
CUHKSZ Food Rating and Recommendation System

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- 2、 Database Design
- 3、 Implementation and Simple Queries
- 4、 Data Mining
- 5、 Interaction with LLM

01



Introduction

■ Motivation

Existing successful cases:



■ Motivation

Existing successful cases:



- Provide reliable reference when choosing restaurant
- Urge restaurants to provide better dishes and service to attract customers

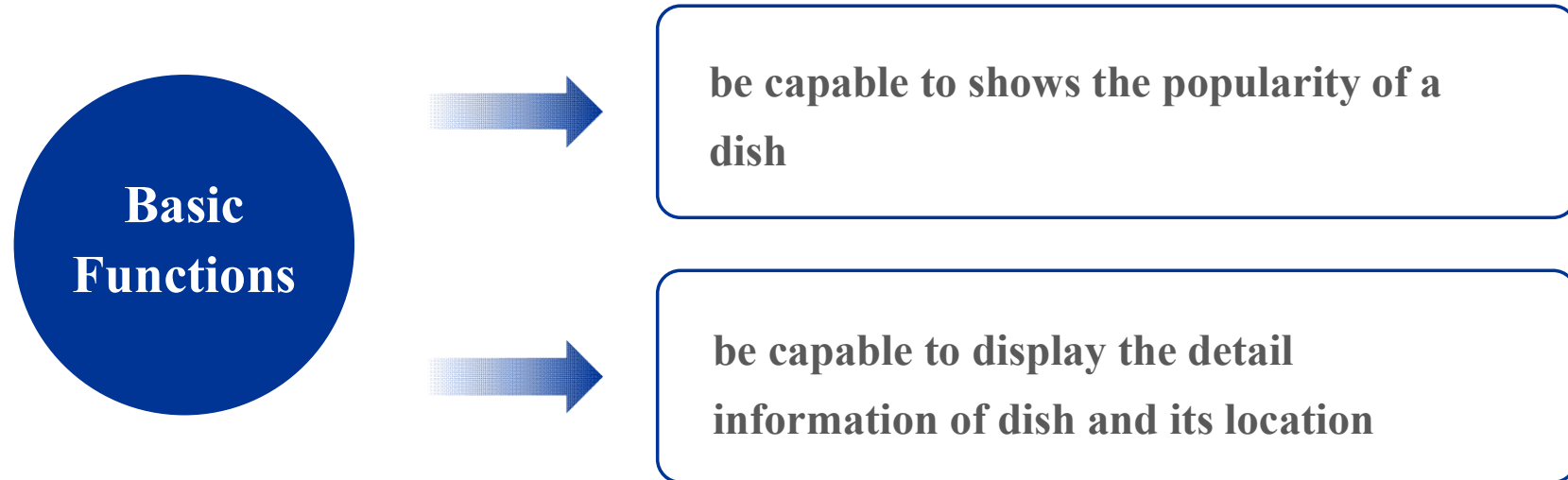


02



Database Design

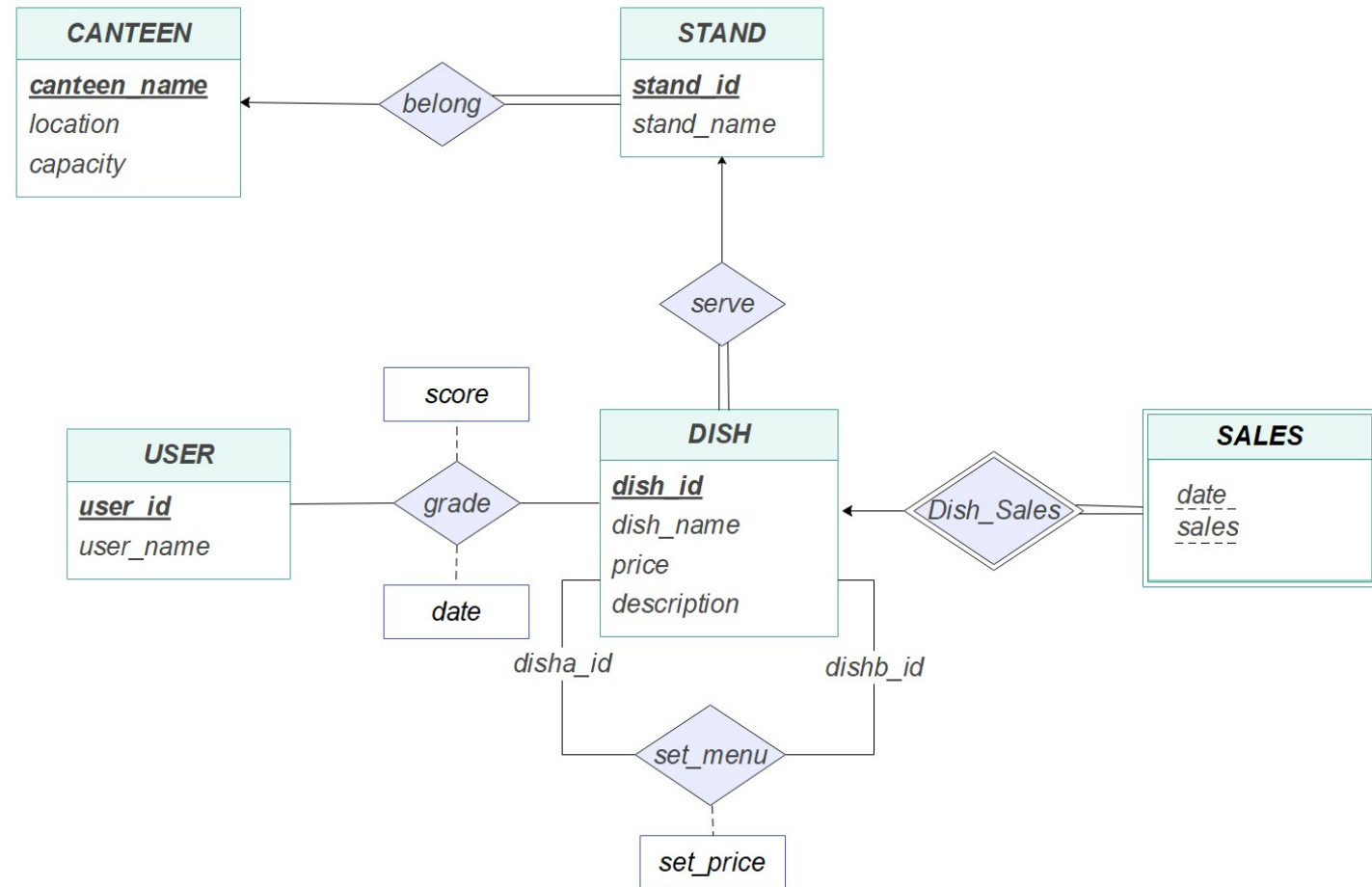
■ Database Design



■ Database Design

Premise:

