IS4242
INTELLIGENT SYSTEMS & TECHNIQUES

L1 – Introduction

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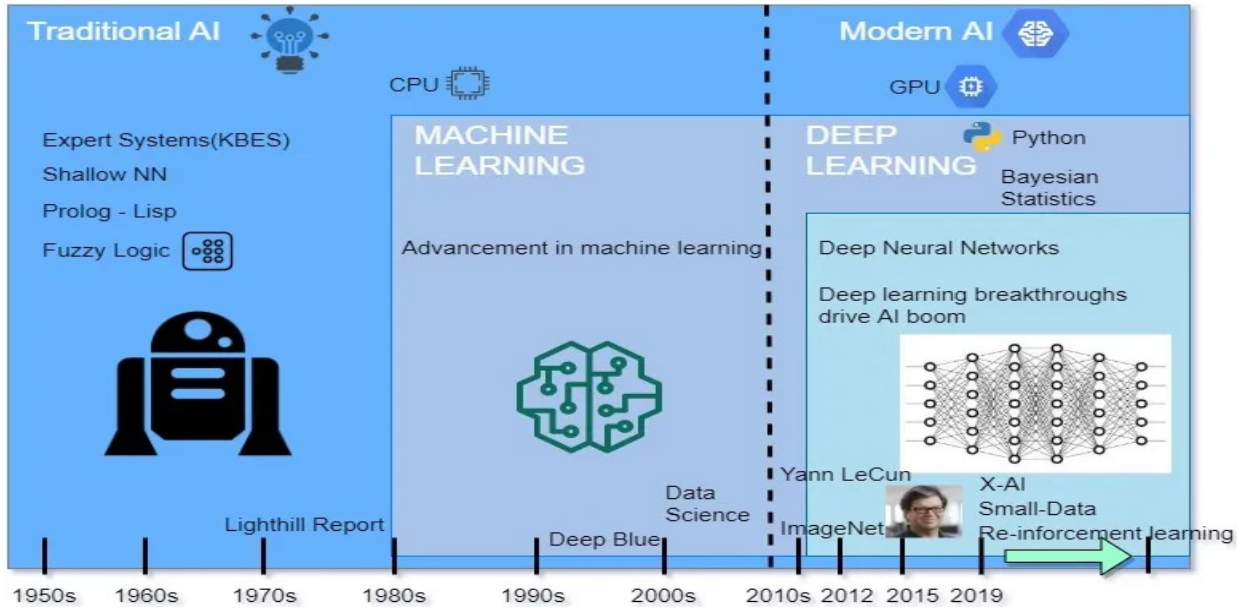
Intelligent Systems for Business

- Every company wants to know:
  - What is happening?
  - What is likely to happen?
  - What strategy provides the best outcome in this situation?

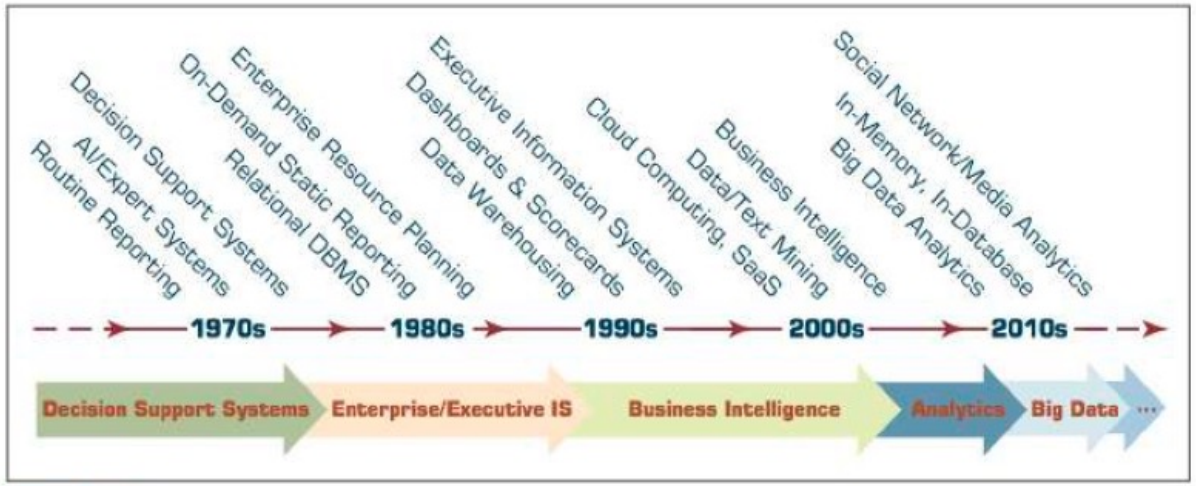
- *Collect* data and *extract meaningful insights* to make every possible decision
  - Transform itself into an AI-first company!

