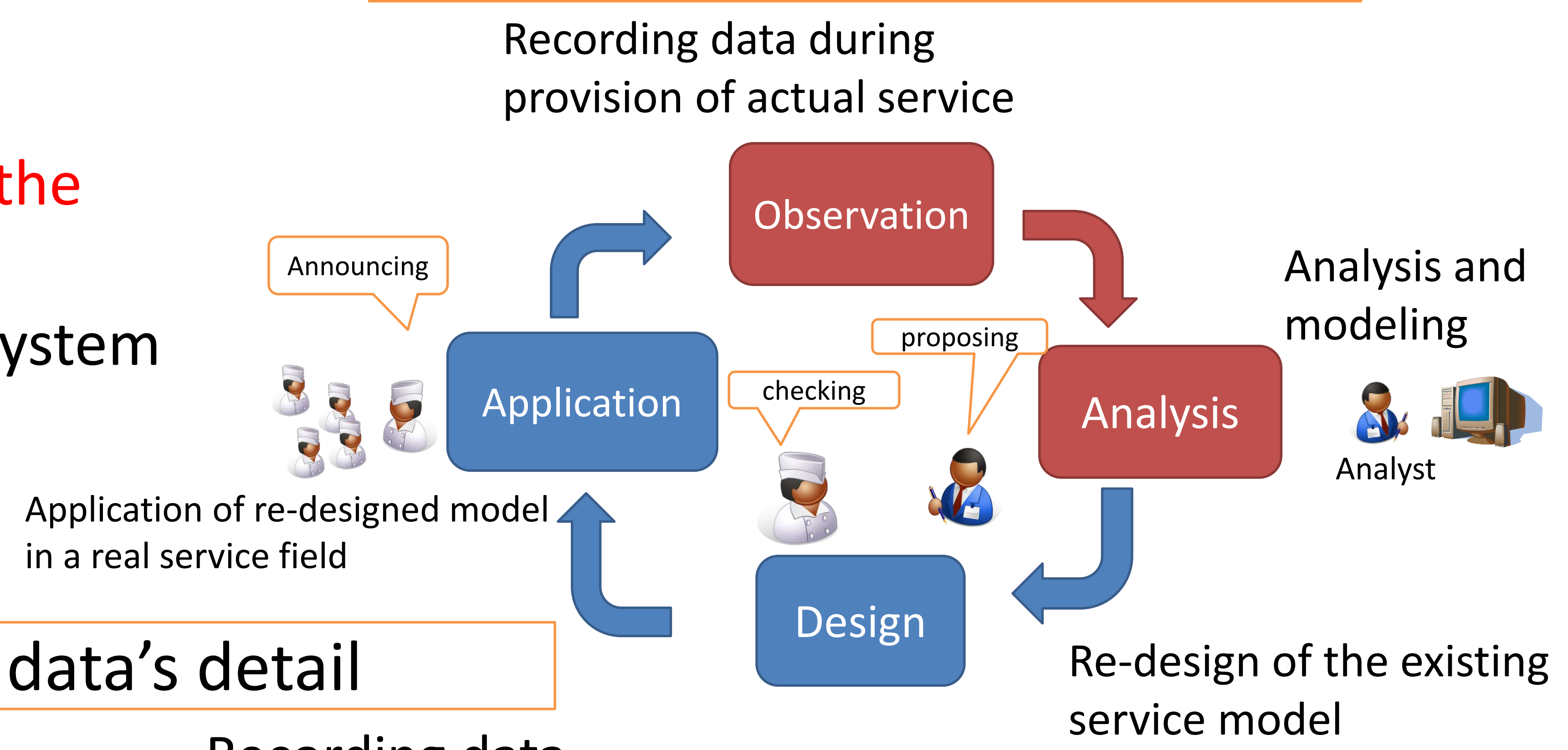


Towards developing a flexible service-operation-estimation system for efficient service-process analysis