1. No canteen shares same name in CUHKSZ
2. A dish must serve by a stand, a stand must belongs to a canteen

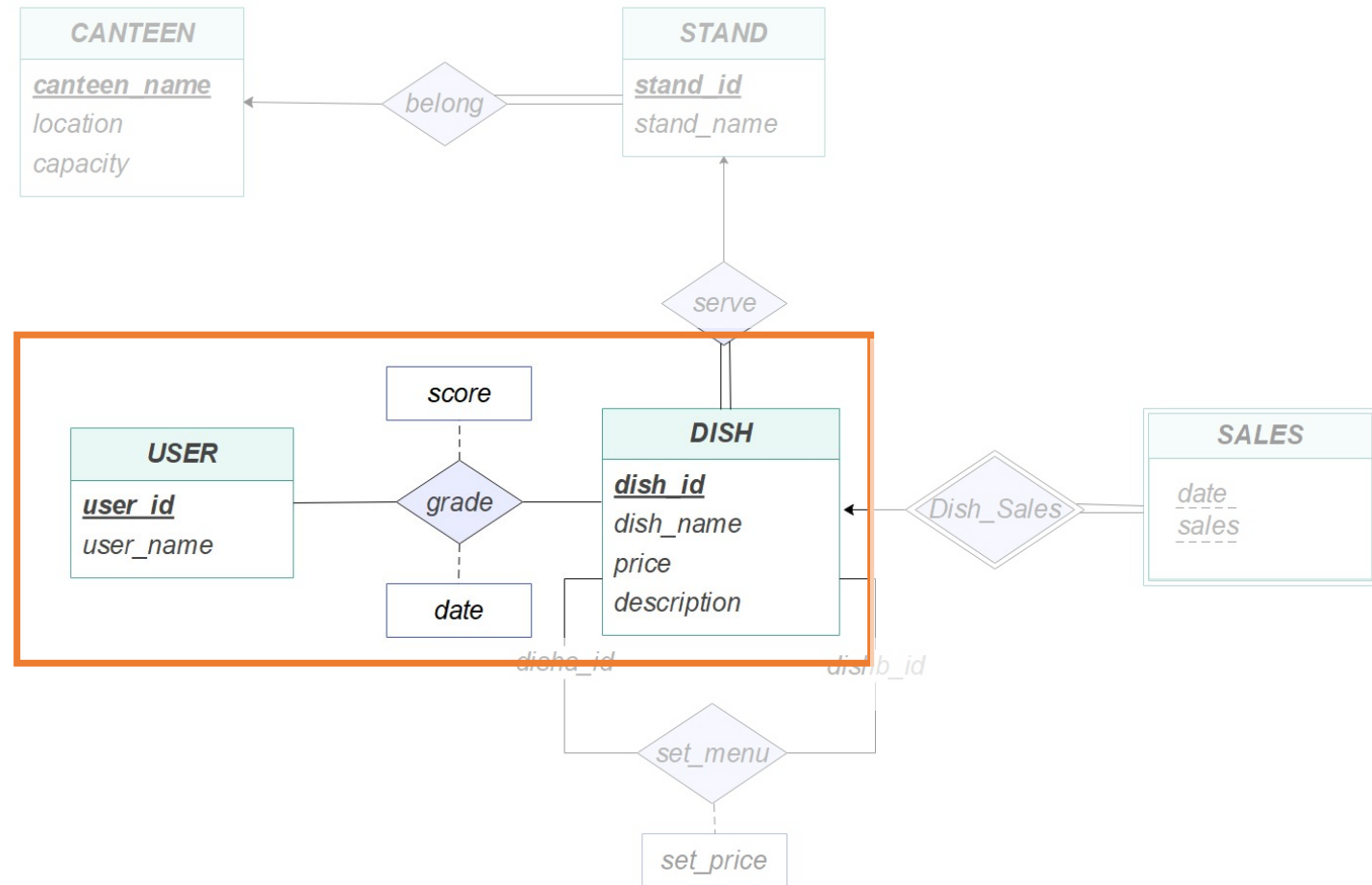


ER Diagram

■ Database Design

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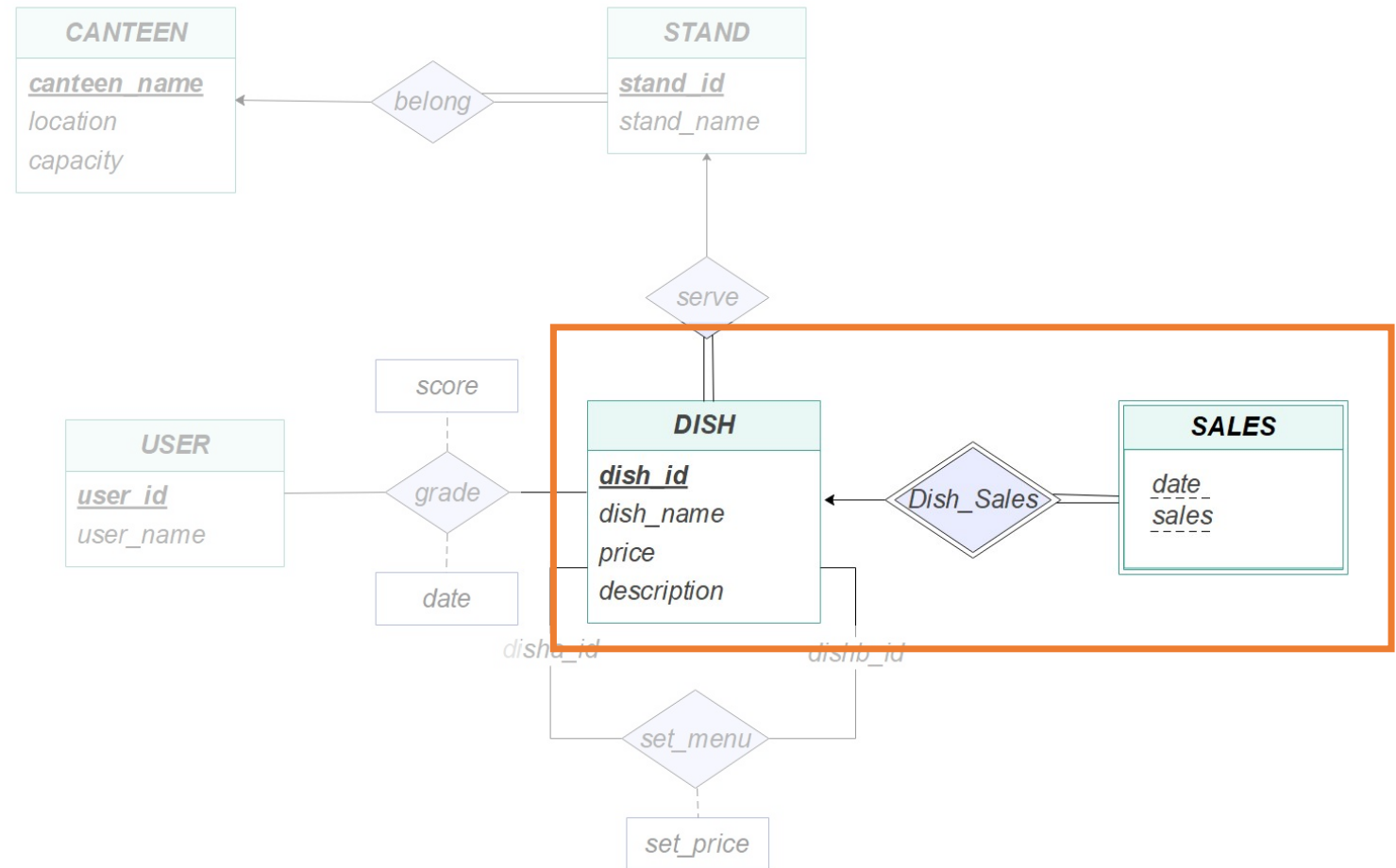


