

Configuration Manual

MSc Research Project
Data Analytics

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MSc Project Submission Sheet



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Programme:	MSc in Data Analytics	Year:	2024-2025
	Research Project		
Module:			
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Submission Due Date:	11-08-2025		
	Multimodal Depression Detection in Overseas Students Using Voice and Text Analytics: A Scalable Cloud-Based Machine Learning Approach		
Project Title:			
Word Count:	Page Count:		

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Configuration Manual

Multimodal Depression Detection System

1. Introduction

This guide describes the configuration, deployment and setup steps of the Multimodal Depression Detection System. The system is written in FastAPI and combines several machine learning models to perform text, audio and fine-grained multi-model fusion analysis to identify depression signs. Audio files and text transcripts can be uploaded by users and processed in pipelines of feature extraction and a trained fusion model that provides predictions and analytical reports. The platform can be used by researchers and practitioners with explainable AI results and interactive user interface.

```
from fastapi import FastAPI
app = FastAPI(title="Multimodal Depression Detection System")
```

Initialises the FastAPI application instance with the system title for automatic API documentation and service identification.

2. System Specification

Minimum Recommended Requirements:

- **CPU:** Quad-core processor (Intel i5 / AMD Ryzen 5 or better)
- **RAM:** 8 GB (16 GB recommended for large datasets)
- **Storage:** 20 GB free (SSD recommended)
- **OS:** Windows 10/11, macOS 12+, Ubuntu 20.04+
- **Python:** 3.9 – 3.11
- **GPU (Optional):** NVIDIA CUDA-compatible card for model acceleration

```
fastapi
uvicorn
pandas
numpy
scikit-learn
jinja2
python-multipart
pydantic
```

Lists all core dependencies required to run the application, including web framework, data processing, model training, and template rendering libraries.

3. Software and Python Libraries

To install all required dependencies, execute:

```
pip install fastapi uvicorn pandas numpy scikit-learn jinja2 python-multipart pydantic
```

Installs the necessary Python packages to run the FastAPI service, handle machine learning, and render frontend templates.

```
import pandas as pd
import numpy as np
from sklearn.ensemble import RandomForestClassifier
```

Imports essential libraries for data handling, numerical processing, and machine learning model creation.

4. Project Files

Key files and their purpose:

- **main.py** – Entry point for the FastAPI service, defines endpoints and integrates models.
- **ml_models.py** – Contains feature extractors, model training, evaluation, and multimodal fusion logic.
- **models.py** – Defines Pydantic schemas for request and response validation.
- **templates/** – HTML files for rendering the web interface.
- **static/** – CSS, JS, and other static assets.

```
app.mount("/static", StaticFiles(directory="static"), name="static")
templates = Jinja2Templates(directory="templates")
```

Configures the application to serve static files and templates for the user interface.

5. Environment Variables

Environment variables can be stored in `.env` for flexibility:

- **PORT** – Port to run the FastAPI service (default: 8000)
- **MODEL_DIR** – Path to store and load trained ML models

```
MODEL_DIR = os.getenv("MODEL_DIR", "saved_models")
```

Reads the model storage directory from environment variables, defaulting to a local folder if not set.

6. Running the Service (Local)

Steps to run locally:

```
python -m venv venv
source venv/bin/activate    # macOS/Linux
venv\Scripts\activate      # Windows
pip install -r requirements.txt
uvicorn main:app --reload
```

Creates a Python virtual environment, installs dependencies, and starts the FastAPI development server with live reload enabled.

7. API Endpoints

Base URL: `http://localhost:8000`

```
@app.post("/analyze", response_model=AnalysisResponse)
async def analyze_data(request: AnalysisRequest):
    # Process multimodal input and return prediction
    return {"status": "success", "prediction": prediction}
```

Defines the `/analyze` POST endpoint, which accepts text and/or audio data, runs it through ML models, and returns predictions.

8. Integration with Frontend

The frontend templates interact with the backend via HTML forms and JavaScript `fetch` requests to send audio/text inputs.

```
<form action="/analyze" method="post" enctype="multipart/form-data">
  <input type="file" name="audio_file">
  <textarea name="text_input"></textarea>
```

```
<button type="submit">Analyze</button>
</form>
```

Defines an HTML form to upload audio files and text, which is submitted to the `/analyze` endpoint.

