Information Systems for Design and Marketing

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Outline

1. Introduction & Purpose

2. Knowledge-based & AI-based Approach

3. New Type of Advanced Data

   ➢ In-store movement data by using RFID sensor

   ➢ Eye movement data by using eye-tracking sensor

4. Research Cases & Business Applications

5. Research Activities & Exchanges

6. References

Introduction & Purpose

- Neither managers nor scholars have never suspended in improving the products and services in order to expand profit from their customers.

Conventional Business Perspective

Information System → Technical Supports → Marketing

Information System ← Technical Needs ← Marketing

Marketing ← Fundamental Supports ← Design

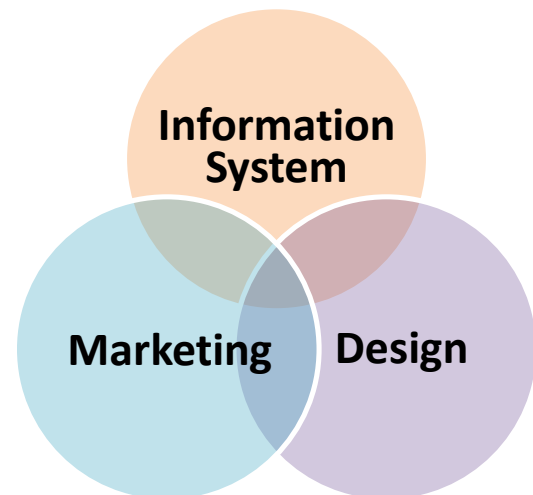Marketing → Fundamental Needs → Design

Introduction & Purpose

- In this technical committee, we discuss and study **Information Systems** for activating and integrating two business phases, i.e., **Design** and **Marketing** to reinforce interdisciplinary field of scientific study.
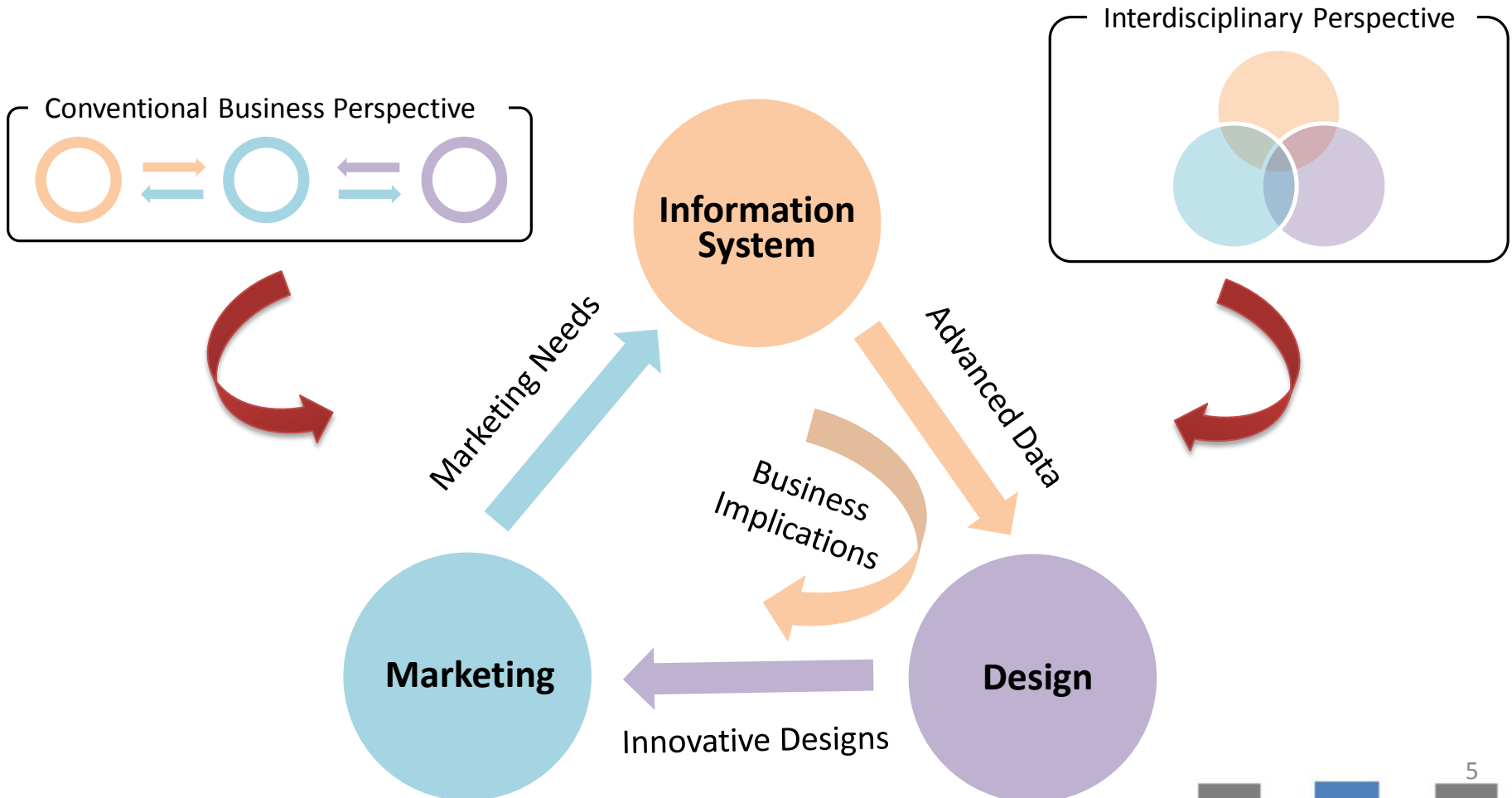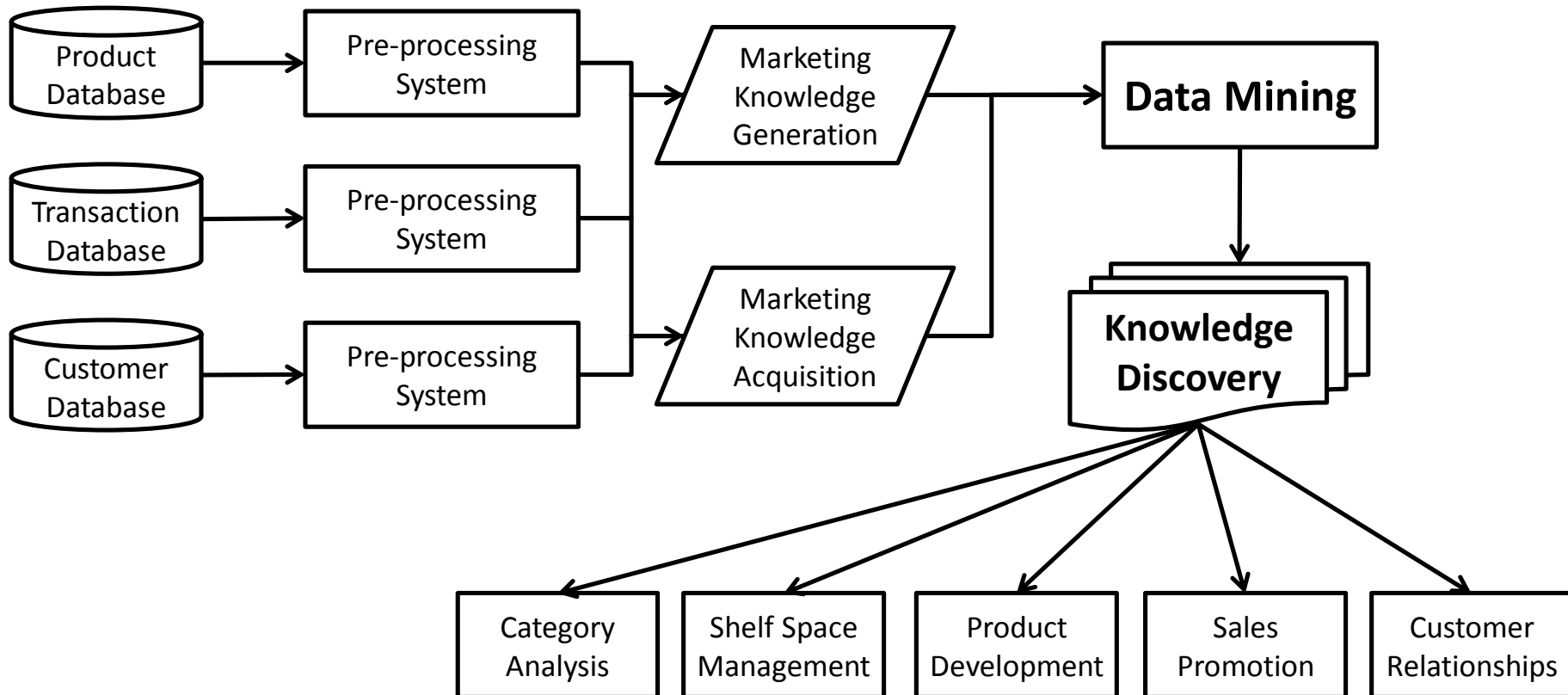
Interdisciplinary Perspective