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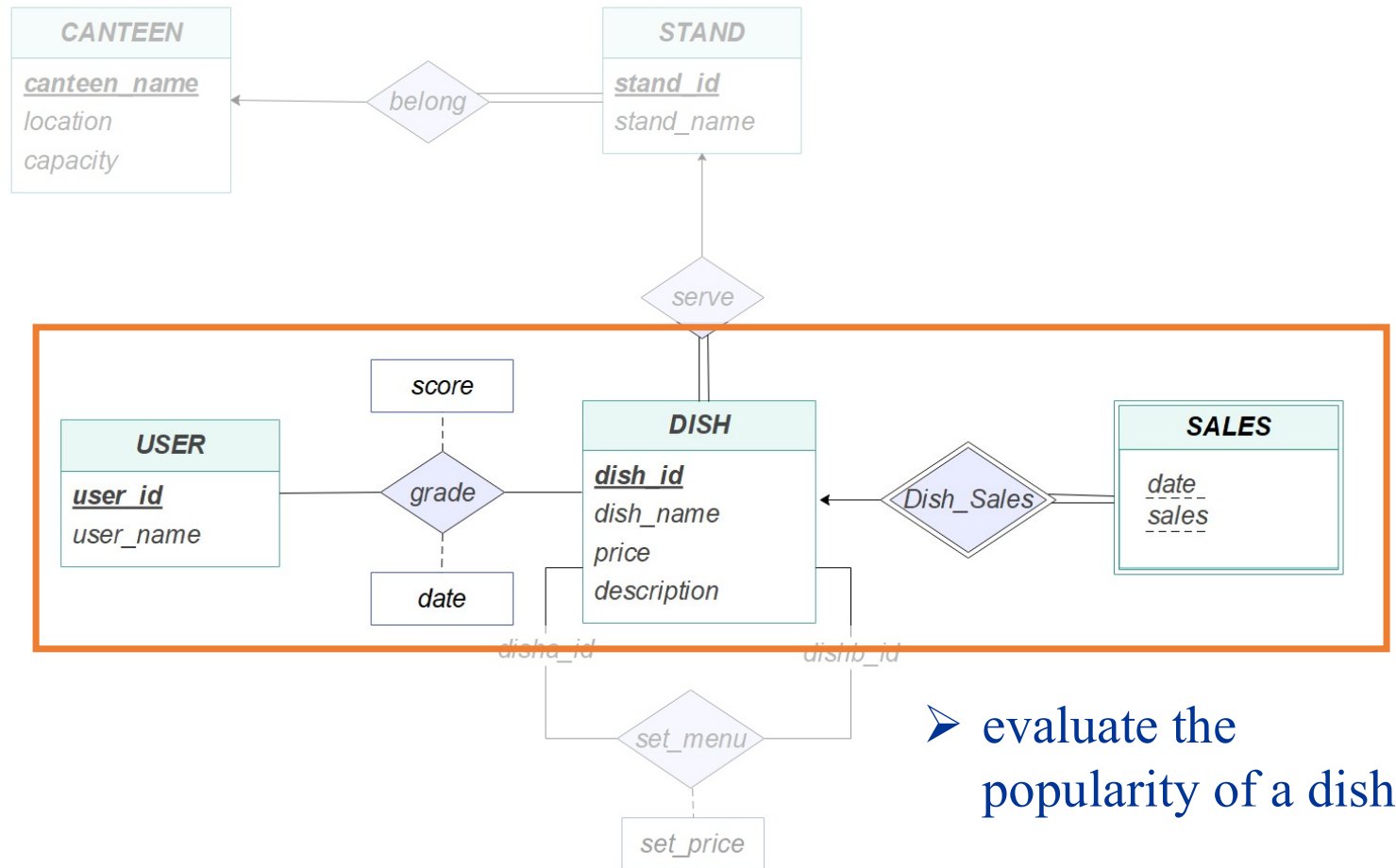
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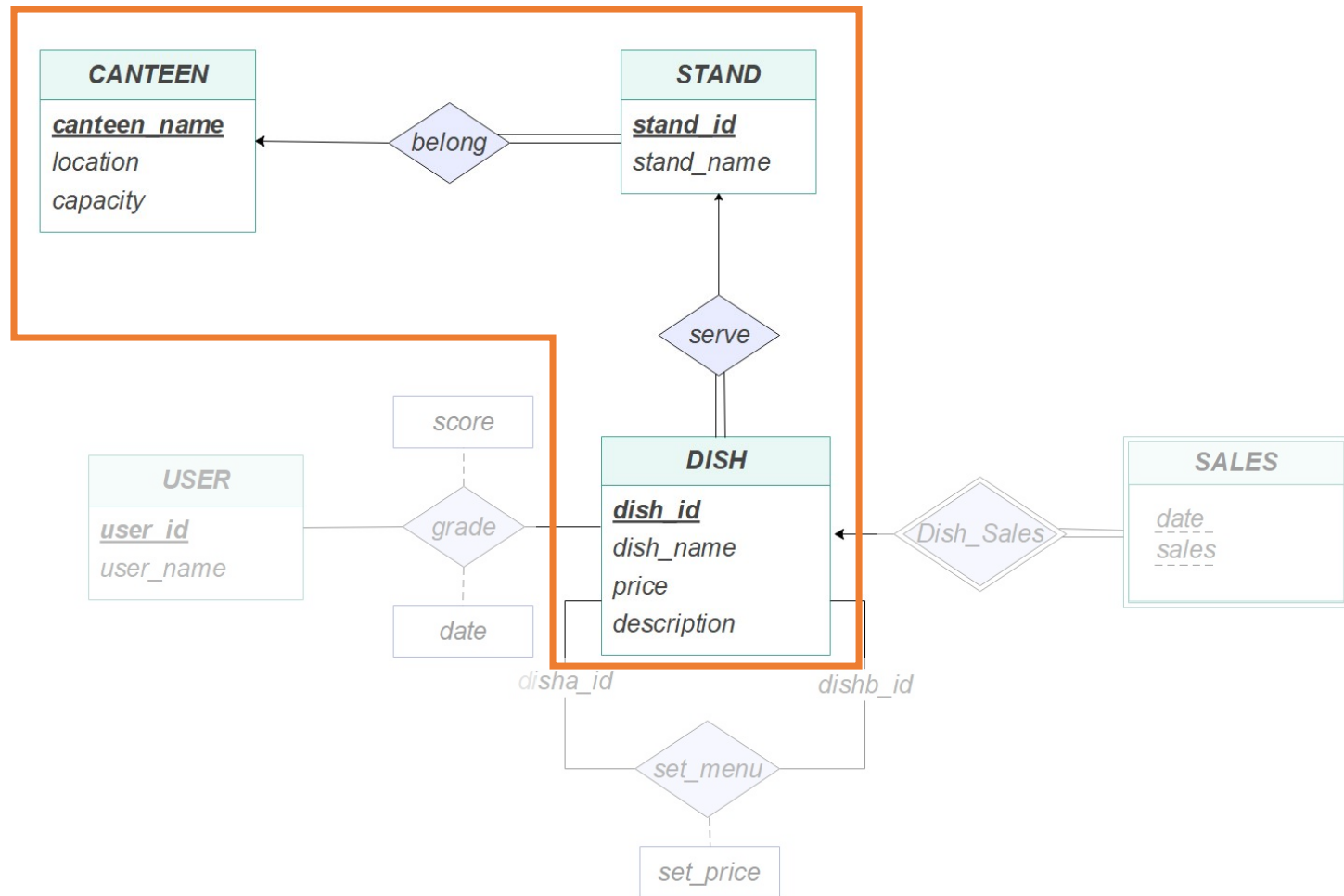
ER Diagram

