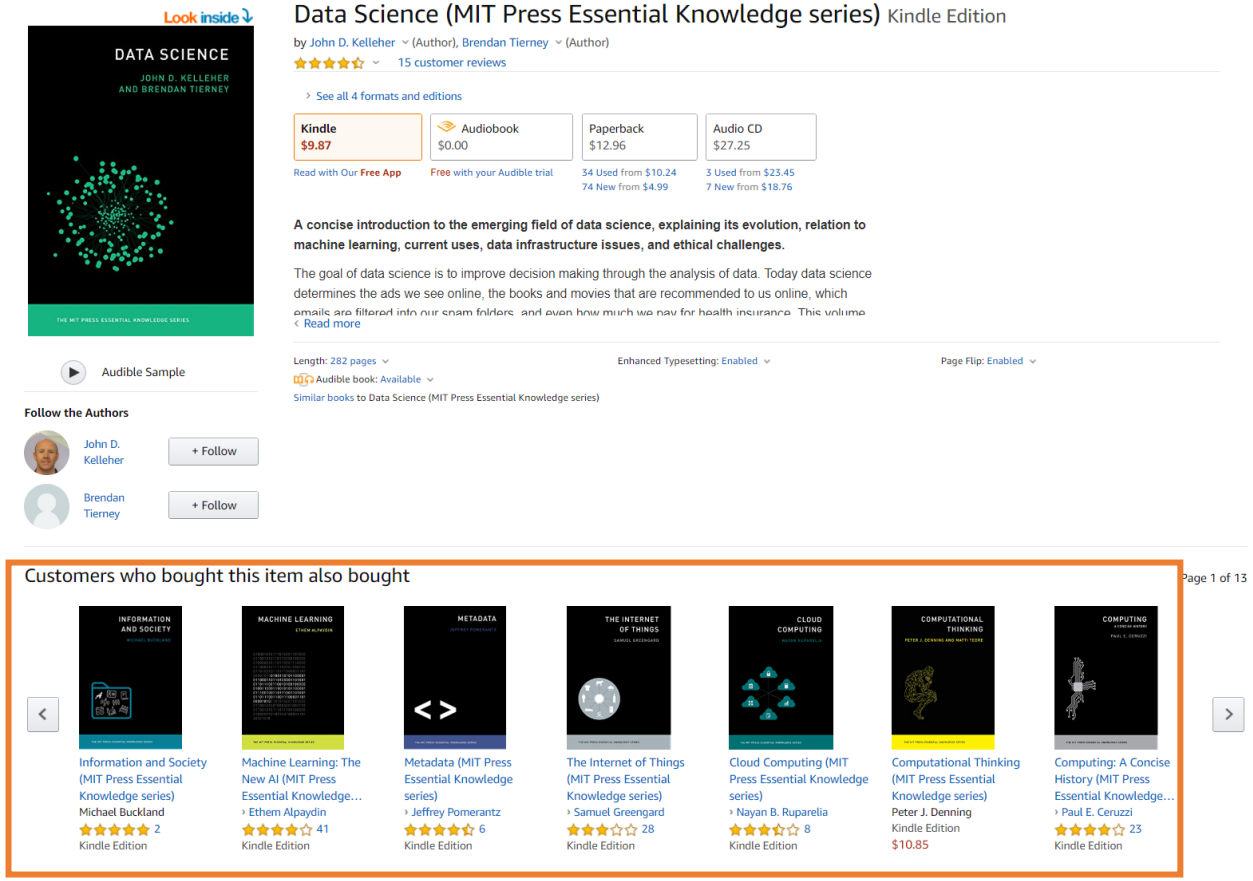
Amazon (online shop) suggests other goods that most people usually bought with what the customer buy.



Data Science Process

Overview of Data Science

1 Business Problem

Understand

Business Questions

Define Objectives

common data science problems:

- Classification/Recognition
- Prediction/Regression
- Association
- Pattern detection/clustering
- Scoring and ranking
- Optimization

Data Science Process

Overview of Data Science

2 Data Acquisition

Data Sources

- Questionnaires
- Web servers
- Web services (API)
- Database
- Logs
- Online repositories

Data Science Process

Overview of Data Science

3 Data Preparation

Data Cleaning

- Inconsistent datatypes
- Missing data
- Duplicate data
- etc.