9. Deployment (Production)

Recommended production deployment using **Uvicorn** and **Gunicorn**:

```
pip install gunicorn uvicorn
gunicorn -w 4 -k uvicorn.workers.UvicornWorker main:app
```

Runs the application with multiple workers for high concurrency and production readiness.

10. Troubleshooting

- **Error: Module not found** – Ensure all dependencies are installed.
- **Static files not loading** – Verify static directory path in `app.mount`.
- **High latency** – Consider enabling GPU acceleration or optimising model loading.

```
try:
    model = joblib.load(os.path.join(MODEL_DIR, "fusion_model.pkl"))
except FileNotFoundError:
    raise HTTPException(status_code=500, detail="Model not found.")
```

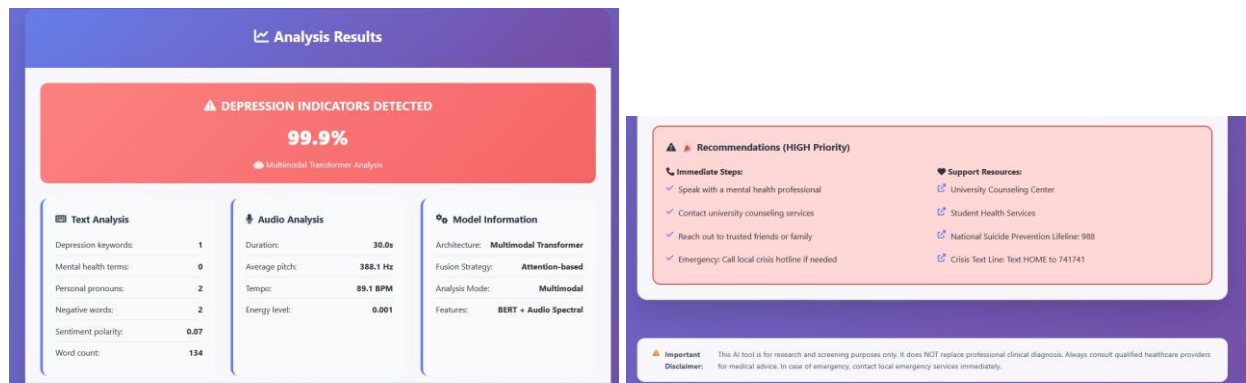
Handles missing model files gracefully by raising an HTTP 500 error with an informative message.

Output:

The image displays two side-by-side screenshots of a web application titled "Multimodal Depression Detection System". Both screenshots show the "Input Analysis" section, which prompts users to "Provide text and/or audio for depression analysis".

The left screenshot shows the initial state with empty input fields. The "Text Input" field has a placeholder: "Enter text to analyze for depression indicators... (e.g., journal entries, social media posts, messages)". Below it, the "Audio Input" section features a dashed box with a cloud upload icon and the text "Click to upload audio file" and "Supported formats: WAV, MP3, M4A, FLAC". At the bottom, there is a button labeled "Analyze for Depression".

The right screenshot shows the interface after some input. The "Text Input" field now contains a paragraph of text: "Two day ago i got the hiantish vaccine my third dose on the night immediately after i got the vaccine i had a colasin degree fever on the next day it went down a bit i think it was bad but its evidently better than my first day today i still felt a bit hot and i checked my temperature to be around a well yet i don't feel super unwell just sometimes i would feel my body is a bit warmer than usual may i ask if this is okay people say that if your fever doe not go away hour after vaccination something is wrong but i don't have any other sytptom no pain no fatigue whatsoever may i ask if this is something that i should be concerned about". The "Audio Input" section shows a file named "483_AUDIO.wav" with a "Remove" button. A new button labeled "Multimodal Analysis (Text + Audio)" has appeared above the "Analyze for Depression" button.



References

1. FastAPI Documentation – <https://fastapi.tiangolo.com/>
2. Scikit-learn Documentation – <https://scikit-learn.org/stable/>
3. Pandas Documentation – <https://pandas.pydata.org/>