➤ evaluate the popularity of a dish

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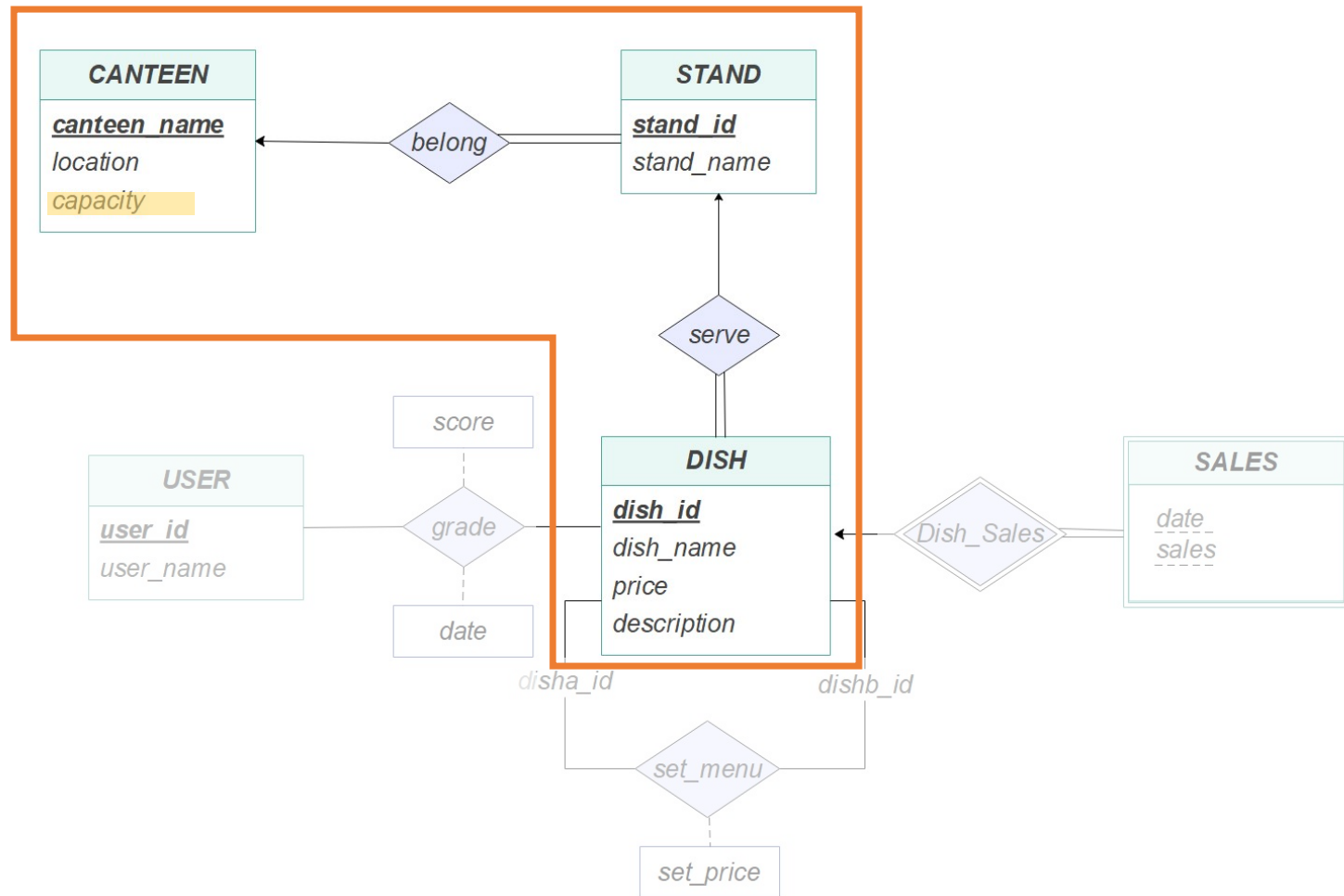


ER Diagram

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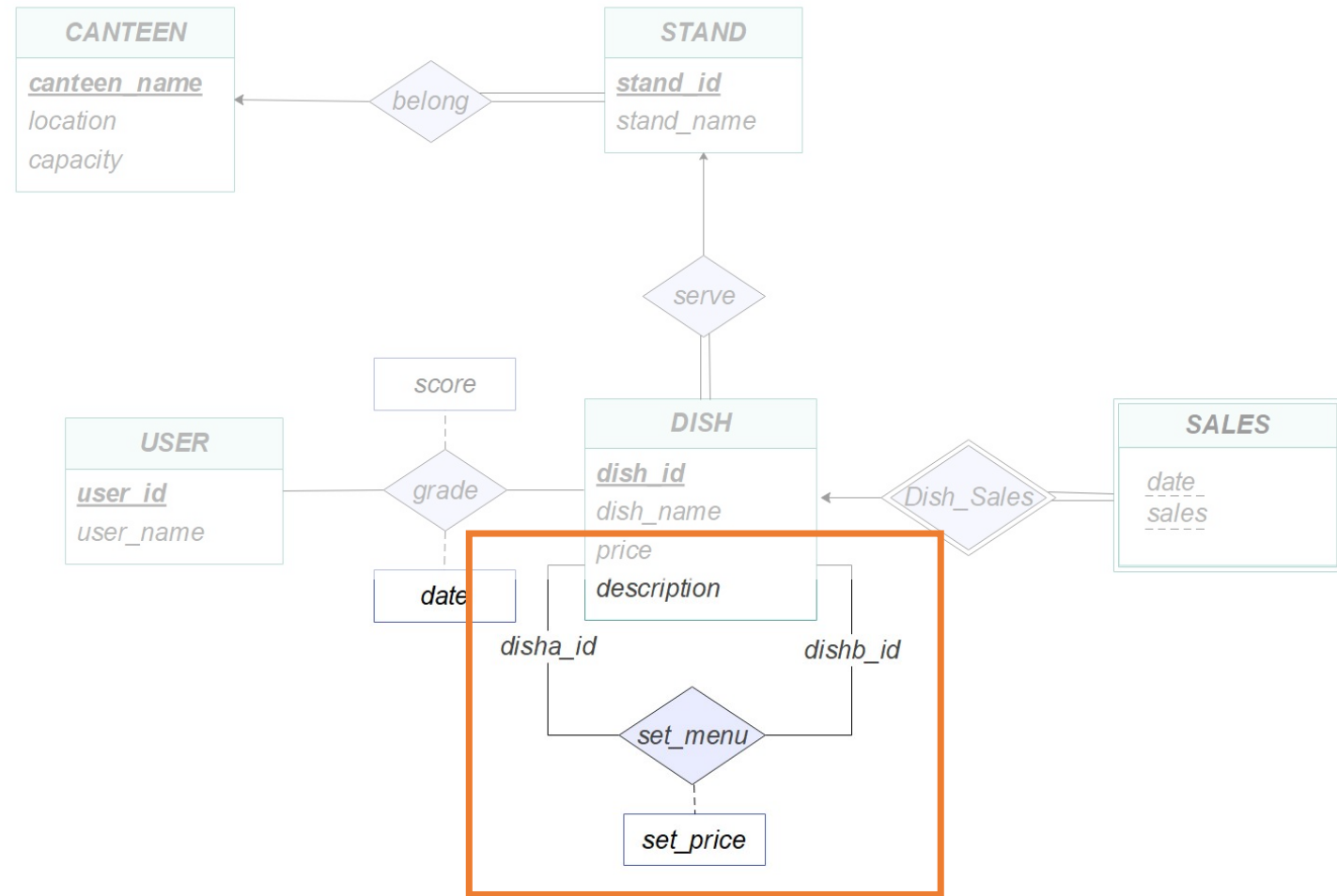