Data Transformation

- Converting data from one format/structure into another format or structure.
- Help to understand data structure
- Understand what we actually can do with the data

Data Science Process

Overview of Data Science

4 Exploratory Data Analysis

name	id	align	eye	hair	gender	alive	appearances	first_appear	publisher
Spider-Man (Peter Parker)	Secret	Good	Hazel Eyes	Brown Hair	Male	Living Characters	4043	Aug-62	marvel
Captain America (Steven Rogers)	Public	Good	Blue Eyes	White Hair	Male	Living Characters	3360	Mar-41	marvel
…	…	…	…	…	…	…	…	…	…
Natalia Romanova (Earth-616)	Public	Good	Green Eyes	Red Hair	Female	Living Characters	1050	Apr-64	marvel

Selection of feature variable that will be used in the model development

?

Data Science Process

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5 Data Modeling

Association
- Itemset mining
- Summarizing Itemsets

Recognition
- Decision tree
- kNN
- SVM

Regression
- Linear regression
- Polynomial regression

Training Set

Mathematical/Statistical Modeling

Clustering
- K-mean
- Hierarchical clustering
- DBSCAN

Model

Test Set

Model Evaluation

Recognition/prediction Accuracy

Data Science Process

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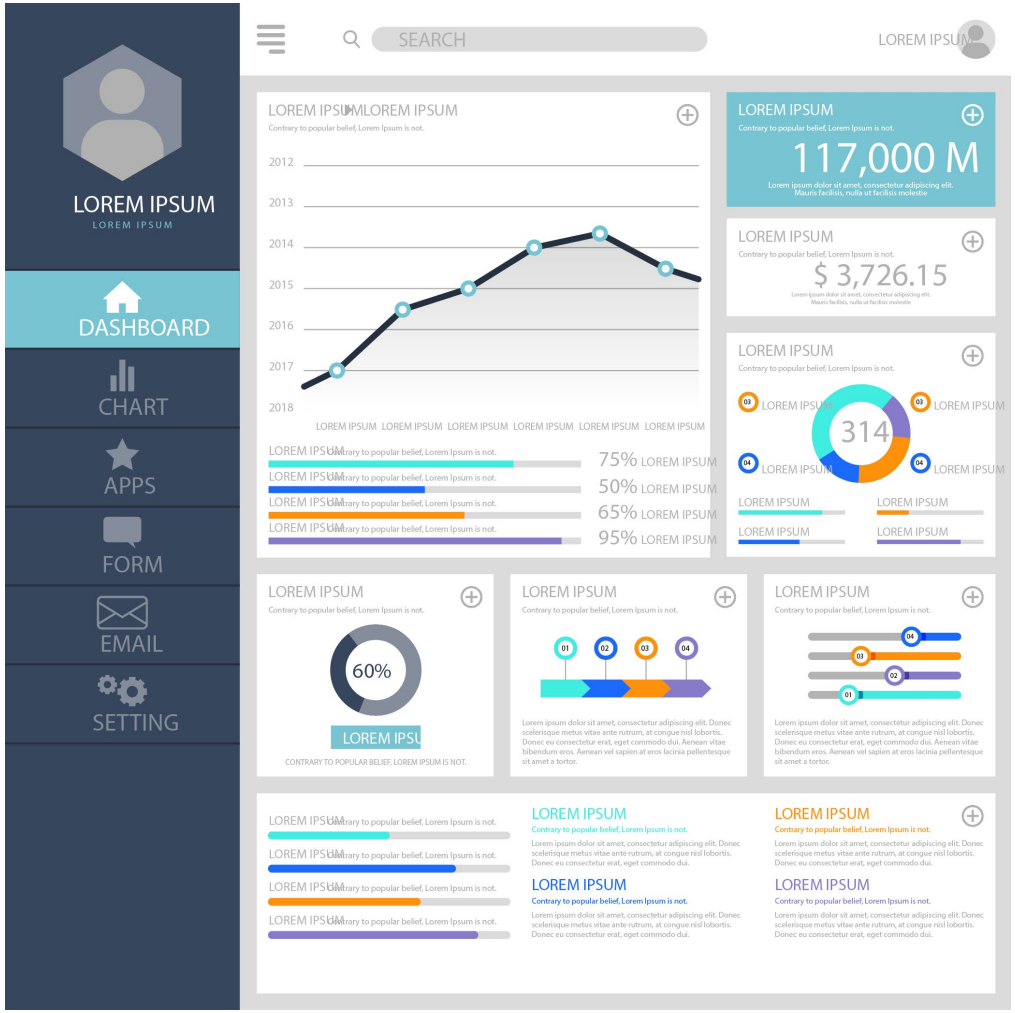
6 Visualization & Communication