- But AI has been around since 1950, why now?
  - *"Machines will be capable of doing any work a man can do."* – Herbet A. Simon *(1965)*

Evolution of AI and Business Intelligent Systems



AI has gone through many ups and downs



But companies were always after the Data

Why do companies need Intelligent Systems?

- Data helps you to measure
  - You can't solve problems you don't know about

- This data revolution has not only created efficient processes but also created data-driven products!
  - Ex: Tesla builds cars by developing software on unique hardware, much in the way Apple develops the iPhone or Microsoft leverages Intel chips and Dell PCs

- This digital transformation has created a *hyper-turbulent* and *hyper-competitive* market in almost every industry

Why do companies need Intelligent Systems?

- Hyper – turbulent:
  - Highly volatile market: difficult to maintain the sustainable and competitive advantage for a long term
- Hyper-competitive:
  - Highly concentrated market, where winner takes all
  - The entire demand goes to the best products, but these best products keep changing over time
  - Decisions should not be made by the whim but based on facts (data)!
- Crucial to be an AI-First company: leverage data to make strategic decision and build competitive advantage

Business Use Cases: Pricing Strategy

- Nothing is more important than ensuring products are priced appropriately
  - Charge too little – you leave revenue on the table
  - Charge too much – alienate and push customers to competitors

- Willingness to pay
  - The maximum price that a customer is ready to pay for a product or service

- How do you learn the willingness to pay of your potential customers?
  - Survey?
    - They would say: they want *the best of everything* by paying *as little as possible*
  - Don't believe what they say but what they do!
    - Past purchase behaviours that reveal consumer preferences

Business Use Cases: Coupons

- Coupons /Promotions
  - Target *valued* customers to improve *profitability*

- Groupon sold coupons called Groupons
  - Purchasers buy goods at discount prices from participating merchants
  - Merchants paid nothing for advertising unless a customer made a purchase
  - Groupon's sales grew rapidly and exceeded $2.5 billion in 2013

- Is this Business Model viable?

Business Use Cases: Coupons

- Groupon spent heavily on marketing to acquire customers
  - Customers got tired of receiving discount offers
  - Merchants found that offering Groupons only brought them unprofitable customers, who don't come back.

- Where is the problem?
  - In the data! Groupon does not know :
    - Consumer purchase behaviour when the Groupons are not used
    - Who are the valued customers for each of their merchants

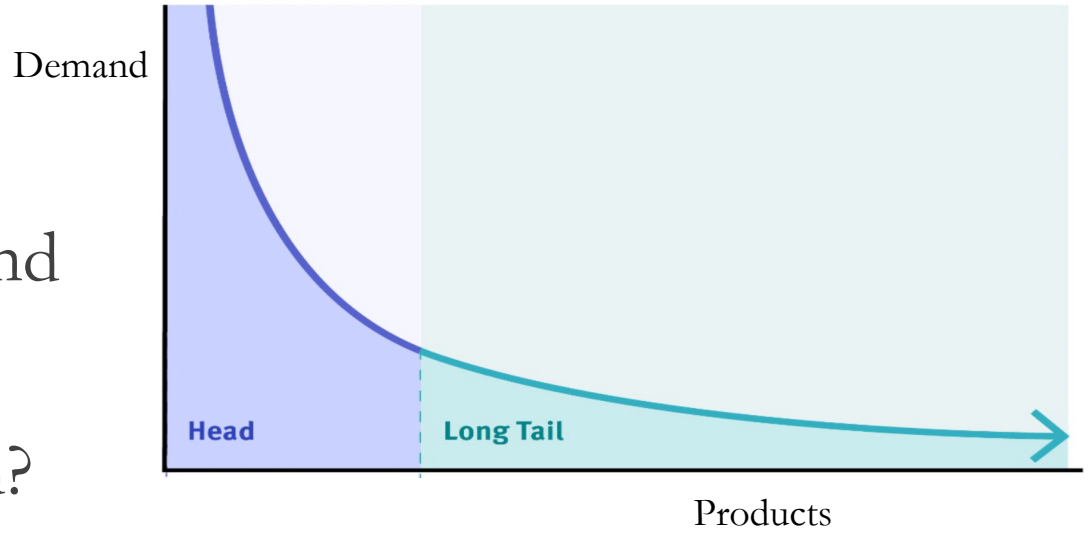
- A better way is to build a classifier to see which *valued* customers would encash the coupon