ER Diagram

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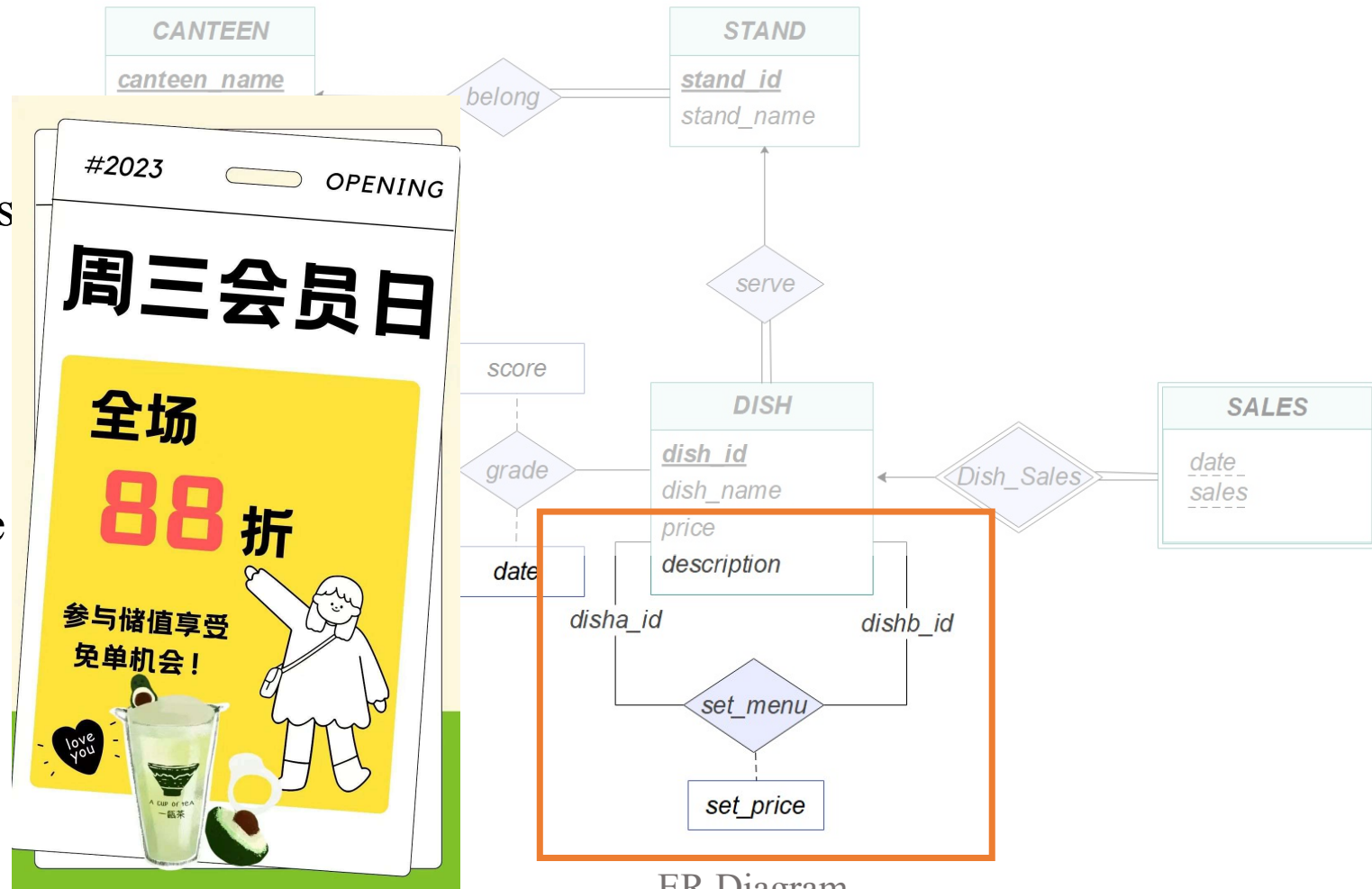


ER Diagram

■ Database Design

Premise:

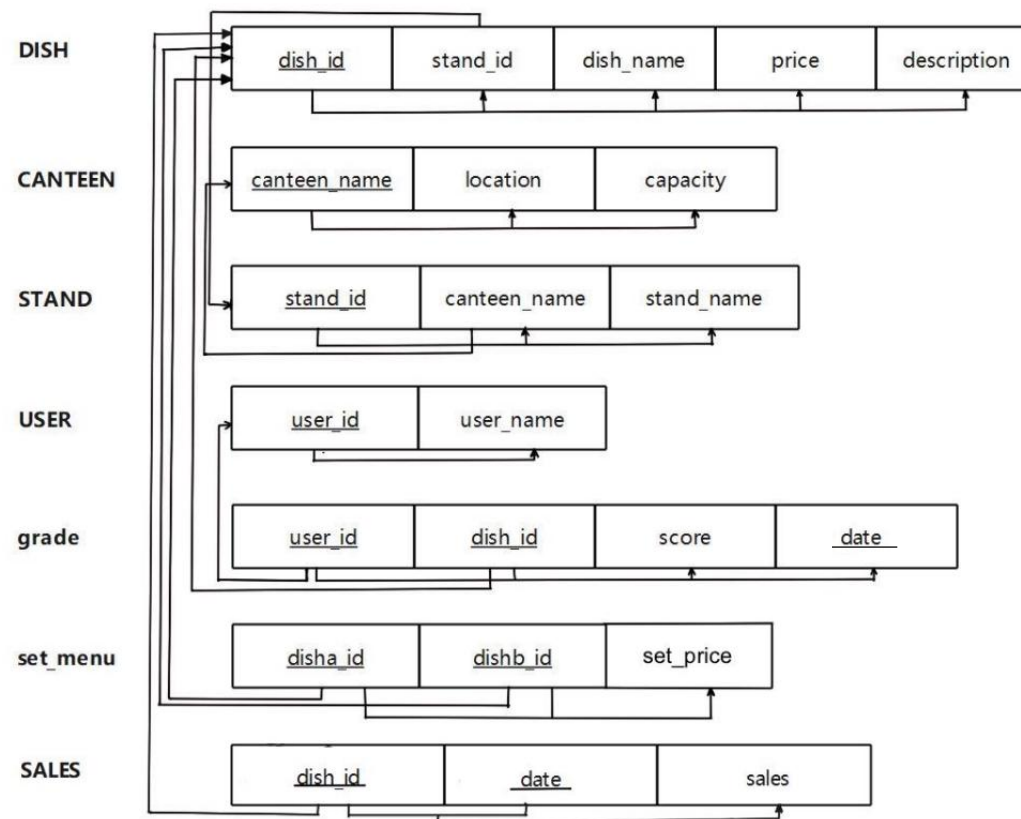
1. No canteen shares same name in CUHKSZ
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ER Diagram

■ Database Design

Functional dependencies:

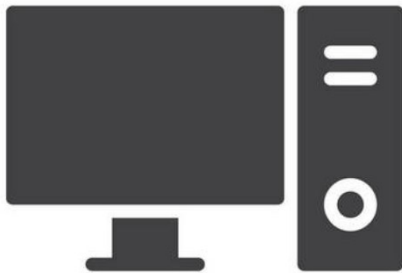


BCNF!