- Create powerful reports and dashboards
- Communicate business finding to convince the stakeholders



Data Science Process

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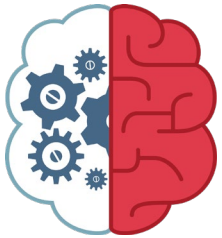
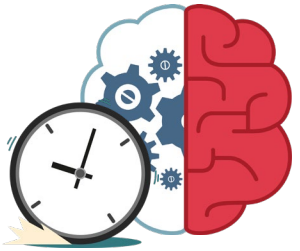
7 Deploy & Maintenance



Model

Test in pre-production environment

Deploy in production environment



Running Model

Monitoring

Real-time Analytics

Data Science Process

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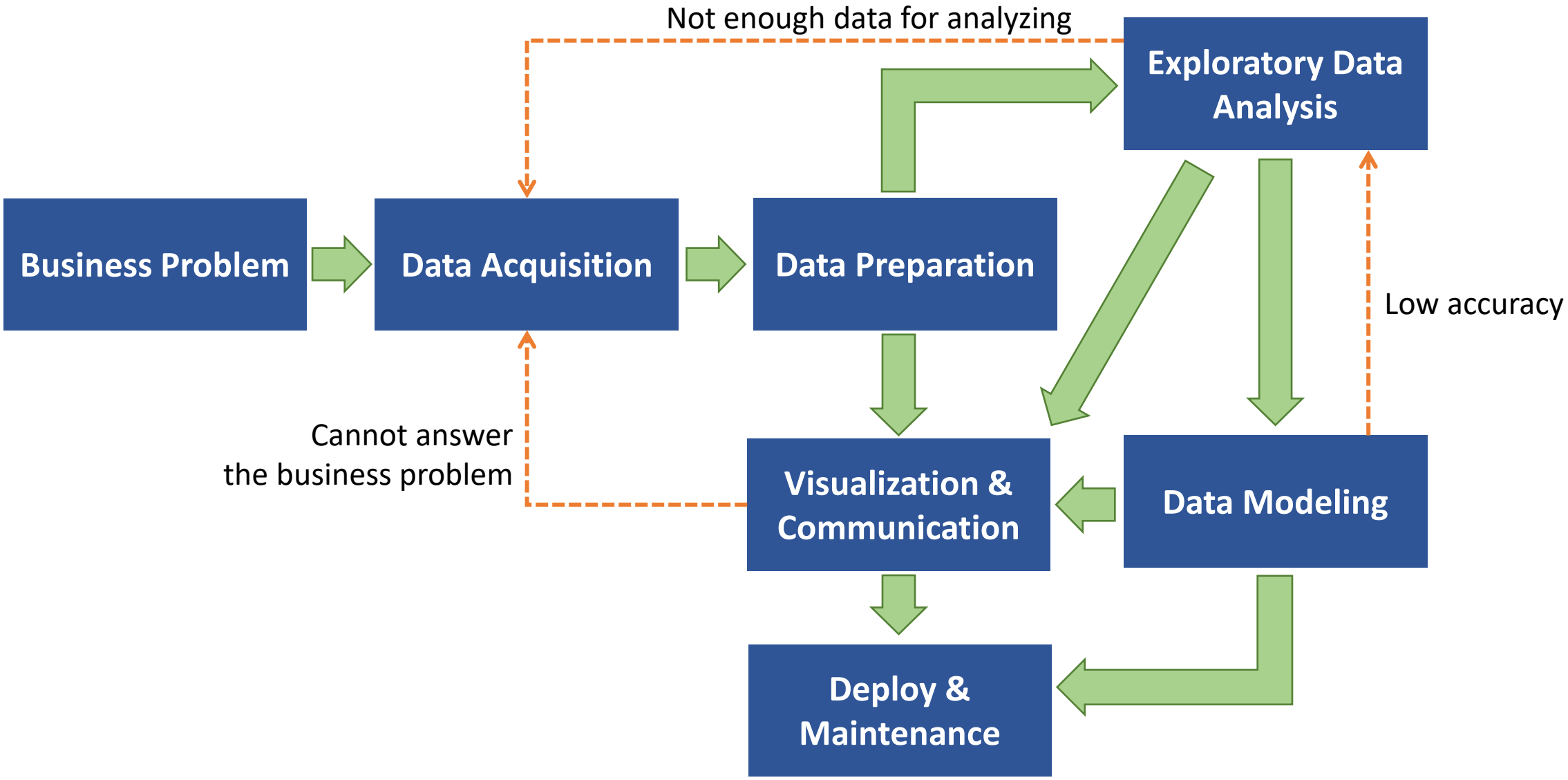
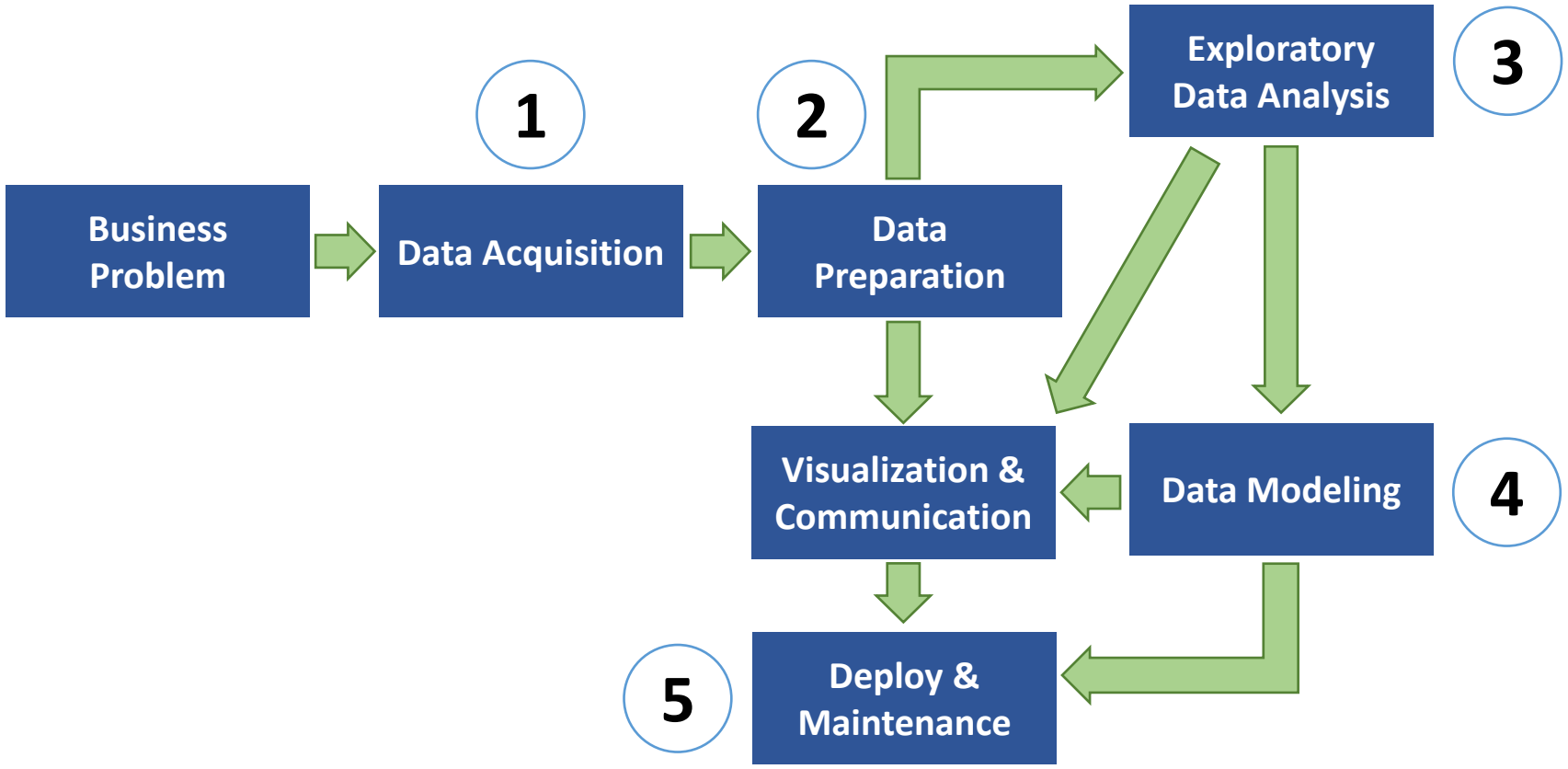