Conventional Business Perspective

Information System

Marketing   Design
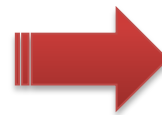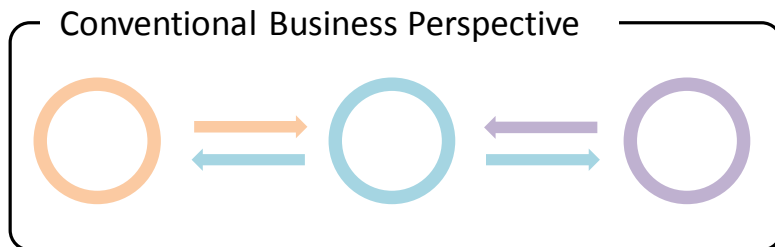
Introduction & Purpose

- New perspective in this technical committee

Conventional Business Perspective

Interdisciplinary Perspective

Information System

Marketing

Design

Marketing Needs

Advanced Data

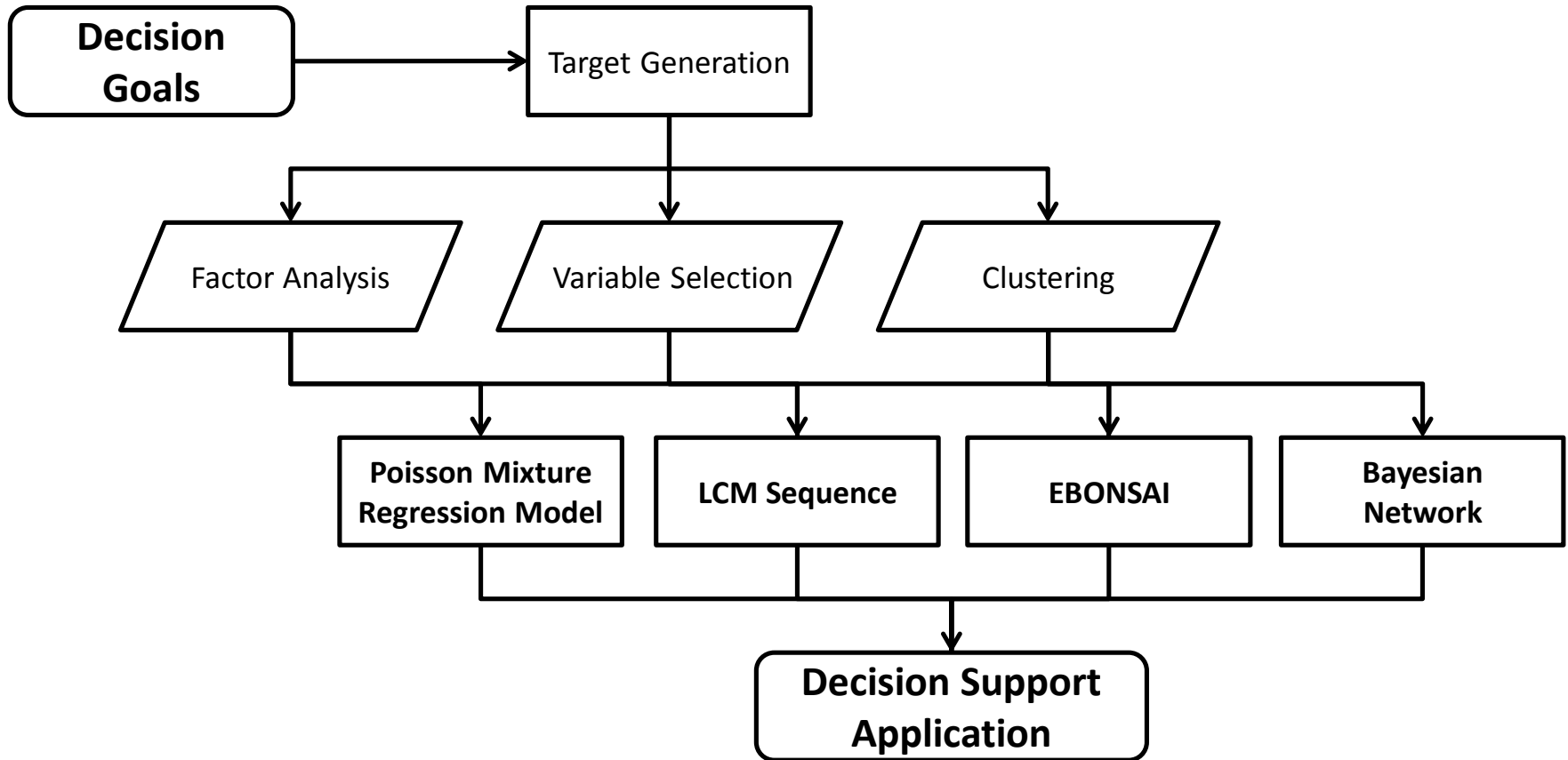Business Implications

Innovative Designs

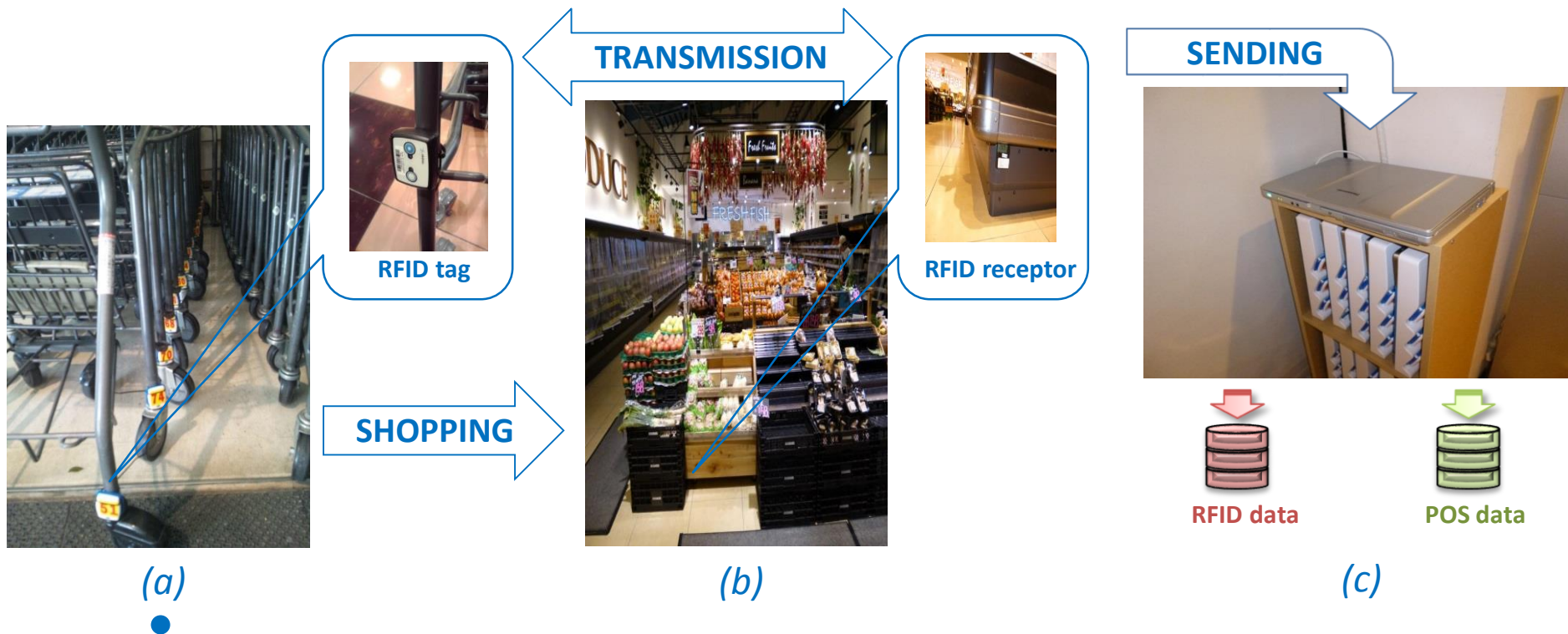# Knowledge-based Approach

- Data mining for knowledge discovery

AI-based Approach

- Machine learning for decision support
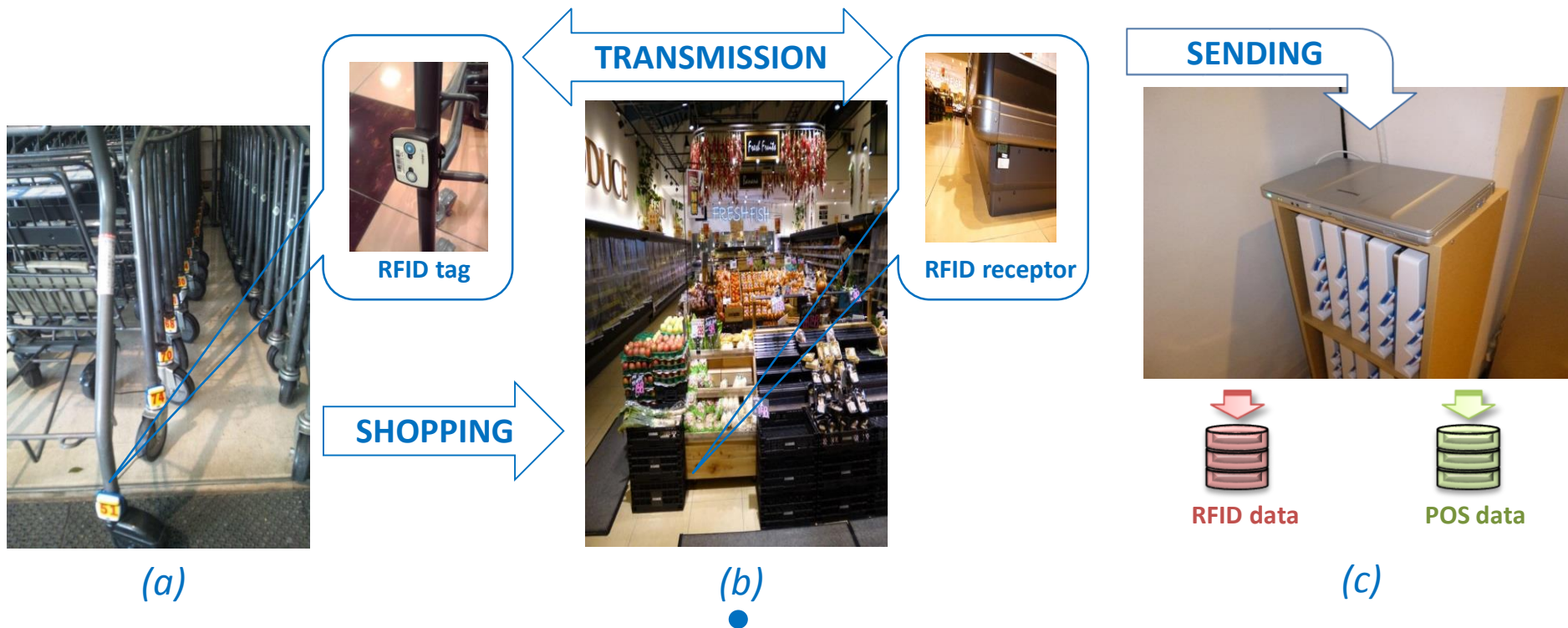
In-store movement data by using RFID sensor

