

# **Adaptive Business Intelligence (ABI)**

## **MAP-i PhD (Edition 2025/26)**

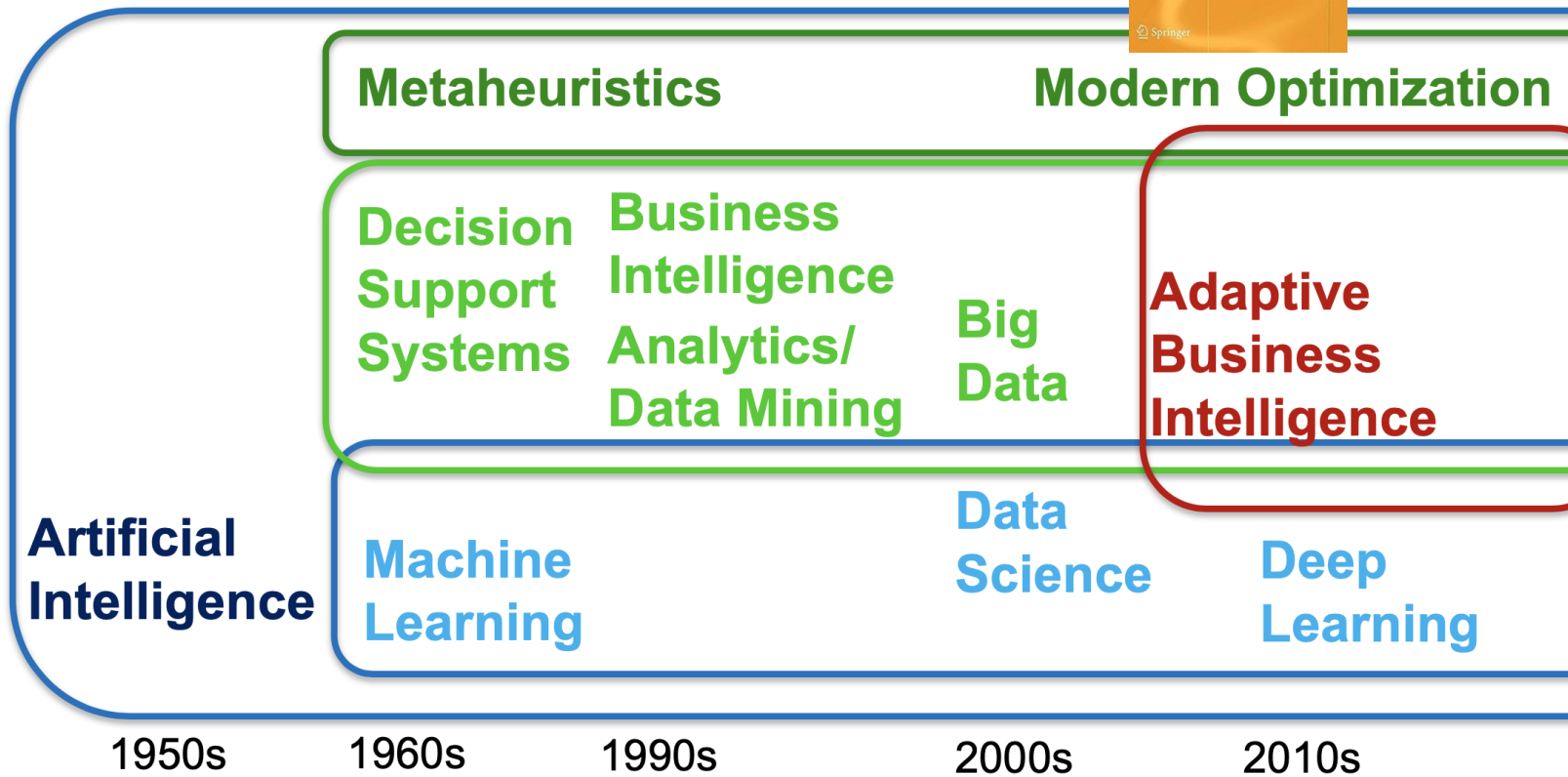
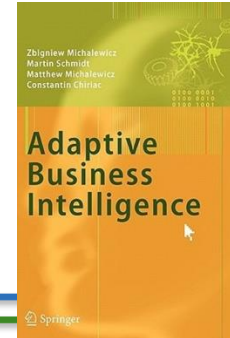
### **Lecture Team:**

