# Visable Challenge

Author: Wael Chabir

Date: 07/03/2024

Github link: <https://github.com/chabirOael/WaeCha024>

# Task 1:

Since the goal of this task is to build a German text classifier, I used a pre-trained model designed for German language: “dbmdz/bert-base-german-cased”.

## Dataset cleaning:

Before jumping in model implementation and training, a pre-processing step is crucial to clean the dataset provided. Below is a list of anomalies found in the dataset and has been cleaned:

* **Blank spaces** in ‘text’ column: blank spaces provide no information to the model, and also cannot be imputed. I dropped these rows.
* **Chinese texts**: The model is targeting German written texts. Finding Chinese text has no sense. I dropped these rows too.
* **Mail addresses**: mail addresses are not part of any type of products that the model need to classify. They must land there by error. To be dropped.

## Missing labels imputation:

Found some rows (100) having empty label in the dataset. The idea is either to drop these rows or impute them. After data analysis, I found out that all the rows having empty labels, have 'text' value containing the word 'drehteile'.

More than 80% of labeled rows where 'text' column containing the word 'drehteile' have the label 'mr'. I imputed missing labels with ‘text’ value of ‘mr’.

## Model training:

After setting up the model and its data input pipeline, I started the training.

The model scored great result after training with only 3 epochs: 92% accuracy on Test sub-dataset.



## Model serving:

The trained model is pushed to HuggingFace repository.

Following the requirements of this task to build a FastAPI app to serve predictions, I implemented the serving script and encapsulated it into a docker container for easy deployment/use. Once lunched, the container pulls the text classifier model from HuggingFace repo, put it into a pipeline for inference by request.

In the Task1 folder, I wrote a Readme file to guide you step-by-step in order to build, deploy and test the containerized application.

## **Further improvements:**

The current model reached great performance on Train and Test datasets. However, I believe there is always room for improvements. In order to achieve this goal, I think we can work on the following axels:

* Try other models (larger size)
* Fine-tune hyperparameters (learning rate…)
* Bring larger dataset for training

# Task 2:

For this task, I choose to target **website URLs.**

My solution for the AI system can be splitted into 3 main parts:

* Classic web crawler
* Real-time user pipeline
* Batch user pipeline

Link to the suggested architecture: <https://github.com/chabirOael/WaeCha024/blob/master/Task2/AI%20system%20design.pdf>

## Classic web crawler:

Given a list of websites to keep an eye on, the crawler works as a crone job (every n days) to extract products information from the desired websites and store them into a Structured DB (like PostgreSQL…). We may use **Scrapy** for web scrapping (open-source and powerful tool for dynamic websites).

We may be interested to have the following data structure (still we can update our structure depending on our needs):

* Brand
* URL
* Product name
* Description
* Photo link
* Update timestamp

## Real-time user pipeline:

In this scenario, the user types a prompt (example: “give me a list of pressure sensors that can handle temperature up to 200°C from Eddylab”. The system at this level encapsulate the user prompt into an envelope prompt for context. Using LLM pre-trained model, the app extracts the brand that the user is looking for. Make a SQL query to filter all products belonging to the desired brand.

Another call to the **LLM model** to sort products by relevance according to the user’s encapsulated prompt (check for context and similarity with each product’s name and description).

The top ***max\_products\_list*** *products* are then formatted as a JSON format and returned to the user.

**NOTE**: We may experience some latency (pseudo real-time). But I think the processing time is limited due to the fact that the ***Product Filter*** is looking to a subset of the ***Products registry* *DB*** (few hundreds).

## Batch user pipeline:

In this scenario, I choose to adapt micro-service architecture based on Brokers (JMS).

Given the user’s prompt, the ***Prompt Dispatcher*** splits the encapsulated prompt into sub-prompts, each sub-prompt targets a Brand/Link (we give room for multi-processing). **Prompt Dispatcher is the first microservice.** Its output (Brand/Link, sub-prompt) is injected into the JMS Broker.

The **second microservice** is **Products filter**. The first step is to filter Products by Brand/Link (got from the Prompt Dispatcher). Then, the sub-prompt is processed along with the filtered Products list. At this point, Products filter works exactly as described in the Real-time user pipeline above. The result is injected into the JMS broker too.

The **third microservice** is **Response collector**. Its role is simple: it waits that all the sub-requests are processed successfully, group and format them as JSON. The output is finally handed to the user.

## **Room for improvements:**

All requests and answers should be stored into a separate DB along with users’ feedback. High feedback Prompt/answer can be used to fine-tune and improve the model.

The architecture suggested provide an overview of a solution to answer the challenge of an AI web scrapper. More tools will arise once we agreed on the solution skeleton (i.e: load balancers, microservice Orchestrator…)