Overview of Data Science

A Simple Toy Problem

We want to tech a computer to distinguish pictures of cats and dogs.
How we can perform a data science process to solve the problem?



Overview of Data Science

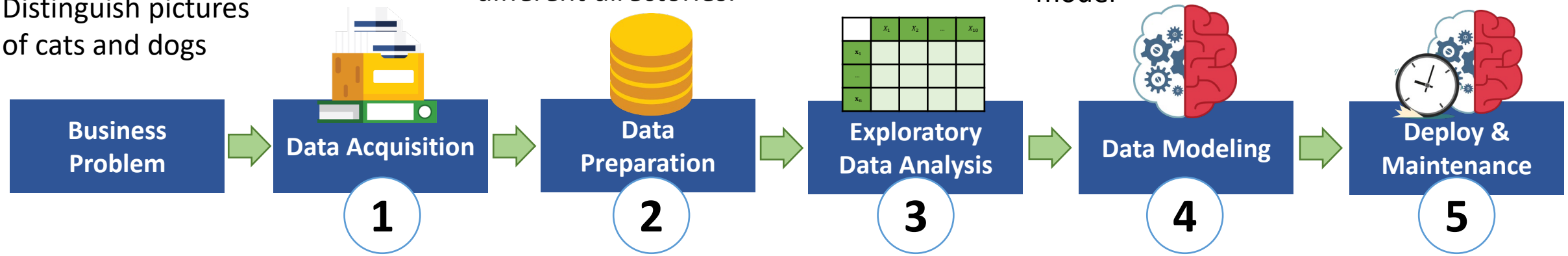
A Simple Toy Problem

We want to tech a computer to distinguish pictures of cats and dogs.

- Extract images that contain only cat or dog
- Scale images to have the same size (Options)
- Store cat's and dog's images in different directories.