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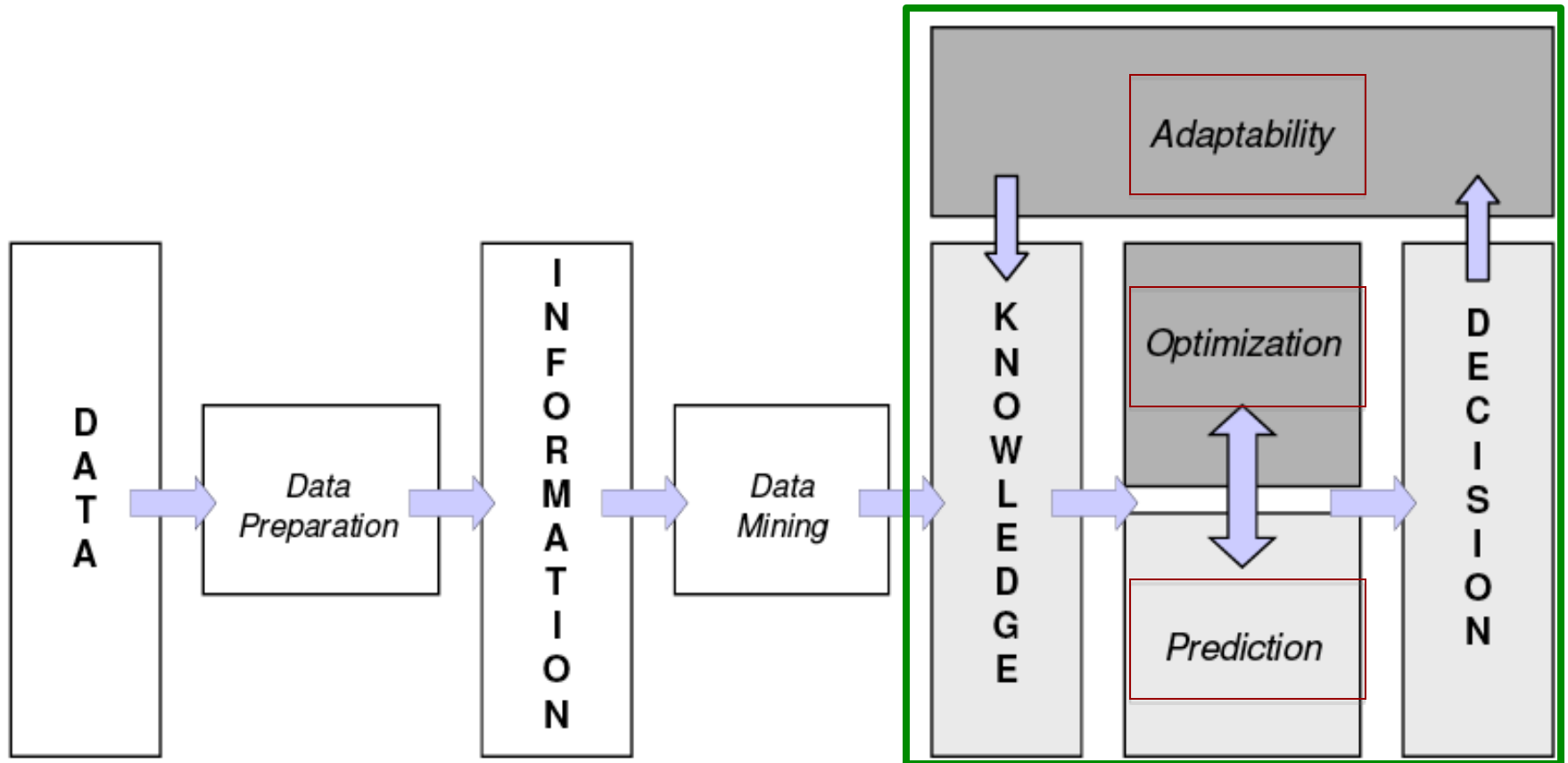
# > **ABI CONCEPT**