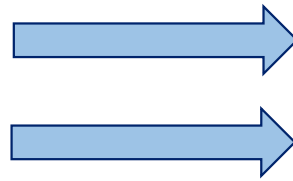
■ Data Collecting



Questionnaire



Random generation

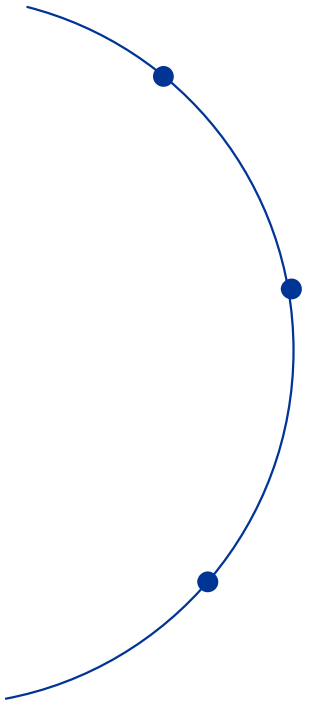


Data

03

Implementation and Simple Queries

■ Three Features of Our Implementation



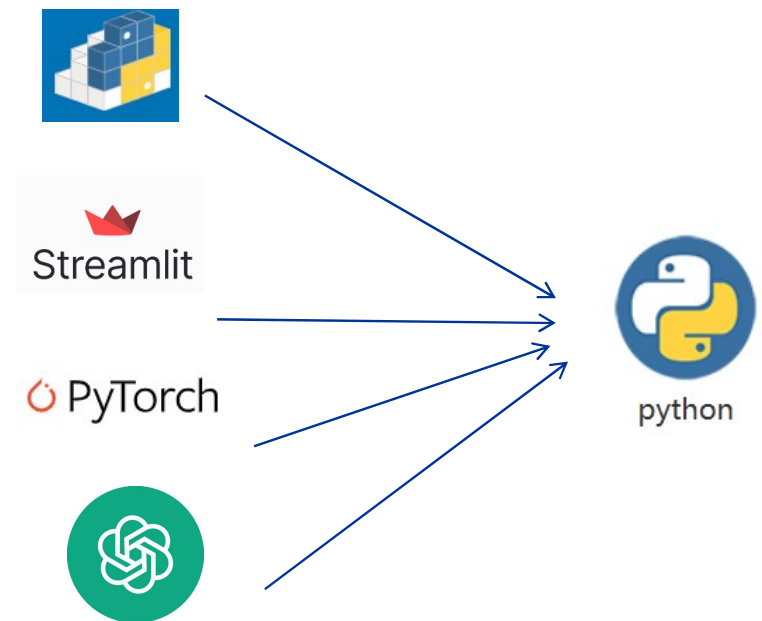
- Flexibility
- Transaction Support
- Interactivity

■ Flexibility

All implemented in *Python*:

Has flexible structure, easy to modify and expand

- PyMySQL: MySQL operations
- Streamlit: Web construction
- PyTorch: Data mining
- ChatGPT API: Interaction with LLM



■ Transaction Support

Structure:

```
try:  
    cursor = db.cursor()  
    cursor.execute(sql)  
    db.commit()  
    print('succeed')  
except:  
    db.rollback()  
finally:  
    cursor.close()  
    db.close()
```

■ Interactivity

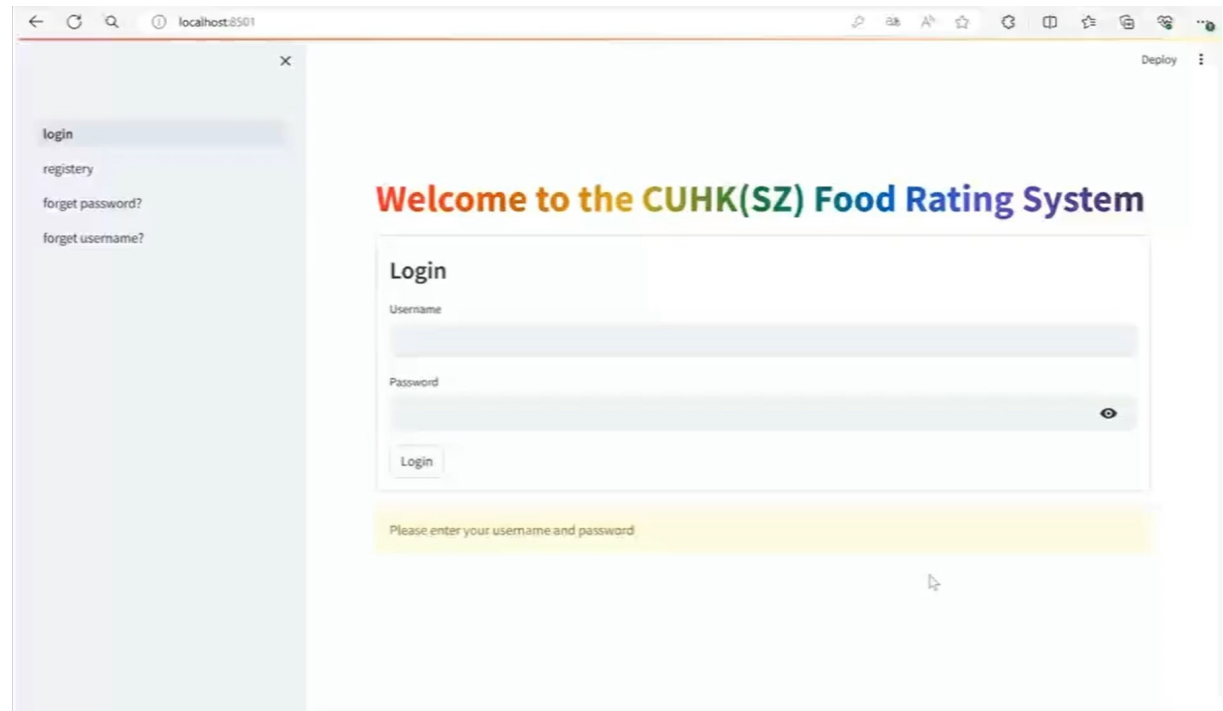
Core Idea:

- Package SQL queries as functions
- Integrate functions on our web
- Transform functions into user-friendly operations
- Easy interaction with database via web

■ SQL+Web: Authentication

Passwords are encrypted using a hash function and stored in a config file to enhance security.

```
with open('filename') as file:  
    config = yaml.load(file,  
Loader=SaferLoader)  
Authenticator =  
stauth.Authenticate()
```



The screenshot shows a web browser window with the address bar displaying 'localhost:8501'. On the left is a sidebar menu with the following links: 'login', 'registry', 'forget password?', and 'forget username?'. The main content area features a heading 'Welcome to the CUHK(SZ) Food Rating System' in a colorful font. Below the heading is a 'Login' form with two input fields: 'Username' and 'Password'. The 'Password' field has a toggle icon for visibility. A 'Login' button is positioned below the password field. At the bottom of the form area, a yellow message box states 'Please enter your username and password'. The browser's top bar includes standard navigation icons and a 'Deploy' button on the right.

■ SQL+Web : Canteen information

SQL searches among relations to extract detail information for item

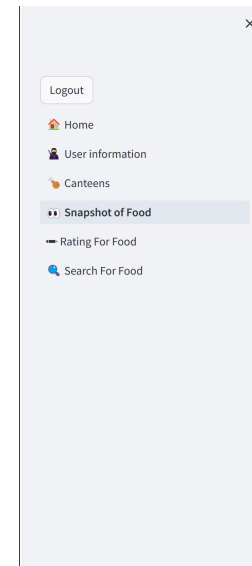
```
tabs = st.tabs(standName)
for i, tab in enumerate(tabs):
    with tab:
        for j, dish in enumerate(dishName):
            show dish information
```



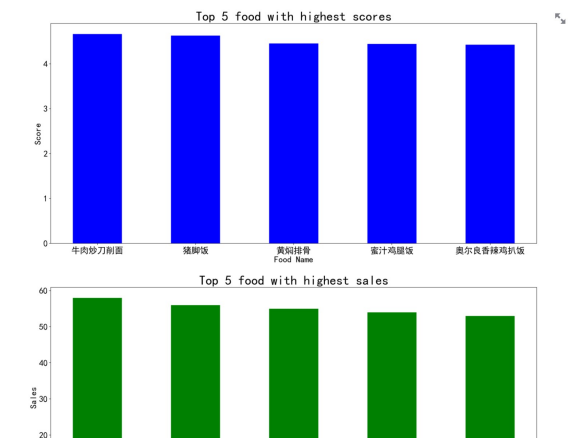
■ SQL+Web : Snapshot

SQL selects top 5 dishes with highest rating or sales

```
topScores, topScoreNames = find_5_top_scores()
topSales, topSalesNames = find_5_top_sales()
fig = plt.figure()
ax1 = fig.add_subplot(gs[0])
ax2 = fig.add_subplot(gs[1])
ax1.bar(topScoreNames, topScores)
ax2.bar(topSalesNames, topSales)
st.pyplot(fig)
```



Snapshot of Food



■ SQL+Web: Rating

SQL searches the detail rating records of certain dish and writes new rating records into database

```
with db_config.cursor() as cursor:
    cursor.execute(grade_sql)
    avg_score, record_count =
cursor.fetchone()
...

date=data.today().strftime('%Y-%m-%d')
with db_config.cursor() as cursor:
    cursor.execute(insert_grade_sql)
    db_config.commt()
```

ID of the food you want to search

15

☐ See detail records

Search

Upload Your Own rate!