- Overview of RFID system

TRANSMISSION

SENDING

RFID tag

RFID receptor

SHOPPING

RFID data

POS data

(a)   *(b)*   *(c)*

-

*(a) In the experiment, small **RFID tags** are attached to the shopping carts which are used by customers. Each RFID tag is assigned with a unique ID to identify.*
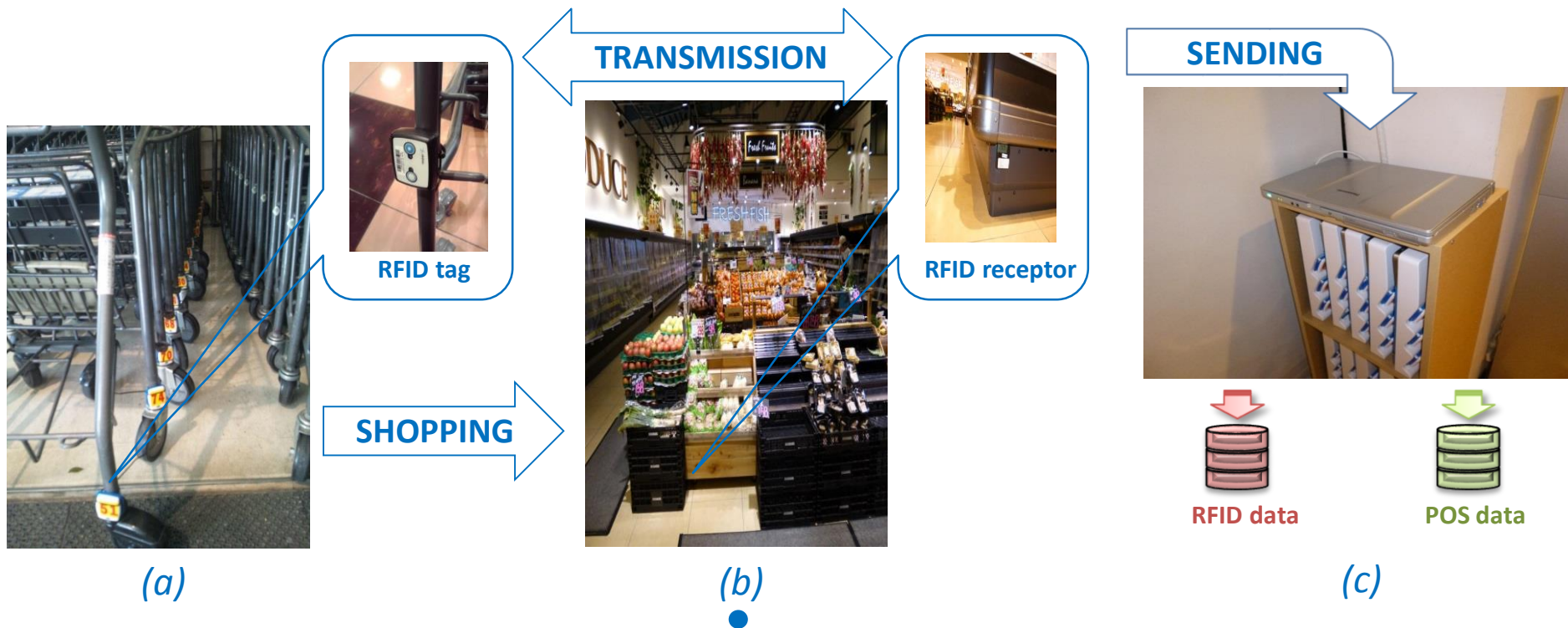
In-store movement data by using RFID sensor

- Overview of RFID system

TRANSMISSION

SENDING

RFID tag

SHOPPING

RFID receptor

RFID data   **POS data**

(a)   *(b)*   *(c)*

(b1)   When the customers walk through shelves with this cart, RFID tag emits signals per second which can express the position information in a coordinates (x, y).
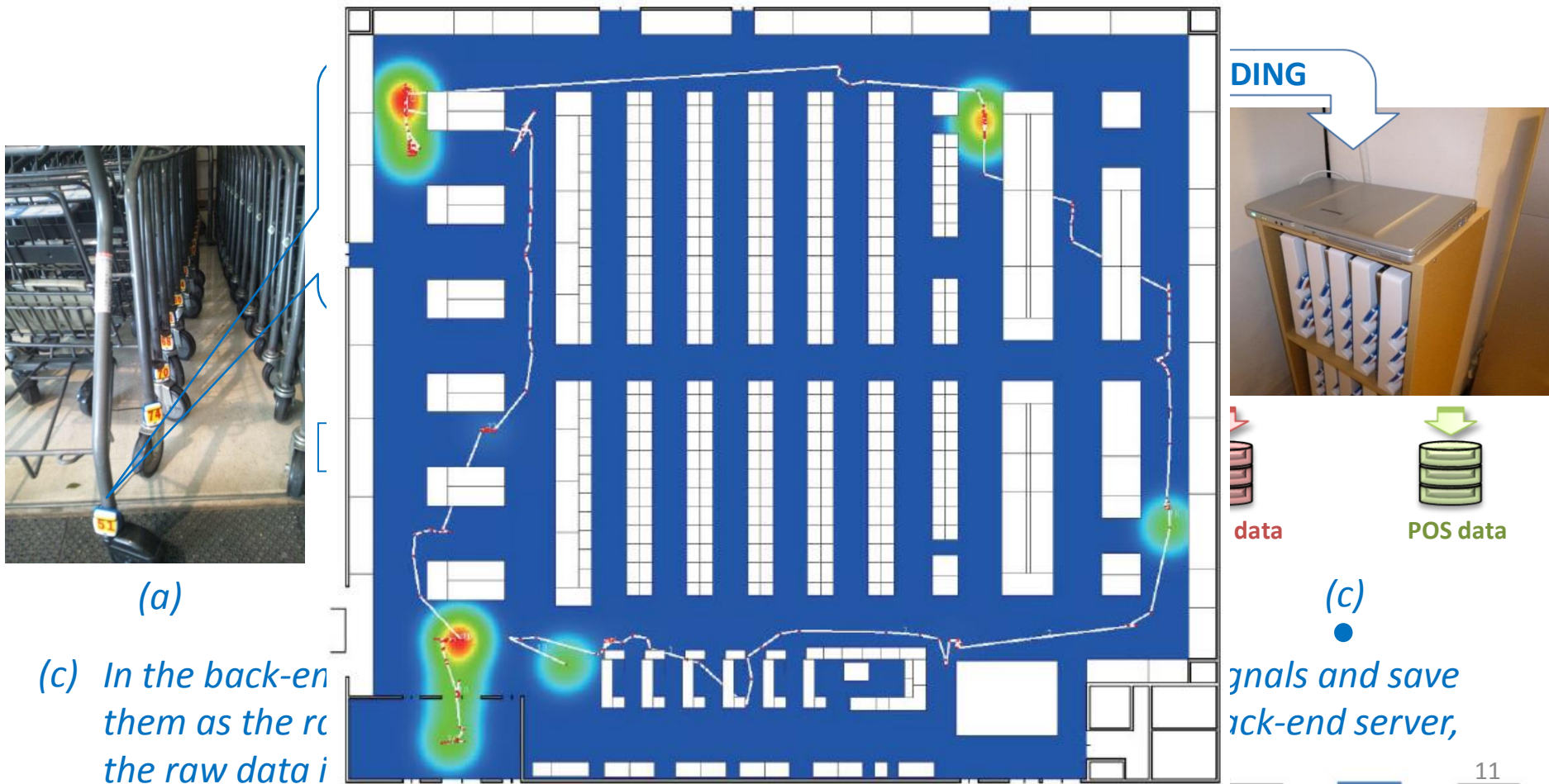
In-store movement data by using RFID sensor

