

Configuration Manual

MSc Research Project
Master of Science in Data Analytics (MSCDAD_C)

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Project Submission Sheet
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Programme:	Master of Science in Data Analytics (MSCDAD_C)
Year:	2025
Module:	MSc Research Project
Supervisor:	Sallar Khan
Submission Due Date:	15/09/2025
Project Title:	Configuration Manual
Word Count:	1280
Page Count:	5

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Configuration Manual

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1 System Requirements

1. **Operating System:** macOS 12+, Linux (Ubuntu 20.04+) or Windows 10 / 11.
2. **Python Version:** Python 3.10.
3. **RAM:** 8 GB Minimum (Recommended 16GB).
4. **GPU:** Optional – NVIDIA GPU with CUDA support.
5. **Disk Space:** Approximately 35 GB.
6. **Internet Access:** Required for accessing and downloading required libraries, GPT2-large model and for GPT-4o API access (OpenAI, 2024).

2 Required Software and Tools

1. Python 3.10
2. Virtual environment using `venv` or `conda`, or Python notebook
3. Locally downloaded EfficientNet_B0 and GPT-2 large models
4. Flask web framework
5. OpenAI Python SDK and GPT-4o API access (OpenAI, 2024)
6. Git version control

3 Installation Steps

Installation Guide

Step 1: Clone the Repository

1. **For Python Notebook Code:**
`git clone https://github.com/devendraksrajput/x23318643_artworks_narrative_notebook.git`
Upload the `.ipynb` file to a Python notebook.

2. For Flask Application:

```
git clone https://github.com/devendraksrajput/x23318643_artworks_narrative_flask_application.git
```

Step 2: Set Up Environment

1. Open the downloaded `.ipynb` file in a Python notebook or a code editor such as Visual Studio Code.
2. Update file paths for input and output folders.
3. Open the downloaded Flask Application folder, unzip the contents, and save locally.
4. Replace the placeholder OpenAI API key with your actual key in both the `.ipynb` file and the Flask application.

Step 3: Install All Dependencies

Run command on the console:

```
pip install -r requirements.txt
```

Dependencies include:

- | | |
|--|----------------------------|
| 1. torch \geq 1.13.0 | 10. matplotlib |
| 2. torchvision | 11. torchmetrics |
| 3. transformers | 12. scikit-learn |
| 4. accelerate | 13. tqdm |
| 5. bitsandbytes | 14. seaborn |
| 6. openai \geq 1.10.0 (OpenAI; 2024) | 15. Pillow |
| 7. flask | 16. timm |
| 8. pandas | 17. albumentations |
| 9. numpy | 18. opencv-python-headless |

Step 4: Set OpenAI API Key

1. OPENAI KEY: `api_key="sk-proj-RBI_ZC7ibScjK1Tn-R-8jB5y0zN1UTeIKIDaE834PApT10ypFFJzEToIiJux-Fm77wnDbFJZ_8T3B1bkFJRrVHA8u3PaEGH7Q-Z3FR7AuGDtvJESpKArjC7FNTFCXeWfnflnc-RJmwSjX1Yc3nkzFDpR9HwA"`
2. Export the API key:

```
export OPENAI_API_KEY='api_key' # Linux/macOS
set OPENAI_API_KEY='api_key' # Windows
```

3. Update the `api_key` variable in both the `.ipynb` file and Flask web application.

4 Dataset Setup

WikiArt Dataset (Wang et al., 2021). Dataset Download Link - <https://archive.org/details/wikiart-dataset>

5 Model Setup

1. Train or load EfficientNet-B0 (Tan & Le, 2019).
2. `python train_classifier.py`
3. Load GPT-2 Large (Radford et al., 2019):

```
from transformers import GPT2LMHeadModel, GPT2Tokenizer
model = GPT2LMHeadModel.from_pretrained('gpt2-large')
tokenizer = GPT2Tokenizer.from_pretrained('gpt2-large')
```

4. GPT-4o OpenAI API access (OpenAI, 2024).

6 Running the Flask Web Application and Python notebook

1. Open the downloaded “.ipynb” file in a Python notebook or a code editor such as Visual Studio Code for editing and running Python code.
2. Run the notebook using the *Run All Cells* option in Python notebook.
3. Open the downloaded Flask Application folder, unzip it, and save it.
4. Change the directory to the Flask Application folder using:

```
cd "directory name"
```

5. Run the Flask application with:

```
python app.py
```

6. Load the application in your browser at address: `http://127.0.0.1:5000`.

7 Project Structure for Flask Web Application

```
flask_app_audience/
  README.md
  requirements.txt
flask_app_audience/
  app.py
  museum.jpg
  models/
```

```
blip_model.py
__pycache__/
  blip_model.cpython-311.pyc
static/
  images/
    museum.jpg
  uploads/
    a.y.-jackson_first-snow-algoma-country-1920.jpg
    adriaen-brouwer_a-boor-asleep.jpg
    adriaen-brouwer_drinkers-in-the-yard.jpg
    adriaen-brouwer_feeling.jpg
    aki-kuroda_cosmogarden-2011.jpg
    aki-kuroda_flower-bench-2007.jpg
    aki-kuroda_night-2011.jpg
    albert-gleizes_acrobats-1916.jpg
    albert-gleizes_portrait-of-igor-stravinsky-1914.jpg
    franz-kline_accent-grave-1955.jpg
    OCAJSE8.jpg
    Sample image.jpg
templates/
  index.html
```

8 Logs and Evaluation

1. **Model-generated narratives:**
 - (a) `final_descriptions_gpt4o.csv`
 - (b) `final_descriptions_gpt2.csv`
2. **Flask Web Application** output on the browser.
3. **Visualizations:** `python visualize_metrics.py`
4. **Flask logs:** `logs/flask_app.log`

9 Troubleshooting

1. Model not loading: Check paths and model files.
2. Flask not starting: Ensure port 5000 is free.
3. Slow GPT-4o: Use GPT-2 locally for speed.
4. OpenAI API Error: Validate API key.

References

OpenAI (2024). Gpt-4o technical report, *Technical report*, OpenAI.
URL: <https://openai.com/research/gpt-4o>

- Radford, A., Wu, J., Child, R., Luan, D., Amodei, D. and Sutskever, I. (2019). Language models are unsupervised multitask learners, *Technical report*, OpenAI.
URL: <https://openai.com/research/language-unsupervised>
- Tan, M. and Le, Q. V. (2019). Efficientnet: Rethinking model scaling for convolutional neural networks, *Proceedings of the International Conference on Machine Learning (ICML)*.
URL: <https://arxiv.org/abs/1905.11946>
- Wolf, T., Debut, L., Sanh, V., Chaumond, J., Delangue, C., Moi, A., Cistac, P., Rault, T., Louf, R., Funtowicz, M. and Brew, J. (2020). Transformers: State-of-the-art natural language processing, *Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP)*.
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