Akaike Assignment - Email Classification System Project Report

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Objective

To develop a production-ready Email Classification API capable of:

- Detecting and masking Personally Identifiable Information (PII) in customer support emails
- Classifying emails into predefined support categories
- Delivering results via a fast, scalable API

Dataset

- **Source**: `combined_emails_with_natural_pii.csv`

- **Total Records**: 24,000 emails
- **Columns**:
    - `email`: email body text
    - `type`: support category label

Approach

Text Preprocessing

- TF-IDF Vectorizer used for text-to-feature vector conversion (5000 max features, stopwords removed)

Model Training

- RandomForestClassifier with 100 estimators
- Dataset split into 80% training / 20% testing
- Model saved as `email_classifier.pkl` using `pickle`

PII Masking Logic

Regex-driven rule-based masking for:

- Email addresses
- Phone numbers
- Aadhar numbers
- Credit/Debit card numbers
- CVV codes
- Expiry dates
- Full names

- Dates of birth

Masked PII replaced with `[entity_type]` placeholders.
Masked entities logged with start-end position, classification type, and original value.

API Implementation

- **Framework**: FastAPI
- **Main Endpoint**: `POST /classify_email`
- **API Documentation**: `/docs` (Swagger UI)

API Request Example

```
{

  "input_email_body": "Hello John Doe, your aadhar number is 1234 5678 9012."

}
```

API Response Example

```
{
  "input_email_body": "Hello John Doe, your aadhar number is 1234 5678 9012.",
  "list_of_masked_entities": [
    {"position": [6, 14], "classification": "full_name", "entity": "John Doe"},
    {"position": [35, 49], "classification": "aadhar_num", "entity": "1234 5678 9012"}
  ],
  "masked_email": "Hello [full_name], your aadhar number is [aadhar_num].",
  "category_of_the_email": "Billing"
}
```

Deployment

- **Platform**: Hugging Face Spaces (Docker SDK)
- **Deployed via Dockerfile running Uvicorn server on port 7860**

Live API URL
https://huggingface.co/spaces/moin0317/email_classifier

Deliverables Summary

- Deployed API on Hugging Face Spaces ✅

- PEP8-compliant modular code ✅
- Regex-based masking ✅
- Production-trained model ✅
- API with strict JSON response format ✅
- Final report (this document) ✅

Challenges Faced

- Managing regex accuracy for multiple PII types without LLMs
- Handling Hugging Face Docker SDK deployment quirks
- Managing large model file size limits on GitHub

Future Improvements

- Integrate transformer-based classification (if permitted)
- Extend regex coverage for multilingual PII patterns
- Add role-based API authentication
- Implement rate limiting, API key access

Conclusion

The API is fully deployed, passes evaluation criteria, and meets Akaike submission requirements. It reliably masks PII, classifies emails, and serves predictions via a live, scalable API endpoint.