- **Business Intelligence (BI)** is an umbrella term that includes methodologies, architectures, tools, applications and technologies
- access data from multiple sources and process these data into useful knowledge to support activities such as monitoring, control, planning, management and decision making
- In 2007, a new trend emerged in the marketplace called **Adaptive Business Intelligence (ABI)**
- extend the traditional BI with two additional modules: **forecasting** and **optimization** , in order to enhance adaptability
- **adaptability** is a vital component of any intelligent system
- ABI goal is to use computer systems that can adapt to changes in the environment, solving complex real-world problems with multiple objectives, in order to aid business managers

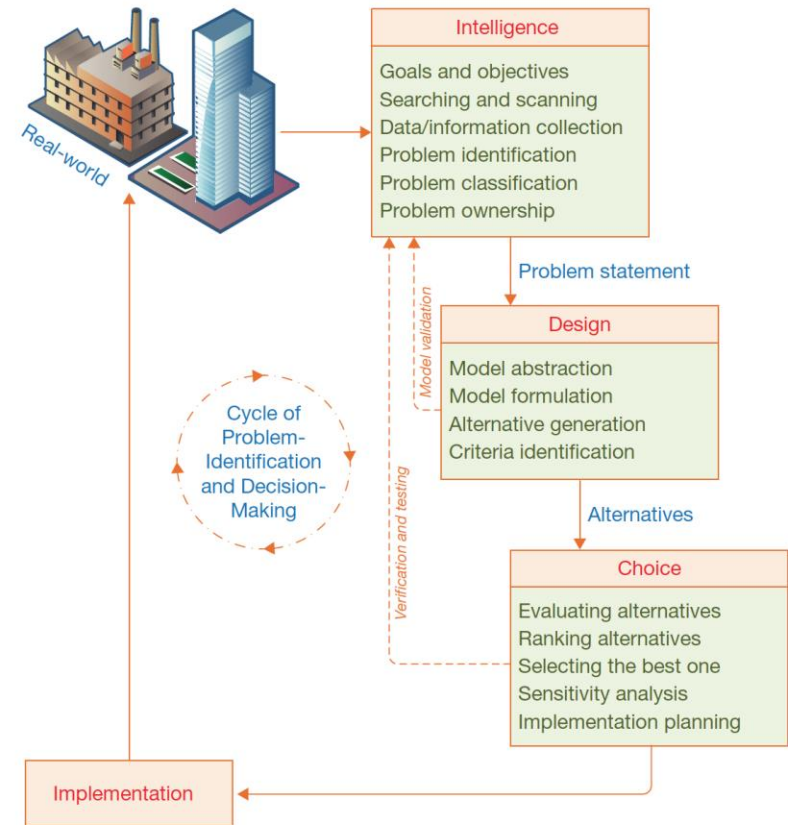
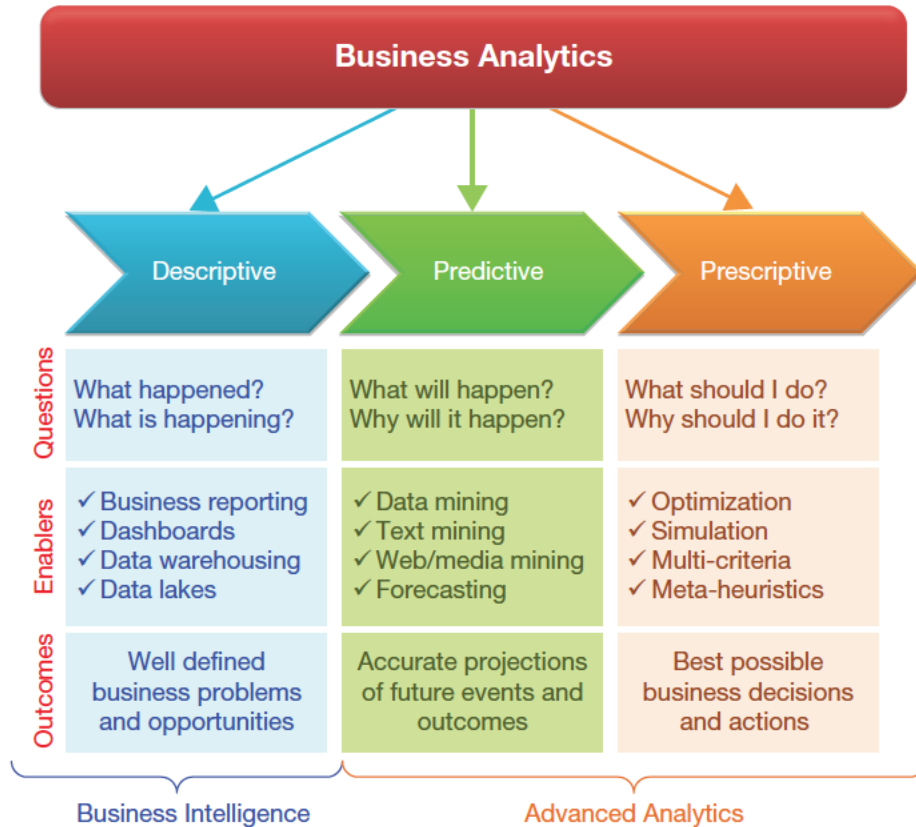
# > ABI CONCEPT



