Disclaimer: This document is just an example. The preparation of this course is still ongoing and it is likely that the format and topics of the actual exam vary. It will be updated accordingly in due time.

Practice Exam - Spring 2024

INFO9023: Machine Learning Systems Design

Instructions

- Oral exam
- You will receive **1 use case** and a series of questions relating to it
- Make sure to **thoroughly read** the use case description and each question
- **Motivate** your answers. Often the reason for making a specific design choice is as important as the choice itself.

This document contains 5 questions to give a diversified example. In the actual exam you will receive about 3 questions, to keep the time reasonable.

Use case - Demand forecasting for baked goods

Deliciousness is a manufacturer of various desserts. They specialize in ice-cream and baked desserts. Their global HQ is in Brussels but they are present in Europe and North America but are considering entering Asian markets.

They have suppliers for basic ingredients. Their main operation is to produce the baked goods in their plants (6 in Europe and 4 in North America). The desserts are then sold through retailers. They have contracts with key partner grocery shop chains in the market they are present in.

They have 5 product categories (ice creams, sorbets, pastries, bake-yourself cakes and savory biscuits). Each category contains many different products. Deliciousness frequently releases new products or discontinues existing ones. The production line can relatively easily be adapted.

Due to the short shell-life of their products they aim at having an efficient supply chain. Furthermore, the different products they sell have varying success over time and over markets.

As Deliciousness grows its activities, they want to start adopting **data driven** models such as ML powered **demand forecasting**.

The IT department of Deliciousness has gathered sales data for the last 15 years for each product, over every market (region level) and retailer. However they know that there might be other interesting data sources around the company.

You have been onboarded on a small team that will start building a demand forecasting tool to support better decision making within Deliciousness. But many points still have to be defined…

Question 1 - Data preparation

You are then tasked with preparing the data for your model.

1.1. What data **sources** could you consider to train your model? Describe in which category of data source they belong.

1.2. What kind of **data model** and **database** could be used here? Motivate your choice.

1.3. Give the main data cleaning and feature engineering steps you would consider for preparing your data.

1.4. How would you split your data to be able to evaluate the different models you are training?

Question 2- Model serving

You have built a successful pilot and now want to start serving your model. You will need to design the serving architecture.

2.1. Will you consider batch or real-time serving of your model? Motivate your answer.

2.2. On which granularity will you serve the model ? I.e. will you produce predictions on a country level, for each type of product category, or directly products, … ?

2.3. The predictions need to be served by an API. Give a description of your endpoints, the type of requests required to call it and what the response would look like.
E.g.

```
# Request URL endpoint
GET https://myservice.com/{logic}

# Request body
{
      "id": "...",
      ...
}

# Response body
{
      "...": "..."
}
```

Question 3 - Model Pipeline

(5 points)

You want to be able to reproduce the model training. You therefore will implement an automated pipeline for it.

3.1. State the **components** of your automated pipeline. You can draw a diagram.

3.2. How will the model pipeline be **triggered**? At which frequency?

Question 4 - Monitoring

(5 points)

Fast forward, your models are now being served in production to a multitude of users. You want to be able to monitor your models.

4.1. How will you monitor the **performance** of your models? Describe what you use for data, method, metric and visualization.

4.2. How will you monitor the **resources** of your models? Think about different signals that can be used for resource monitoring.

Question 5 - CICD

You want to prepare to scale and maintain your solution. For that, you will need to implement a CICD pipeline.

5.1. List and describe the **stages** implemented in your CICD pipeline. What will happen in each stage for this implementation? Be specific.