- Overview of RFID system

TRANSMISSION

SENDING

RFID tag

RFID receptor

SHOPPING

RFID data

POS data

(a)

(b)

(c)

*(b2) These signals are received and sent to the back-end server via a **RFID receptor** at the bottom (on the top) of shelves.*

In-store movement data by using RFID sensor

- Overview of RFID system

(a)

DING

data   POS data

(c)

(c) In the back-en[...]gnals and save
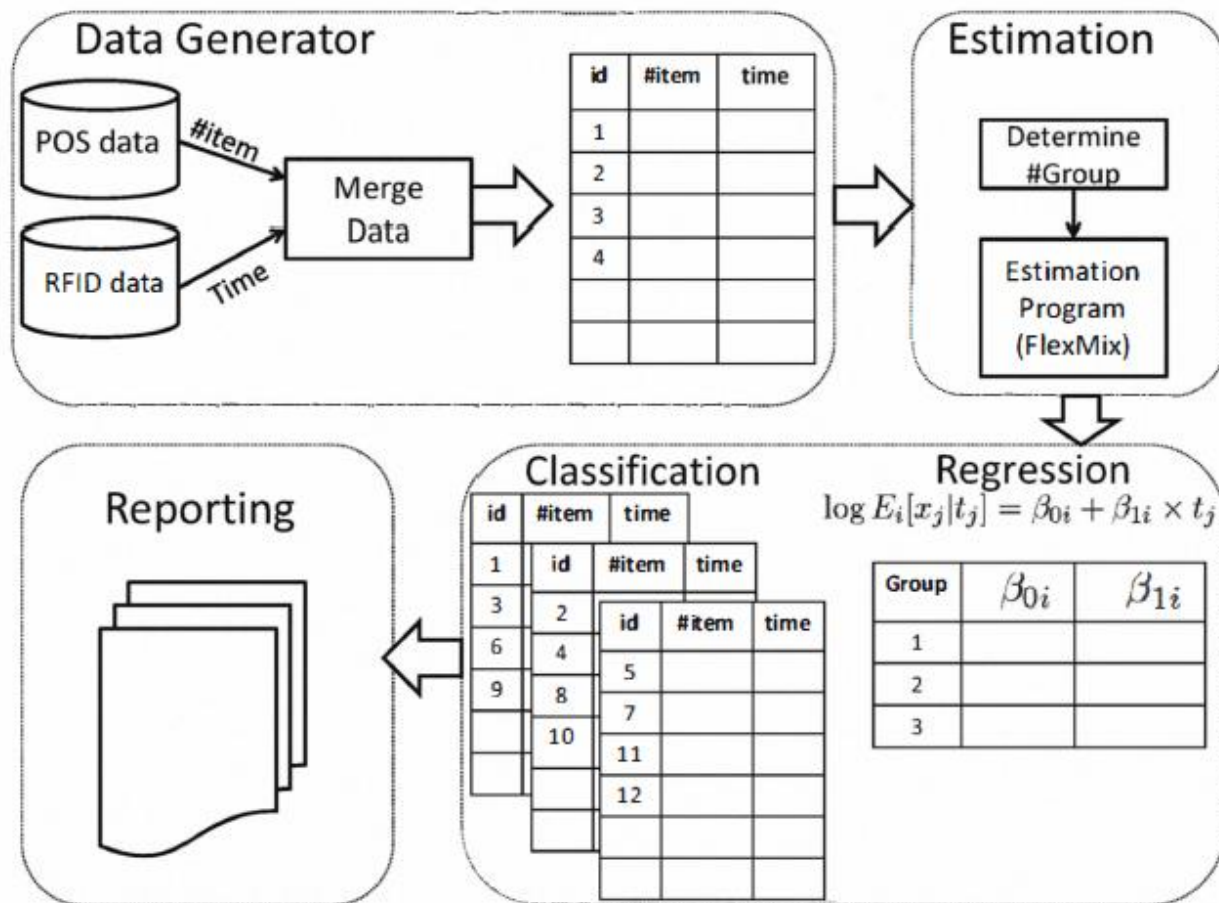   them as the r[...]ack-end server,
     the raw data i[...]