Your ID

3

ID of the food you want to rate

12

Rate

4

Submit

Thank you for rating!

■ SQL+Web: Dish Rating Search

SQL searches information of Food or
Stand by ID, Canteen by selections.

```
if option == 'Food' or option == 'Stand':  
    id = place.text_input('enter the ID')  
if option == 'Canteen':  
    id = place.selectbox('select canteen', ('c1', 'c2'...))  
submitted = st.form_submit_button('Search')
```

Deploy ⋮

Search the Food Right Now!

Select the type of information you are looking for?

Canteen

Select which canteen you are looking for?

Select contact method...

Canteen 5

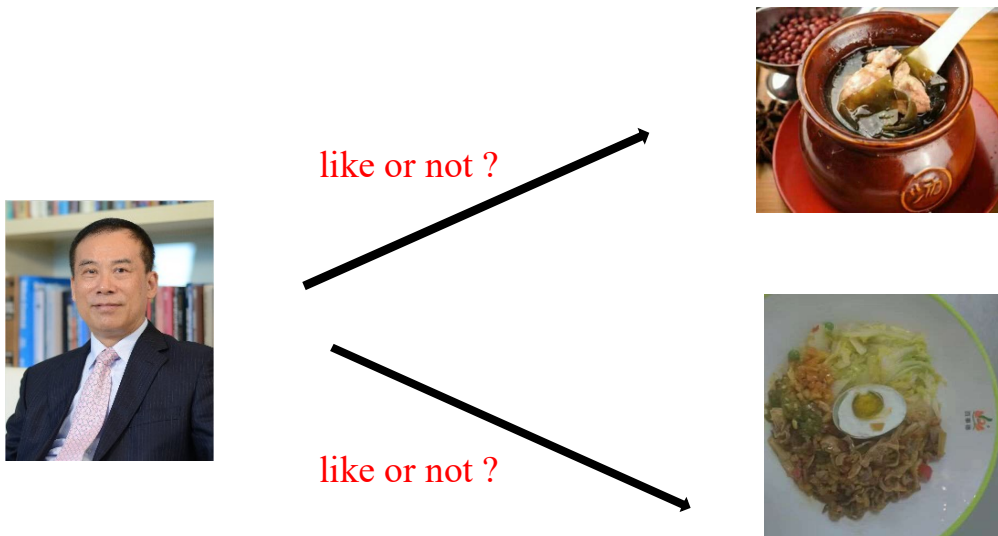
- 学生活动中心二楼食堂
- 快乐食间
- 海月廷
- 逸夫食堂

04

Data Mining

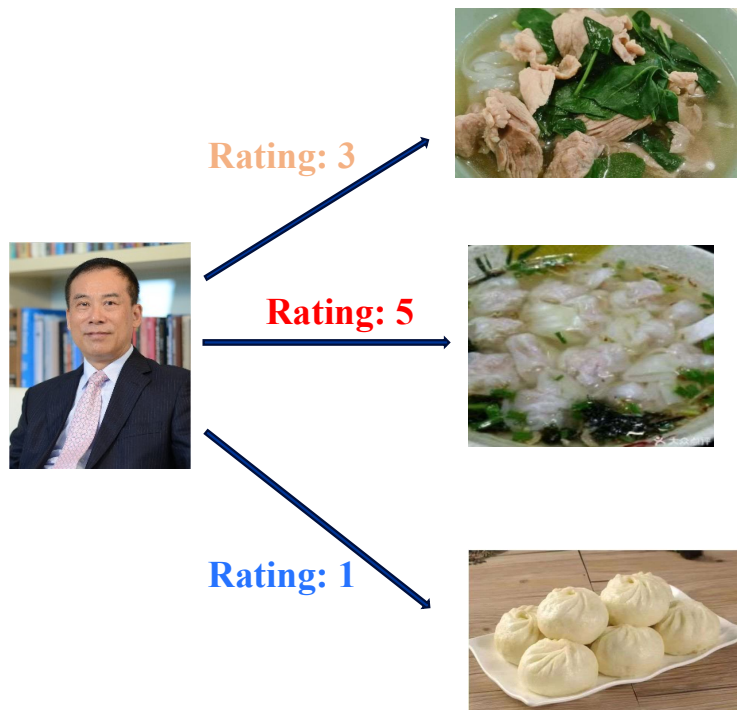
■ Overview of Our Recommendation System

Goal: Make personalized recommendation of dishes for each user .



Method: Learn feature vector for each user and dish by machine learning.

■ Extract User-Dish Rating Matrix from DB for Recommendation



→ **Data Base** → **SQL** →

User-Dish Rating Matrix R

	D1	D2	D3
U1	5	3	-
U2	4	-	-
U3	1	1	-
U4	1	-	-



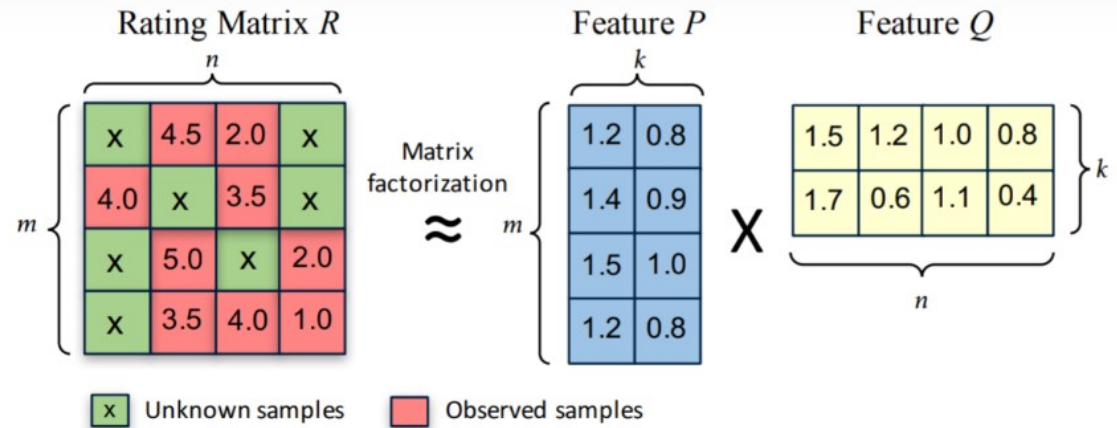
Rating Matrix R

		n			
		x	4.5	2.0	x
m		4.0	x	3.5	x
		x	5.0	x	2.0
		x	3.5	4.0	1.0

x Unknown samples Observed samples

■ Learn Feature Vectors by Decomposing R

$$R \approx P \times Q^T = \hat{R}$$



Prediction

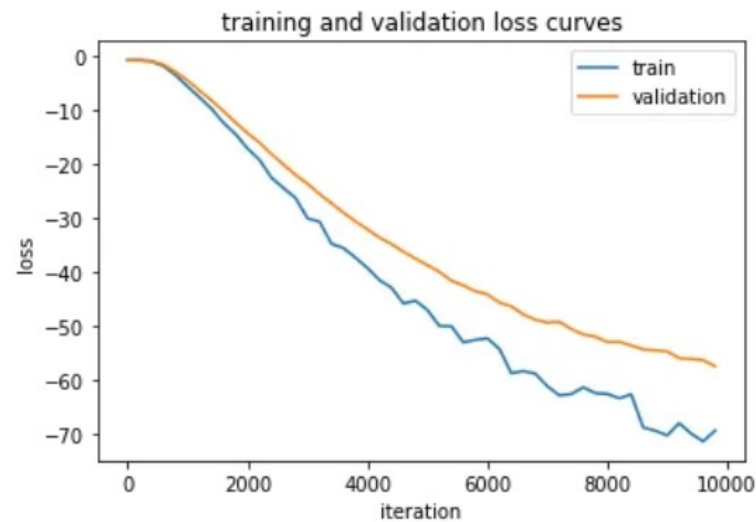
$$\hat{r}_{ui} = p_u^T q_i = \sum_{k=1}^K p_{uk} q_{ki} \quad (1)$$

