Technische Universiteit
Eindhoven
University of Technology

# JM0100
# Business Analytics

## Assignment 3

Goos Kant
Yingqian Zhang

Where innovation starts

| Week | Date | Hearing Lecture | Course Nr. | Content | Task | Deadline |
|---|---|---|---|---|---|---|
| 5 | Mon, 29 Jan | YZ | 1 | L1: Introduction, predictive versus prescriptive, linear programming | Work on Assignment 1 | |
| 6 | Mon, 5 Feb | YZ | 2 | L2: LP: simplex method | | |
| 7 | Mon, 12 Feb | | | Carnaval break | | |
| 8 | Mon, 19 Feb | YZ | 3 | | | |
| 9 | Mon, 26 Feb | GK | 4 | L4:Introduction heuristics, construction algorithms, explanation TSP and VRP | | |
| 10 | Mon, 5 Mar | GK | 5 | L5:VRP-algorithms, local search techniques and introduction meta-heuristics, tabu-search | | |
| 11 | Mon, 12 Mar | YZ | 6 | L6:Genetic Algorithms | | |
| 12 | Mon, 19 Mar | YZ | 7 | L7:Ant Colony Optimization | | |
| 13 | Mon, 26 Mar | GK | 8 | L8:Simulated Annealing, summary heuristics, applications, introduction book chapters/review | | |
| 14 | mon, 2 Apr | | | Easter closure | Work on Assignment 2 | |
| 15 | Mon, 9 Apr | YZ | 9 | ~~L3: ILP and combinatorial optimization;~~ Introduce project | | deliver assignment 1 (23:59, 9/4) |
| 16 | Mon,16 Apr | GK/YZ | 10 | Guest lecture (eBay) | Work on project | Deliver Assignment 2 (23.59; 23/04) |
| 17 | Mon, 23 Apr | GK/YZ | 11 | Guest lecture (Ortec) | | |
| 18 | Mon, 30 Apr | GK/YZ | 12 | office hour | | deliver intermediate report (30/04) |
| 19 | Mon, 7 May | GK/YZ | 13 | office hour | | |
| 20 | Mon, 14 May | | | | Prepare exam | deliver final project report (23.59;14/05) |
| 21 | Mon, 21 May | | | no course; White monday | | |
| 22 | Mon, 28 May | | | exam | | |
| | | | | | | |

# Assignment 3: project work

- Two guest lectures on “business analytics in practice”
  - attendance highly recommended
  - part of final exam materials
- Teams will focus on solving an auction design case: predictive analytics + prescriptive analytics
- Intermediate report (optional, not graded): by 30 April
- Final report/program:  by 14 May

# Background

- Online (industrial) auctions
  - Sell inventories of companies
- Data from one of the largest online auctioneers in Europe (let's call it A)
  - >1000 auctions (or sales) per year
  - Each sale lasts (typically) 2 weeks; has multiple lots
  - (online) bidders from many countries
  - English auction: open with a starting price, accept increasing higher bids, until no more bids. The last bid is the winning bid (i.e., selling price)
  - "soft close": every lot has a scheduled closing time; but bidding continues if there are at least two active bidders after closing time

# Background

- The objective of auctioneers:

  maximize the revenue, i.e., maximizing selling price of each lot of each sale

- Challenges:
  - Who are prospective buyers (bidders)?
  - Too many variables in auction design: unclear how these variables contribute to revenue/selling price
  - Currently: A has about 15 auction experts, who have different vision/opinion on good auction design

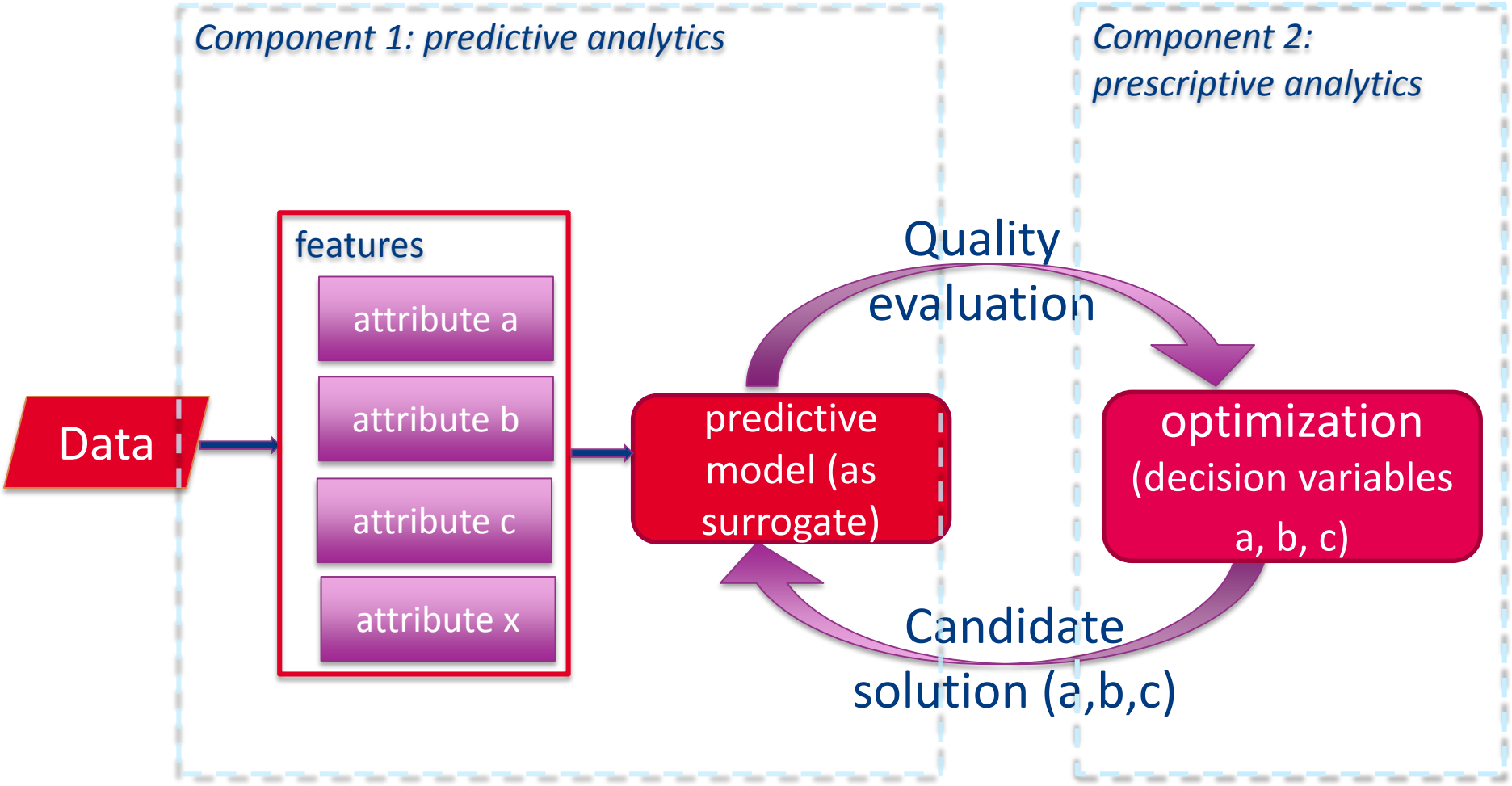
- Main task:
  - *A data driven auction design that maximizes the expected revenue of a given auction*
  - *Combining predictive analytics and prescrptive analytics!*