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Eye movement data by using eye-tracking sensor

- Overview of eye-tracking system

Research Cases

- Find latent groups of customers via shopping behavior[1]

Research Cases

- Analyze shopping behavior using RFID data and pattern mining[2]
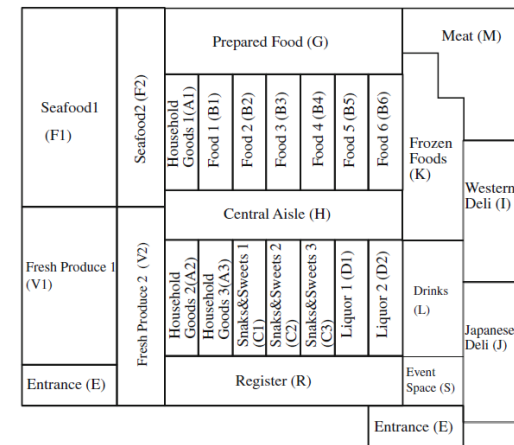
(a) shopping path data

customer ID	Date	time	X	Y	product zones	product zones ID
0001	20090511	120342	95	531	entrance	E
0001	20090511	120456	125	331	fresh produce 1	V1
0001	20090511	120458	155	271	fresh produce 2	V2
0001	20090511	120517	151	105	seafood 2	F2
0001	20090511	120639	62	75	seafood 1	F1
0001	20090511	120655	500	90	prepared food	G
0001	20090511	120658	500	96	food 6	B6
0002	20090511	120659	500	91	prepared food	G
0002	20090511	120737	499	142	food 6	B6
0002	20090511	120742	565	194	frozen foods	K
0002	20090511	120754	637	297	western deli	I

(b) visit sequence series data

customer ID	product zones visit sequence
0001	E,V1,V2,F2,F1,G,B6
0002	G,B6,K,I

Time spent in each product zone

Customer ID 1000

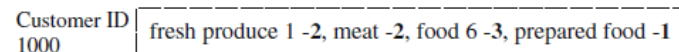| 10 sec	12 sec	25 sec	4 sec
fresh produce 1	meat	food 6	prepared food
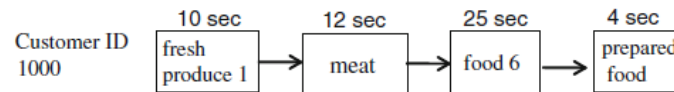
Time in zone
3 : 19 secs or more
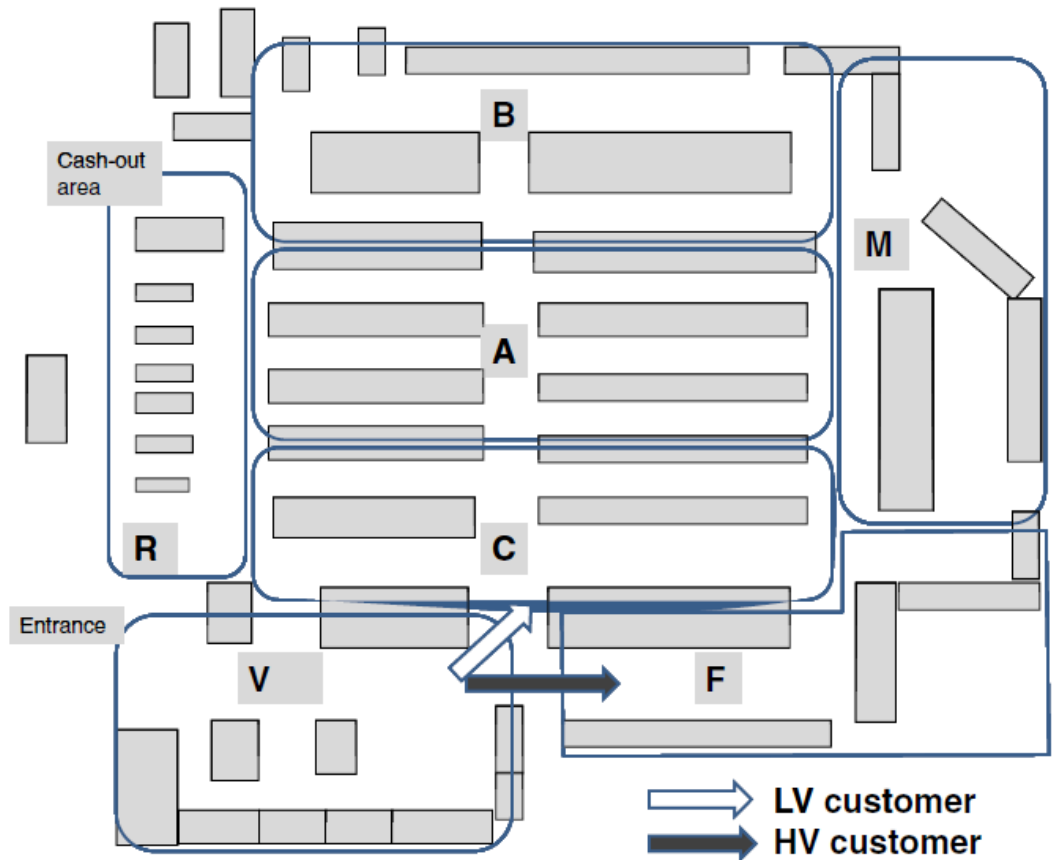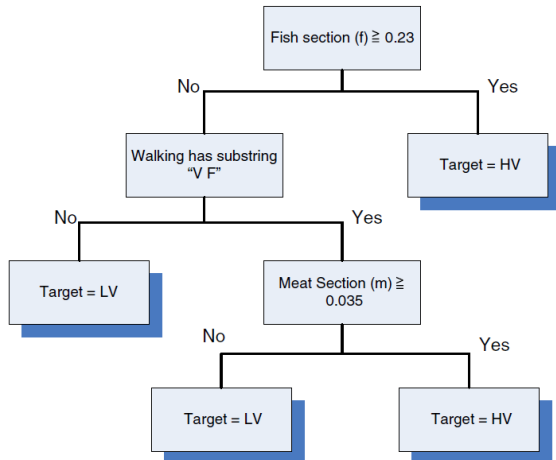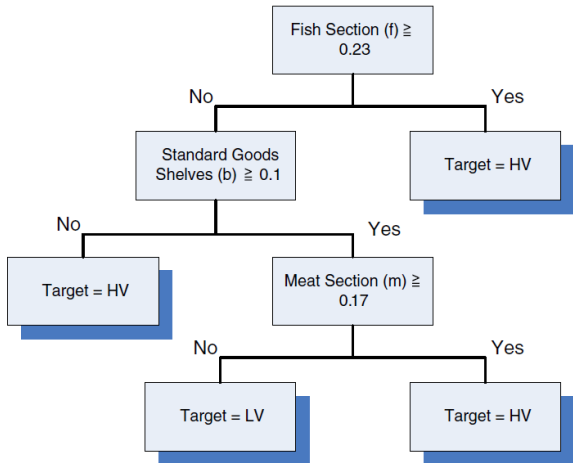2 : 6 to 18 sec
1 : 5 secs or less

In order to equalize data items for the staying time in each zone they were classified into 3 groups (from 1 to 3).

