Email Classification System - Akaike Assignment

1. Problem Overview:

Objective:

This project focuses on classifying support emails into predefined categories. The goal is to create a system that can automatically understand the intent of an email and categorize it accordingly.

Goal:

- Automate the classification of incoming support emails.
- Ensure sensitive information (PII) is masked before processing.

2. Approach:

Data Preprocessing:

- The email dataset contains natural language text, often including PII (e.g., emails, phone numbers).
- A custom, rule-based (non-LLM) masking system is implemented to sanitize the data.
- Emails are then normalized (lowercased, punctuation removed, etc.).

PII Masking:

- Utilized regular expressions to detect and mask PII (like phone numbers, email IDs, and dates).
- Ensures the privacy of users without relying on LLMs.

Text Vectorization:

- Implemented TF-IDF Vectorizer to convert emails into numeric features for model input.

Classification:

- Used Multinomial Naive Bayes for email classification.

- Trained on labeled dataset with categories such as Product Query, Complaint, Feedback, etc.

Evaluation:

- Evaluated using accuracy and classification reports.

- Confusion matrix used to validate misclassifications.

3. Tech Stack:

Language: Python

Libraries:

- pandas, numpy - Data handling

- re - PII masking using regex

- scikit-learn - Vectorization and classification

- joblib - Model serialization

- Flask - Backend API

Deployment: Hugging Face Spaces with a Gradio UI interface

4. Deployment Details:

- Packaged the model and masking functions into an API using Flask.

- Frontend interface via Gradio on Hugging Face Spaces.

- API follows strict response format:

```
{
  "class": "Complaint",
  "masked_text": "Hello, my email is [EMAIL] and I need help with..."
}
```

5. Test Example:

Input Email:

Hi, I'm John. My email is john.doe@example.com. I'm facing an issue with the app crashing on startup.

Output:

```
{
  "class": "Complaint",
  "masked_text": "Hi, I'm [NAME]. My email is [EMAIL]. I'm facing an issue with the app crashing on startup."
}
```