■ Model Training

Objective :

$$\min_{p^*, q^*} \sum_{(u,i) \in M} (r_{ui} - p_u^T q_i)^2 + \lambda(||p_u||_2^2 + ||q_i||_2^2) \quad (2)$$

M: set of existing rating pairs



■ Examples

✓
0秒

```
[5] 1 # recommend 5 items for user 1  
2   svd.recommend_user(user=1, n_rec=5)
```

{1: array(['黄焖茄子', '烧鸭手撕鸡饭', '番茄无骨鱼', '芥菜鲜肉小馄饨', '脆皮锅烧粉'], dtype='<U7')}

✓
0秒

```
[7] 1 # recommend 5 items for user 2  
2   svd.recommend_user(user=2, n_rec=5)
```

{2: array(['肉多多汤粉', '芥菜鲜肉小馄饨', '蜜汁鸡腿饭', '酸汤肥牛', '黄焖鸡'], dtype='<U7')}

✓
0秒

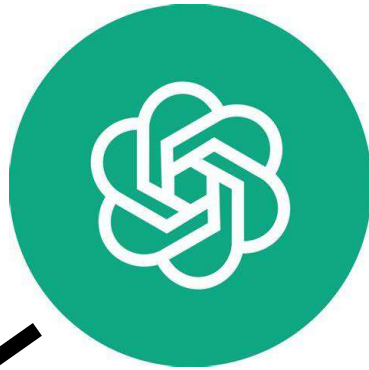


```
1 # recommend 5 items for user 3  
2   svd.recommend_user(user=3, n_rec=5)
```

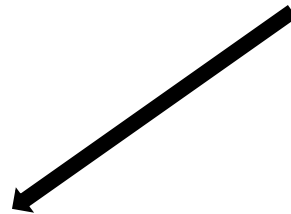
{3: array(['蜜汁鸡腿饭', '土耳其烤肉拌饭', '重庆酸辣粉', '番茄无骨鱼', '酸汤肥牛'], dtype='<U7')}

05

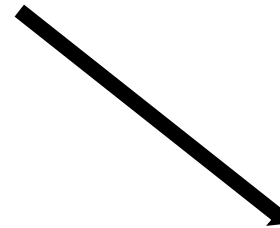
Interaction with LLM



ChatGPT-3.5



Improve data access efficiency



Generate accurate queries

■ Improve Data Access Efficiency

Prompt:

TC

You

Data base schemas + How to improve data access efficiency ?

ChatGPT answers

ChatGPT

ChatGPT

对于更快速高效的数据访问、增删改操作，可以考虑以下修改：

1. 索引优化：

- 对于经常被查询的字段，如菜品名称、餐厅名称等，可以创建索引以加速查询操作。
- 可以根据具体查询需求创建复合索引，提高查询效率。

Changes in our DB

2. 范式优化：

- 考虑将数据规范化，减少数据冗余，提高数据一致性。
- 例如，可以将菜品价格、描述等信息从菜品表中提取出来，放入独立的表中，减少重复存储。

3. 分区表：

- 如果数据量较大，可以考虑对表进行分区，提高查询效率。
- 根据数据的时间特征或其他业务特征进行分区，例如按销售日期分区。

4. 缓存：

- 对于频繁访问的数据，可以使用缓存技术，减少对数据库的访问压力。
- 可以使用内存数据库或缓存服务，将热门数据缓存起来。

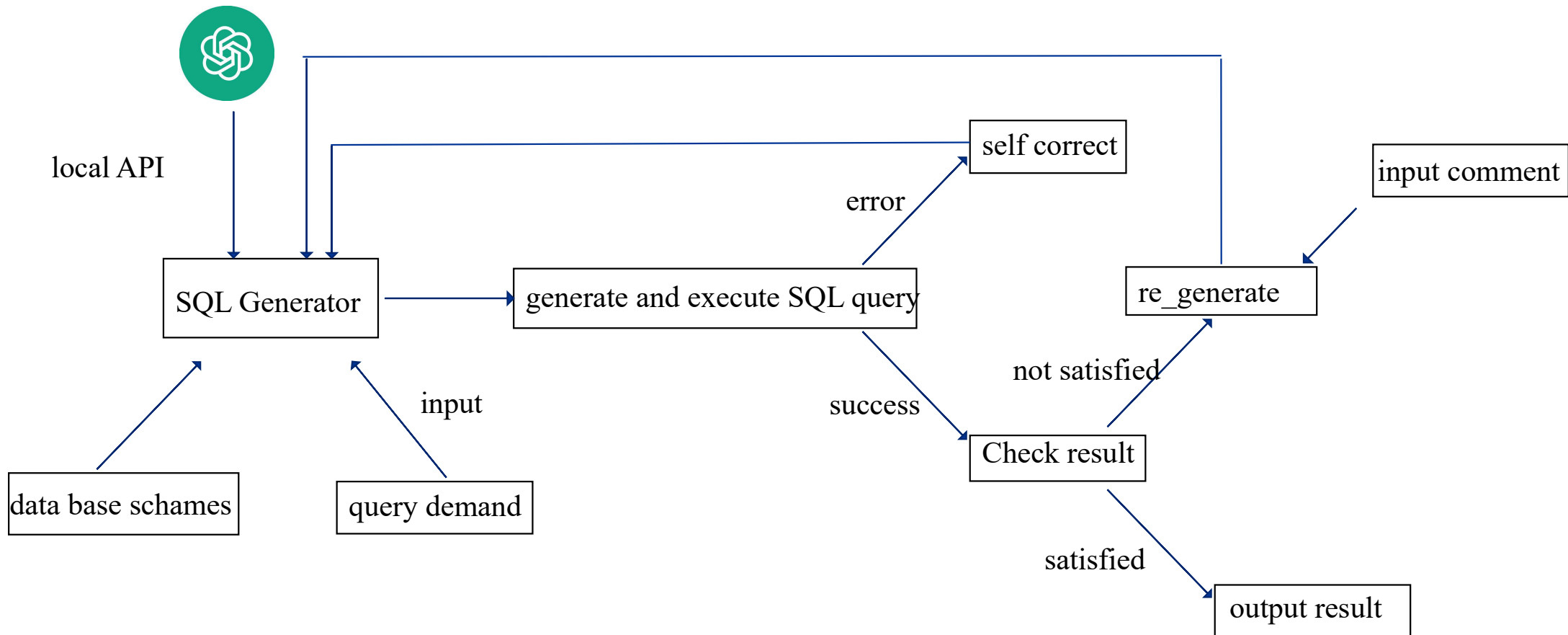
1. Create index on 'DISH_ID' of relation 'Grade'

```
CREATE INDEX idx_dish_id ON grade (dish_id);
```

2. Partition relation 'SALES' by attribute 'date'.

```
PARTITION BY RANGE (YEAR(date)) (  
    PARTITION p0 VALUES LESS THAN (2023),  
    PARTITION p1 VALUES LESS THAN (2024),  
    PARTITION p2 VALUES LESS THAN MAXVALUE  
)
```

■ Self-Correction Model



login

registry

forget password?

forget username?

Welcome to the CUHK(SZ) Food Rating System

Login

Username

Password

Login

Please enter your username and password

THANK YOU