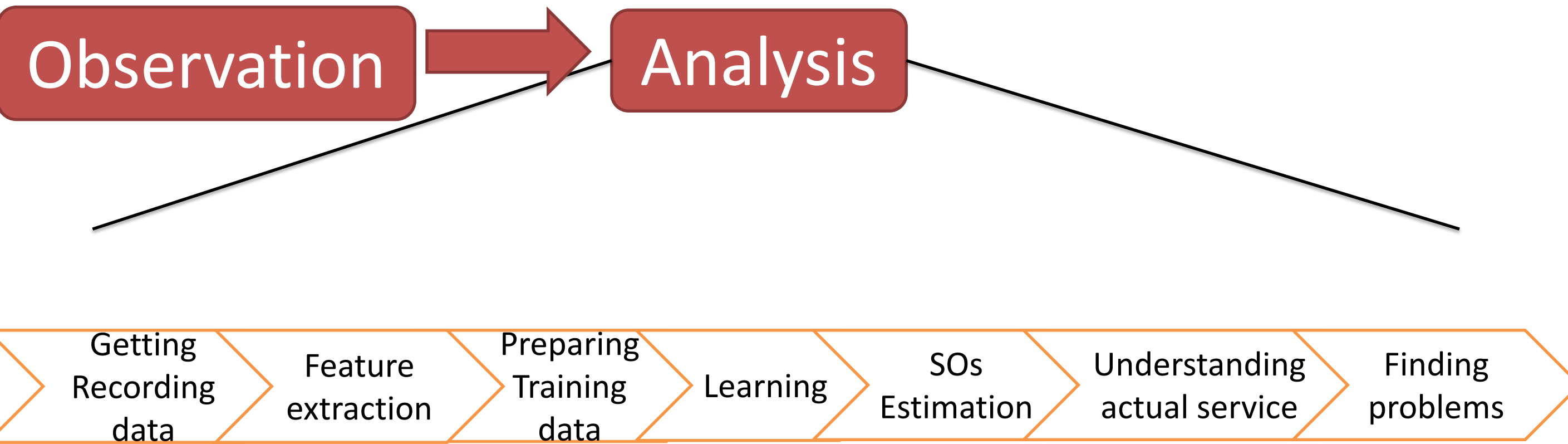
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- Service industries have a strong demand for improving the service processes by checking the service operations (SOs) of their employees more quantitatively.
- The contribution of this study is to clarify the issues of the previously proposed service operation estimation method.
- We develop Flexible Service-Operation-Estimation (FSOE) system including:
 - A new efficient and flexible SOE engine.
 - The supervised learning support tool.