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# > ABI / PRESCRIPTIVE ANALYTICS / DECISION MAKING



# > Examples of ABI Projects:

## Car Distribution Example

### > ABI Impact:

**Current solution:** human team specialized in shipping cars to auction sites (very complex task); A small error of \$150 per car implies hundreds of thousands of \$ per day!

ABI system: estimate of an improvement of several million \$ per year when compared with the human team.

Prediction Module:

Based on historical sale records:

$f(\text{base\_price}, \text{model}, \text{mileage}, \text{season}, \text{other})$

Optimization Module to search for the best sale price based on a car distribution solution

# > **Examples of ABI Projects:**

## **Dynamic Energy Consumption**

### **> ABI Impact:**

Forecasting Module to predict Energy:  
ARIMA, Prophet, LSTM

Optimization Module:

Approaches: Linear/Nonlinear Programming, Reinforcement Learning, or Genetic Algorithms.

Goal: Minimize energy consumptions under constraints

# > **Examples of ABI Projects:**

## **Waiting List Optimization**

Public hospitals face long patient waiting lists. ABI can dynamically allocate resources and schedule procedures.

## **> ABI Impact:**

Forecasting Module to predict surgery time:

Inputs: Historical admissions, seasonality (e.g., flu season), hospital capacity, referral patterns.

Optimization Module:

Approaches: Mixed-Integer Linear Programming (MILP), Constraint Programming, or Heuristic Algorithms (e.g., Genetic Algorithms, Tabu Search).

Goal: Minimize patient waiting times while respecting resource constraints (beds, staff, equipment).

# > Objectives and Learning Outcomes

1. To understand ABI concepts: BI, ABI, data mining, prediction, modern optimization and adaptability
2. To master the state of the art of ABI methods, models and tools
3. To perform review essays over an advanced research ABI topic
4. To apply ABI concept in real-world problems

# > Program

1. Introductory ABI concepts: BI and ABI, data mining, prediction, optimization and adaptability, state of the art
2. Using prediction and optimization to build adaptive systems: application of data mining models and techniques in ABI (e.g., decision trees, neural networks and deep learning, support vector machine, random forests, hierarchical and relational clustering, inductive logic programming), application of modern optimization techniques in ABI (e.g., simulated annealing, evolutionary computation)
3. Conducting ABI projects and case studies: CRISP-DM, ABI applied to real-world problems (e.g., Finance, Economy, Healthcare, Marketing)
4. Exploration of ABI tools: Prediction and optimization tools (e.g., R, Python, WEKA/MOA/Rapidminer, Inductive Logic Programming (ILP))

# > Teaching Methodology and Evaluation

**Three teaching methodologies will be applied:**

- 1 Lecture exposition of key ABI issues
- 2 Active learning
- 3 Project-based learning

**Evaluation will include two elements:**

- A - **review** of an advanced ABI research article from an ISI/Scopus journal, leading into a presentation and short article (**30%**);
- B - an **ABI project** (group of 2/3 students) that describes the application of ABI to a real-world dataset (**70%**);