Customer ID 1000 | fresh produce 1 -2, meat -2, food 6 -3, prepared food -1

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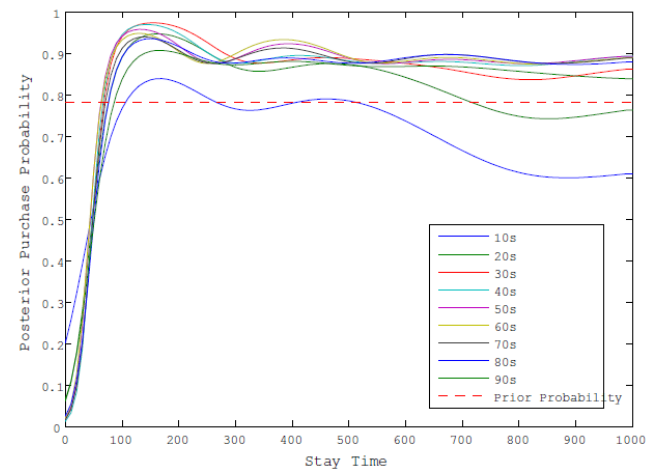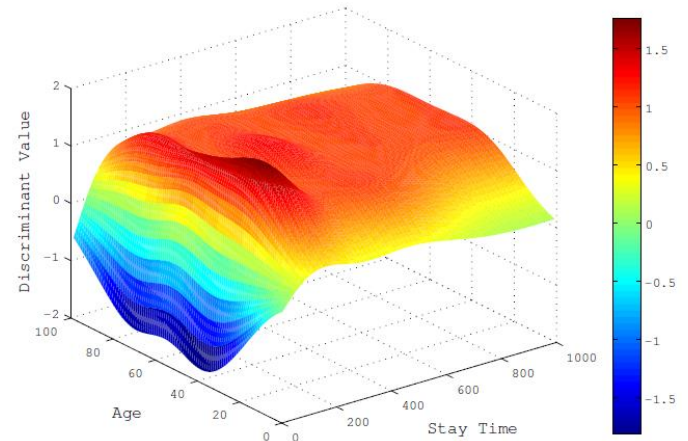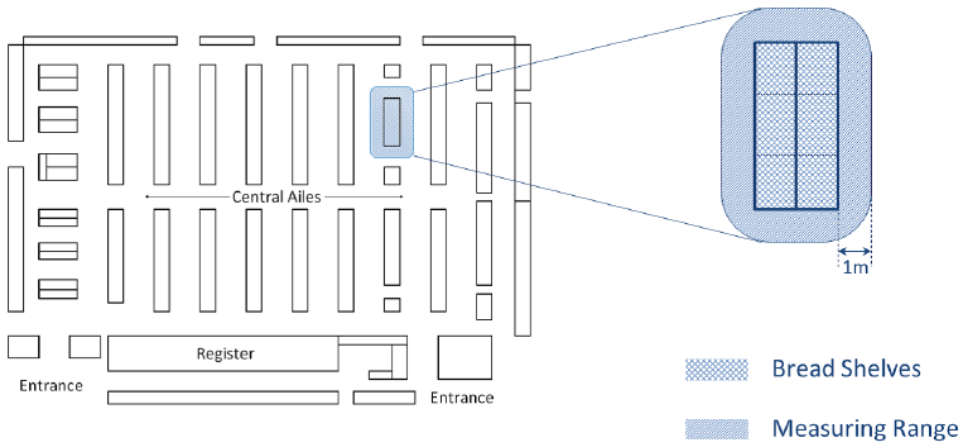# Research Cases

- String analysis technique for shopping path[3]

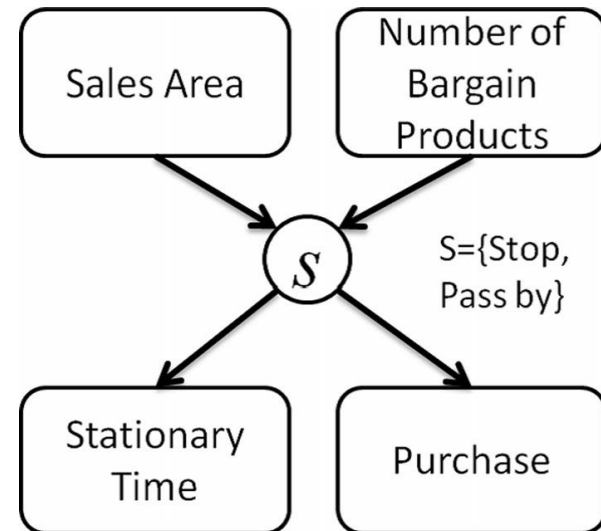# Research Cases

- Consumer behavior extraction using statistical learning theory[4][5]

Research Cases

- The influence between sales areas and bargain sales[6]
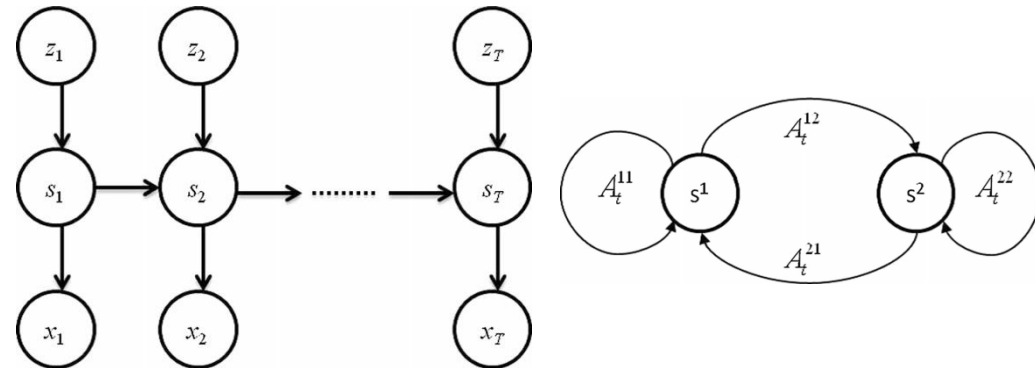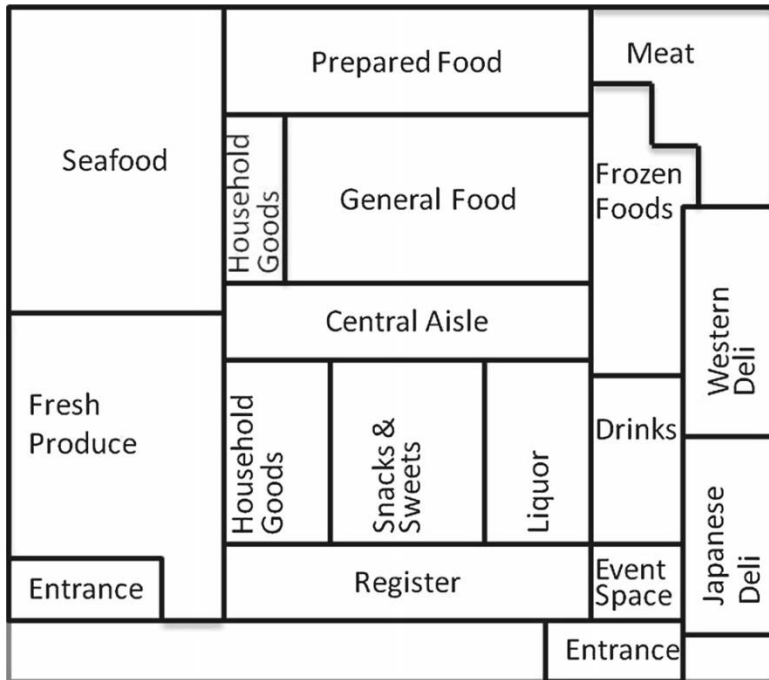
Business Applications

