National College of Ireland

Configuration Manual

MSc Research Project Practicum

Masters in Artificial Intelligence

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MSc Project Submission Sheet

School of Computing

Student Name:	Hitesh Vijay Patil
Student ID:	23145331
Programme:	Masters in Artificial Intelligence **Year:** 2025
Module:	Msc (Research) Practicum
Lecturer:	Prof. Kishlay Raj
Submission Due Date:	11th August 2025
Project Title:	Explainable AI for Medical Diagnoses: Advancing Explainability and Assurance in AI-Supported Healthcare.
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ALL internet material must be referenced in the bibliography section. Students are required to use the Referencing Standard specified in the report template. To use other author's written or electronic work is illegal (plagiarism) and may result in disciplinary action.

Signature:	Hitesh Vijay Patil
Date:	9th August 2025

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Configuration Manual

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1 System Requirements

Hardware

Device: Apple MacBook Pro equipped with an M4 chip
CPU: Apple Silicon M4, 8-core
RAM: 16 GB Unified Memory
Storage: 512 GB SSD
GPU: Integrated Apple M4 GPU

Software

Operating System: macOS Sonoma 14.x
Python Version: 3.11.9 (managed with pyenv)
Integrated Development Environment (IDE): Visual Studio Code (latest version)

Libraries & Frameworks

TensorFlow / Keras, AI Fairness 360 (AIF360), SHAP, LIME, NumPy, Pandas, scikit-learn, Matplotlib & Seaborn, OpenCV

Dataset Source: Chest X-Ray Images (Pneumonia) – Kaggle dataset by Paul Timothy Mooney
Other Tools: Homebrew (for package management), pyenv (for Python version control)

2 Installation & Setup

I configured the development environment on my MacBook Pro (M4, 16GB RAM) operating on macOS Sonoma 14.x. The following procedures were followed:

1. **I installed Homebrew, a macOS package manager, to facilitate the installation of Python and the other dependencies.**

/bin/bash -c "$(curl -fsSL
https://raw.githubusercontent.com/Homebrew/install/HEAD/install.sh)"

2. **I installed pyenv to manage multiple Python versions and subsequently installed Python 3.11.9.**

   brew install pyenv
   pyenv install 3.11.9
   pyenv global 3.11.9

3. **A virtual environment was created and activated to ensure the isolation of project dependencies.**

   python -m venv venv
   source venv/bin/activate

4. **All necessary Python libraries pertinent to deep learning, fairness evaluation, and explainability were installed.**

   pip install -r requirements.txt

5. **I downloaded the dataset (Chest X-Ray Images – Pneumonia from Kaggle) and extracted it into the dataset/chest_xray/ directory. This directory comprises train/, test/, and val/ subdirectories for model training and evaluation.**

3 Execution Intructions

The following scripts were executed sequentially to implement the entire pipeline.

1. **Generation of Metadata File**
   Command: generate_metadata.py
   Output: metadata.csv, which includes file paths, labels, and gender annotations.

2. **Training of the CNN Model**
   Command: cnn_training.py
   Output: cnn_model.keras, which represents the trained pneumonia detection model.

3. **Execution of Reweighing Fairness Evaluation**
   Command: reweighting_fairness_check.py
   Output: reweighting_fairness_results.csv and a fairness metric comparison chart.

4. **Application of Adversarial Debiasing**
   Command: adversarial_debiasing_fairness_check.pyOutput:
   adversarial_tuning_results.csv with fairness metrics displayed in the terminal.

5. **Generation of Grad-CAM Heatmaps**
   Command: gradcam_explain.py
   Output: Grad-CAM images, such as gradcam_output.jpg

6. **Creation of SHAP Explanations**

Command: shap_explainability.py
Output: shap_summary_plot.png and SHAP force plots in HTML format.

7. **Creation of LIME Local Explanations**
   Command: lime_explainability.py
   Output: lime_explanation_instance_0.html to lime_explanation_instance_4.html.

8. **Generation of Learning Curves and Sensitivity Analysis**
   Command: generate_learning_curve.py
   sensitivity_analysis_plot.py
   Output: learning_curves.png and sensitivity_analysis_plot.

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