Business Use Cases Example: Market Segmentation

- How do you find new customers?
- Learn as much as we can about current customers and their similarities
- Group customers based on their demographics or purchase behavior
- These groups should provide information on potentially new customers as well as existing customers!
- Design products to target these groups accordingly
  - Ex: In an audio equipment company:
    - Casual listeners: any speakers, headphones or ear buds
    - Music lovers: the highest quality in audio equipment

Business Use Cases: Matching Demand & Supply

- Amazon has a catalog of 12 billion products and 310 million users
  - Long tail of suppliers
  - Few suppliers have high demand and
    a lot of suppliers have very low demand



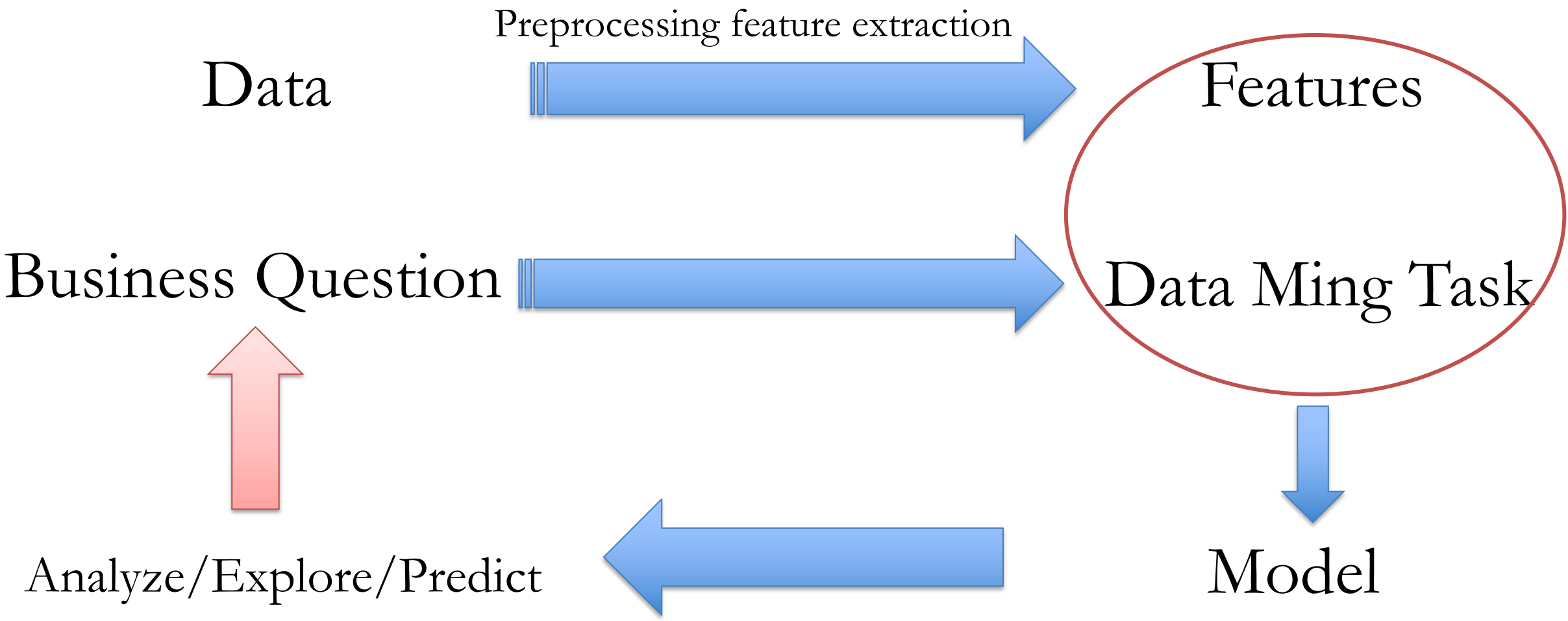
- How to help quality suppliers gain demand?
- How to help customers find quality products they like?