- ## Sweets & Snacks
  - Point of purchase advertising (Positive Effect)

Stay Time
- 16.40s
- 14.93s

- 39.48%
- 37.61% 28.30%
- 25.37%

Visiting Rate
Purchasing Rate
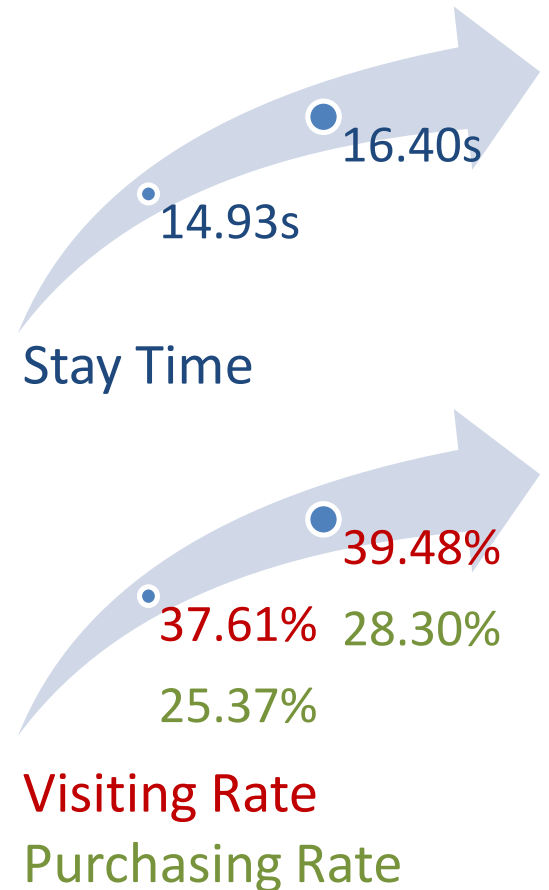
Business Applications

- Coffee
  - Layout optimization (Negative Effect)

10.81s

Stay Time

10.23s

68.64%

62.59%   6.44%

5.38%

Visiting Rate

Purchasing Rate

Business Applications

- Beers
  - Being simple is the best (No Effect)

103 Sales

57 Sales

Stay Time

Research Activities & Exchanges

- International Workshop organized as follows:
  - Osaka, Japan, 9-10 March, 2010
  - Mesa, Arizona USA, 28-30 April, 2011
  - Kaohsiung, Taiwan, 8 June, 2012
  - Osaka, Japan, 17 March, 2013
  - Osaka, Japan, 7 March, 2014
  - Tokyo / Osaka, Japan, 14 / 17 March, 2015

Research Activities & Exchanges

- Workshop on Data Mining for Service (DMS) in IEEE International Conference on Data Mining
  - DMS2010 in Sydney, Australia, 14 December, 2010
  - DMS2011 in Vancouver, Canada, 11 December, 2011
  - DMS2012 in Brussels, Belgium, 10 December, 2012
  - DMS2013 in Dallas, TX, USA, 7 December, 2013
  - DMS2014 in Shenzhen, China, 14 December, 2014

Research Activities & Exchanges

- Invited Session on "Data Mining and Service Science for Innovation" in International Conference on Knowledge-Based and Intelligent Information & Engineering Systems (KES)
    - In KES2009, Santiago, Chile, 28-30 September, 2009
    - In KES2010, Cardiff, UK, 8-10 September, 2010
    - In KES2011, Kaiserslautern, Germany, 12-14 September, 2011
    - In KES2012, San Sebastian, Spain, 10-12 September, 2012
    - In KES2013, Kitakyushu, Japan, 9-11 September, 2013
    - In KES2014, Gdynia, Poland, 15-17 September, 2014

Research Activities & Exchanges

- Special Session on "Tools for Discovery, Decision, and Design" in IEEE International Conference on Systems, Man, and Cybernetics (SMC)
    - In SMC2009, San Antonio, Texas, USA, 11-14 October, 2009
    - In SMC2010 , Istanbul, Turkey, 10-13 October, 2010
    - In SMC2011, Anchorage, Alaska 9-12 October, 2011
    - In SMC2012, Seoul, Korea, 14-17 October, 2012
    - In SMC2013, Manchester, UK, October 13–16, 2013

- Special Session on "Data Science for Big Data" in IEEE International Conference on Systems, Man, and Cybernetics(SMC)
    - In SMC2014, San Diego, CA, USA, 5-8 October, 2014

References

[1] K. Takai and K. Yada, "A framework for analysis of the effect of time on shopping behavior," *Journal of Intelligent Information Systems*, Vol. 41, No. 1, pp. 91-107, 2013.

[2] T. Nakahara and K. Yada, "Analyzing consumers' shopping behavior using RFID data and pattern mining," *Advances in Data Analysis and Classification*, Vol. 6, No. 4 pp. 355-365, 2012.

[3] K. Yada, "String analysis technique for shopping path in a supermarket," *Journal of Intelligent Information Systems*, Vol. 36, No. 3 pp. 385-402, 2011.

[4] Y. Zuo, S. Ali, and K. Yada, "Consumer purchasing behavior extraction using statistical learning theory," *Procedia Computer Science*, Vol. 35, pp. 1464-1473, 2014.

[5] Y. Zuo and K. Yada, "Using bayesian network for purchase behavior prediction from RFID data," *2014 IEEE International Conference on SMC*, pp. 2262-2267, 2014. (Best Conference Paper Finalist)

[6] N. Sano and K. Yada, "The influence of sales areas and bargain sales on customer behavior in a grocery store," *Neural Computing and Applications*, Vol. 26, No. 2 pp. 355-361, 2015.