Train a classification model and test the model

Distinguish pictures of cats and dogs

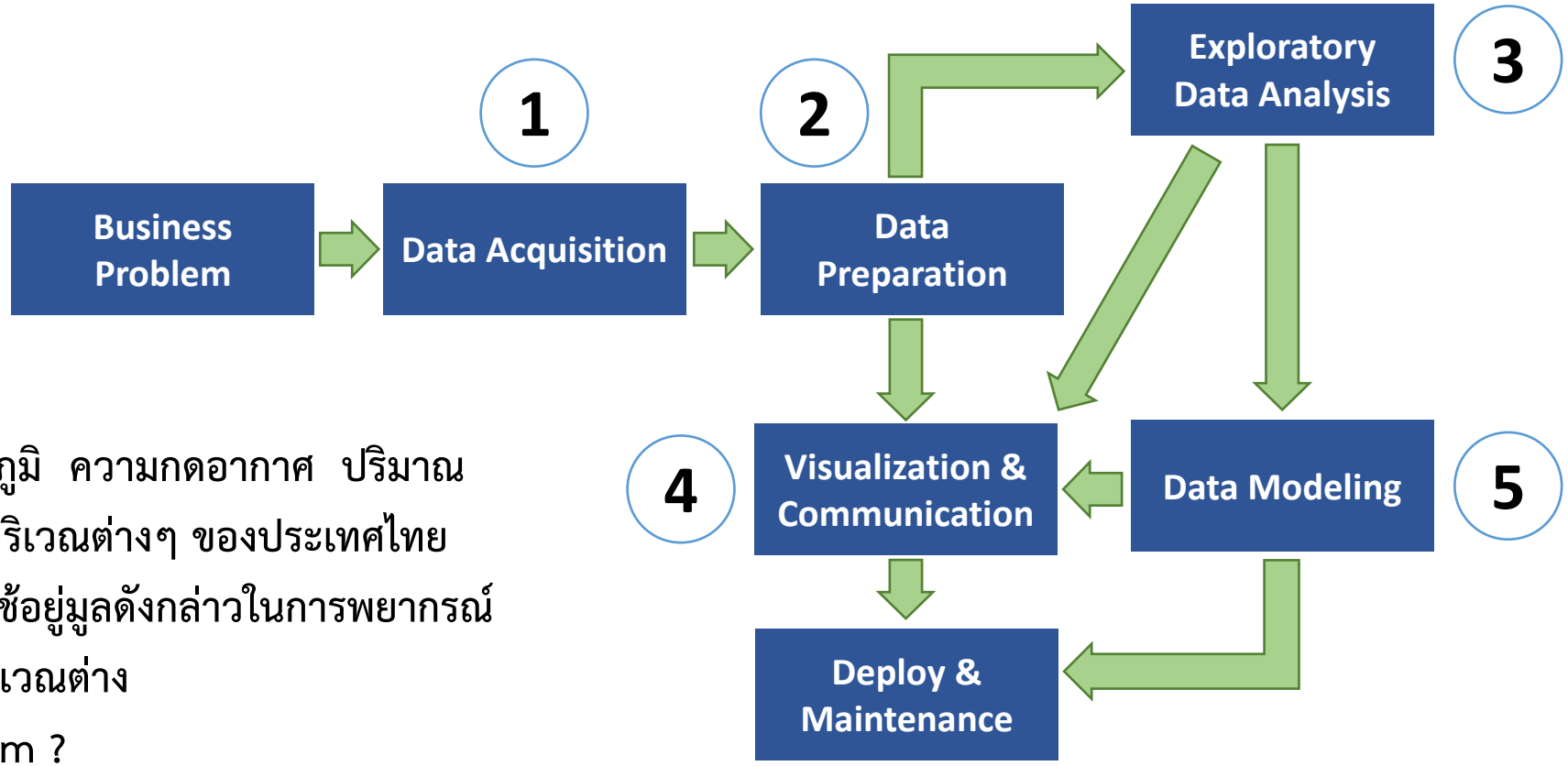


Collect images of cats and dogs from data sources

Extract information that can be used to distinguish cat from dog

Launch an application

Practice

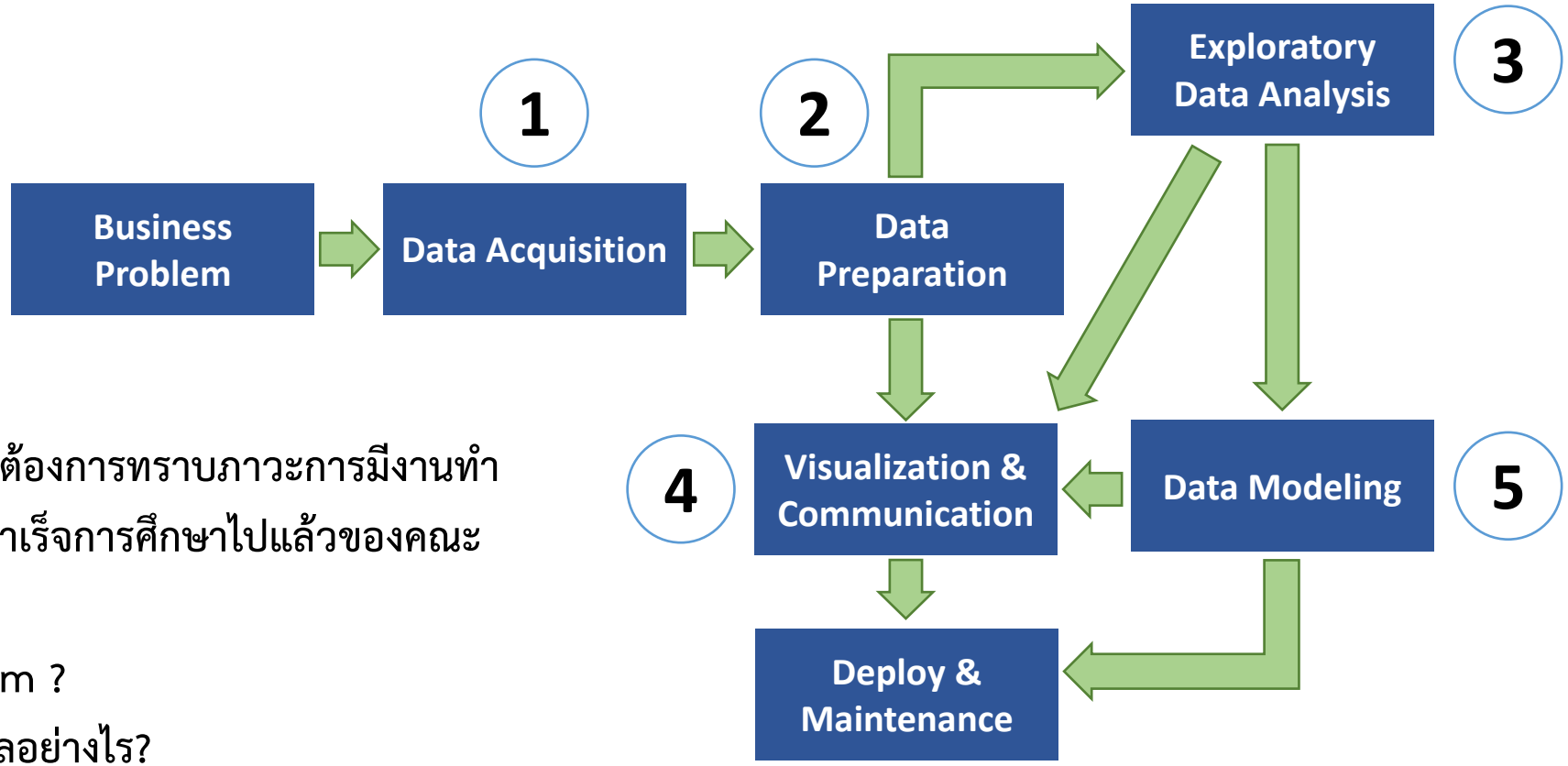


Problem

กรมอุตุนิยมวิทยามีข้อมูลอุณหภูมิ ความกดอากาศ ปริมาณความชื้น และกระแสลม ณ บริเวณต่างๆ ของประเทศไทย เจ้าหน้าที่กรมคนหนึ่งต้องการใช้อยู่มูลดังกล่าวในการพยากรณ์ความเป็นไปได้ที่ฝนจะตกในบริเวณต่าง

- อะไรคือ Business Problem ?
- มีขั้นตอนการวิเคราะห์ข้อมูลอย่างไร?

Practice



Problem

ผู้บริหารมหาวิทยาลัยเชียงใหม่ต้องการทราบภาวะการมีงานทำและสายอาชีพของนักศึกษาที่สำเร็จการศึกษาไปแล้วของคณะต่างๆ ในมหาวิทยาลัย

- อะไรคือ Business Problem ?
- มีขั้นตอนการวิเคราะห์ข้อมูลอย่างไร?
- ให้ยกตัวอย่างข้อมูลที่จะต้องเก็บรวบรวม (2 ตัวอย่าง)

Further Study

- **Video**: Data Science In 5 Minutes | Data Science For Beginners | What Is Data Science? – Simplilearn https://www.youtube.com/watch?v=X3paOmcrTjQ&t=201s
- **Online lesson**: วิทยาการข้อมูลเบื้องต้น (Introduction to Data Science) – CMU MOOC https://thaimooc.org/courses/course-v1:CMU-MOOC+cmu034+2019_T1/about
- **Books**:
  - Jeremy Watt, Reza Borhani and Aggelos K. Katsaggelos. **Machine Learning Refined: Foundations, Algorithm, and Application**. Cambridge University Press, 2016.