- One simple way: Efficient search functionality
  - Better way: Recommendation systems!

Other Pertinent Business Questions

- Mobile Apps: How do you retain customers?
- Product design: N ways of designing a feature but how do you know which is the best?
- Social media monitoring:
  - Enormous amounts of user data, which can be used to obtain customer preferences
  - Data is unstructured: text, images, and videos
- Competitor Analysis: What is the market structure and who are your competitors?

'Intelligence' of the Intelligent System: Model



Learning Paradigms of Data Mining Tasks

- Supervised
- Unsupervised
- Others
  - Semi-supervised
  - Active Learning
  - Reinforcement Learning

Supervised Learning

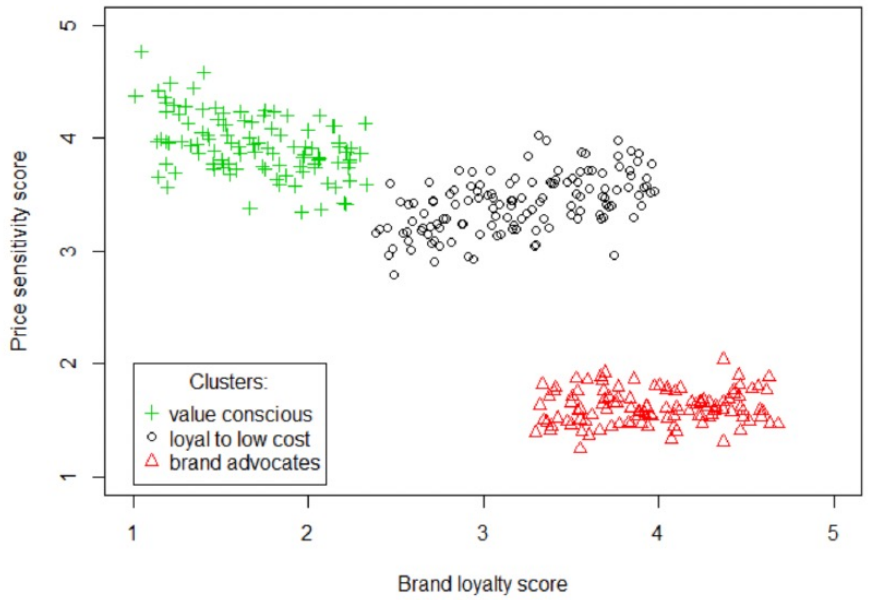
- Training Data: $(\boldsymbol{X_1}, y_1), (\boldsymbol{X_2}, y_2), \ldots, (X_n, y_n)$
- Learning function: $y = g(\boldsymbol{X})$
- y is *numerical or ordinal* : Regression
- y is *categorical* : Classification (binary or multiclass)
- Prediction: $g(\boldsymbol{X_i}) = \hat{y}_i$

	f_1	f_2	...	Y
$\boldsymbol{X_1}$				y_1
$\boldsymbol{X_2}$				y_2
$\boldsymbol{X_3}$				y_3

Unsupervised Learning

- No labeled training data: $\{(\boldsymbol{X_1}, \boldsymbol{X_2}, \ldots, X_n\}$
- Discover structure in data
- Clustering is $g(X) = y$
  - Partitioning: K-means, Fuzzy C-Means, etc.
  - Hierarchical Clustering

	f_1	f_2	…
$\boldsymbol{X_1}$			
$\boldsymbol{X_2}$			
$\boldsymbol{X_3}$			



https://select-statistics.co.uk/blog/customer-segmentation/

Building Intelligent Systems: Example

- Does providing discounts improve the sales of a product?
  - *Data Mining Task: Prediction (Regression)*
  - $Sales = \alpha_0 + \alpha_1 discount + \varepsilon$
    - Building the model corresponds to identifying $\boldsymbol{\alpha}$
  - Algorithm: Maximum Likelihood Estimation (MLE)
  - Theory: Which algorithm is correct – MLE, Least Squares, etc.?