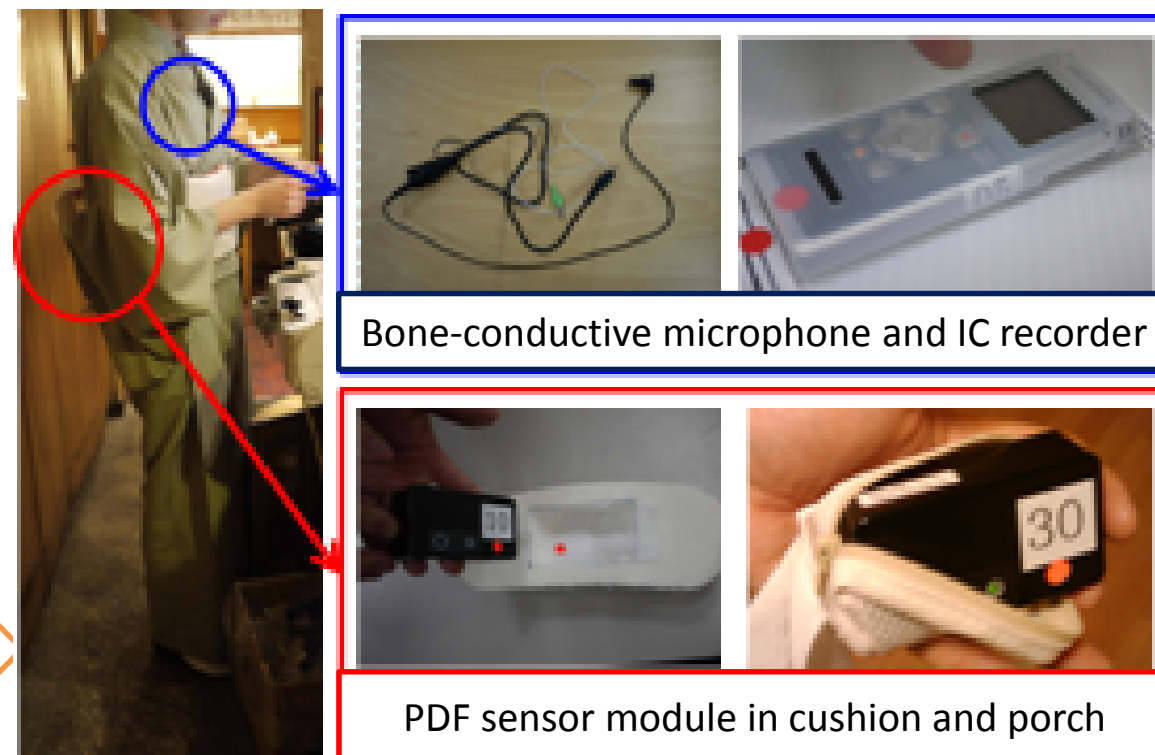
Optimum Design Loop



SOE's process



Training data's detail



Recording data

- Employee's behavior data(position, orientation, action, voice activity), work-related data(shift data, operational schedule), accounting data (POS data)

How to prepare

- The analysts prepare training data by putting unique SO labels onto employees' time-series data as checking recorded video and voice data.

The study of a service field description

Cross-validation of SOE

Dataset

- 3hours recording data in the Japanese restaurant.

	Estimated (ID)								Recall (%)	Accuracy rate (%)	
	1	2	3	4	5	6	7	8			
Labeled (ID)	1	11	5	0	0	0	2	0	2	55.0	50.0
	2	0	19	0	0	0	1	0	0	95.0	71.7
	3	2	1	4	0	2	11	0	0	20.0	32.0
	4	3	1	0	15	0	1	0	0	75.0	85.7
	5	0	1	0	0	14	5	0	0	70.0	63.6
	6	0	1	0	0	2	17	0	0	85.0	56.7
	7	7	4	0	0	2	0	6	1	30.0	44.4
	8	1	1	1	0	4	3	1	9	45.0	56.3
Precision(%)	45.8	57.6	80.0	100.0	58.3	42.5	85.7	75.0			

ID	SO
1	Taking orders
2	Serving food or drink
3	Moving and carrying something
4	Accounting
5	Greeting and offering customers to the table
6	Cleaning up and setting tables
7	Dialogue with customers
8	Dialogue with other staffs

Usability of creating training data



Hearings with the analysts

- The analysts used work full-time, but they added to label the employee's data for 2 hours.
- The analysts does not start understanding actual service in SOE, until a large amount of training data is prepared.
- Can not fast-feed the time-series data.
- The analysts rewind the time-series data when they find start position of SO.
- For using accounting data , the analysts can skip the time-series data.

Is SOs definition adequate? cf.) Misclassifying SO3 into SO6

Hearings with the analysts

- SO definition is as follows:
 - Serving food or drink: The employee carries something to the customers.
 - Moving and carrying something: The employee is not carrying something to the customers but moving between area and area.
 - Cleaning up and setting tables: The employee says " May I clear the table?".
- The Analysts wants to put multiple SO labels onto the same time
 - We have to define a new SOs structure.

To stimulate finding problems of service process

SO's hierarchical structure

SO's parallel structure

To reduce cost for preparing training data

To increase estimate accuracy for incremental learning mechanism

GUI to feedback the estimated data for the incremental learning

Flexible Service-Operation-Estimation System (FSOES)

SO's hierarchy

Serving for Customer A

Conveying +α (Getting for food or drink, Confirming location customer, Confirming ordered items)

SO's parallel

Serving for Customer A

order of customer B

Order for Customer B

time : t