- How to measure whether the auction is successful or not?
  - Winning bid (end price, or selling price)
  - We use

    multiplier: Winning bid/Estimated value

# Dataset: (Processed) auction data from mid 2014 – early 2015

- Multiplier: performance indicator
- LotNr: lot number in the sale
- Allocate: whether the seller of the lot has set a price which he want as minimum for the lot
- EstValue: estimated value of the lot (by auction experts)
- StartPrice: starting bidding price of the lot
- Followers: nr. of people following the lot
- Bank, Dealer, Liquidator, Volunteer: type of sales
- LotsSale: amount of lots of one sale
- LotsCtgry: amount of lots within a sale with the same category
- Forced: whether a sale is forced or not (due to bankruptcy)
- SP.EV: starting price/estimated value
- Duration: duration of auctions in hours on a lot
- Morning, Evening, Afternoon: last bid on the lot




*One solution is a design of an auction, including starting price, lot number, durations*

# Step 1: descriptive analytics

- Summarize data into meaningful charts and reports

- Example research questions:
  - What is the current situation of the auction outcomes?
  - Which parameters (especially design variables influence the outcome?

- Techniques: statistical description, visualization

# Step 2: component 1

- Task: build a prediction model that classify/predict the performance of a new auction?

- Example research questions:
  - Using multiplier information to transform the performance outcomes to different classes
  - What features are relevant and important for such a prediction model?
  - What data mining methods to select for building such a prediction model?

- Main techniques: feature selection, classification

# Step 3: component 2

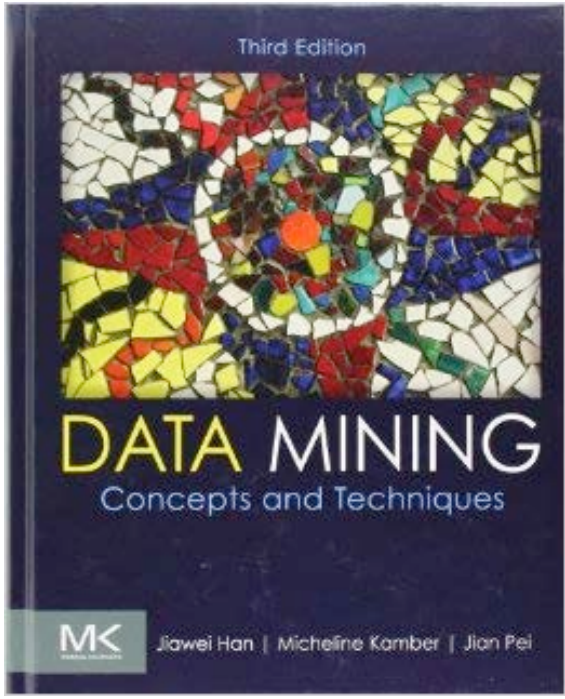
- Task: use optimization to identify the best auction design variables to maximize the expected auction performance

- Example research questions:
  - How to model it as an optimization problem?
  - What optimization methods are appropriate for this task?
  - What auction design parameters we should tune?
  - How to integrate the developed predictive model into the optimization process?
  - How to evalute the performance of the optimal design?

- Techniques: modelling, optimization methods

- Data Mining: concepts and techniques

  Good overview of basic data preprocessing, classification




http://www.sciencedirect.com/science/book/9780123814791

- Optimization: Lecture notes of this course!

# Deliverables

- Intermediate report (optional) : by 30 April
  - Main results from Step 1 and step 2
  - not graded
  - brief feedback (sufficient, or insufficient) will be provided
  - deliver clear analysis and overview, in pdf (<10 pages), or PowerPoint (<15 pages)

- Final report and program:  by 14 May
  - grade will be based on this report/program

*Details on the format of the end report will be provided later.*