- Primarily: Modeling and Application
  - Algorithm and Theory in some cases

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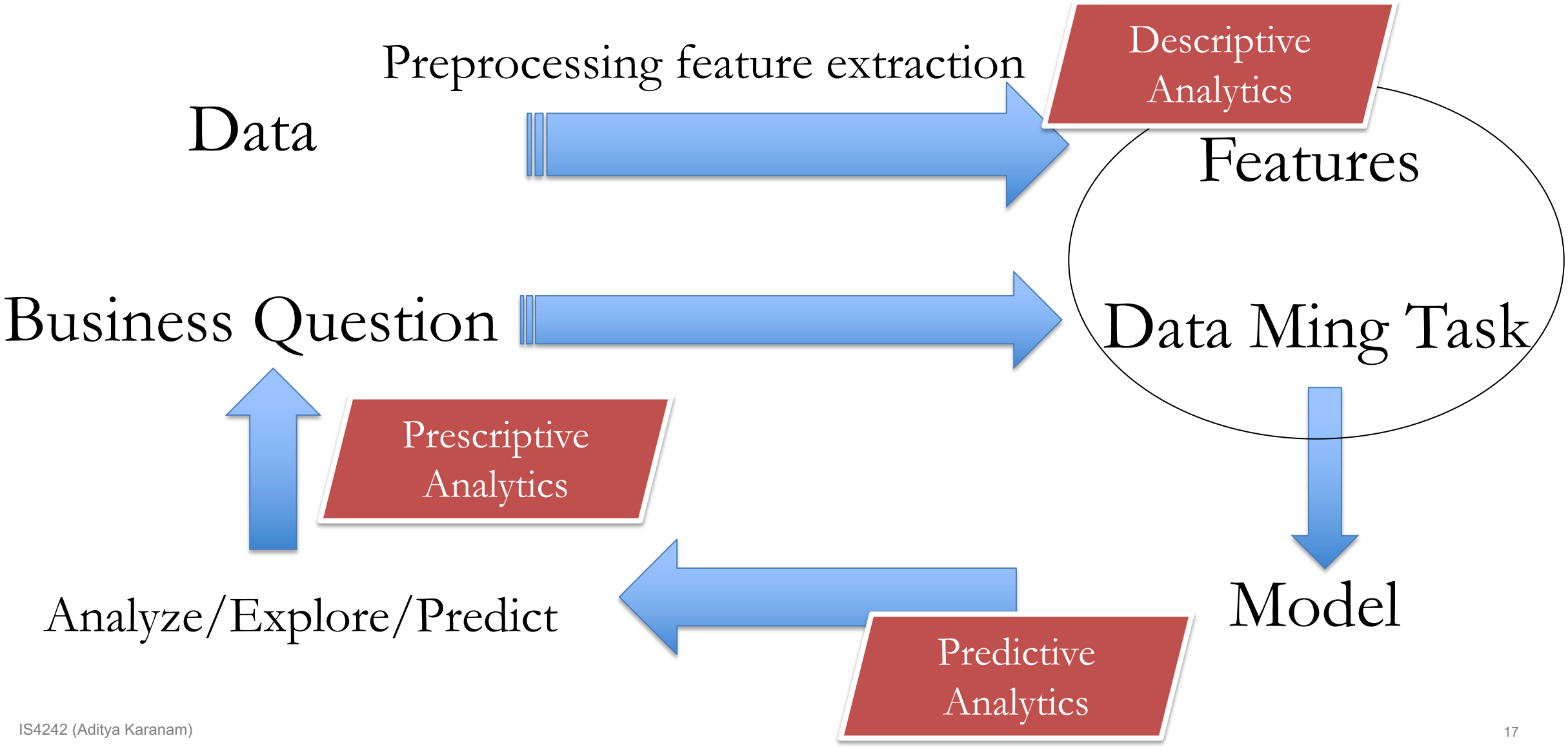

References

- Sharda et al., Business Intelligence, Analytics, and Data Science: A Managerial Perspective

- https://hbr.org/2008/07/investing-in-the-it-that-makes-a-competitive-difference

NUS National University of Singapore

Thank You