

Spotting the Synthetic: Vision Transformers vs Diffusion-Based Image Generation

MSc Research Project
Data Analytics

Brian Riera
Student ID: 23186771

School of Computing
National College of Ireland

Supervisor: Jorge Basilio

National College of Ireland
MSc Project Submission Sheet
School of Computing



Student Name: Brian Riera.....

Student ID: 23186771.....

Programme: ...MSc Data Analytics..... **Year:** 2025.....

Module: ...MSc Research Project.....

Supervisor: Jorge Basilio.....

Submission Due Date: 11/08/2025.....

Project Title: Spotting the Synthetic: Vision Transformers vs Diffusion-Based Image Generation.....

Word Count: ...475..... **Page Count** ...3.....

I hereby certify that the information contained in this (my submission) is information pertaining to research I conducted for this project. All information other than my own contribution will be fully referenced and listed in the relevant bibliography section at the rear of the project.

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: Brian Riera.....

Date: 09/08/2025.....

PLEASE READ THE FOLLOWING INSTRUCTIONS AND CHECKLIST

Attach a completed copy of this sheet to each project (including multiple copies)	<input type="checkbox"/>
Attach a Moodle submission receipt of the online project submission, to each project (including multiple copies).	<input type="checkbox"/>
You must ensure that you retain a HARD COPY of the project, both for your own reference and in case a project is lost or mislaid. It is not sufficient to keep a copy on computer.	<input type="checkbox"/>

Assignments that are submitted to the Programme Coordinator Office must be placed into the assignment box located outside the office.

Office Use Only	
Signature:	
Date:	
Penalty Applied (if applicable):	

Configuration Manual

Brian Riera
Student ID: 23186771

1 System Requirements

- **GPU (optional but recommended):** with at least 8 GB VRAM for faster training
- **RAM:** Minimum 8 GB system memory
- **Storage:** At least 10 GB free disk space for dataset, models, and logs

2 Software Requirements

- Python 3.8+
- PyTorch
- torchvision
- timm
- albumentations
- datasets (Hugging Face)
- matplotlib, pandas
- opencv-python
- Pillow

Note: Most installation commands (via `pip`) are included and commented at the top of the Thesis.ipynb notebook

```
## Environment Setup & Library Imports ...
Environment Setup & Library Imports

# Optional: Install required packages (uncomment if needed)

# PyTorch and related libraries (specify CUDA version if needed)
# pip install torch torchvision torchaudio --index-url https://download.pytorch.org/whl/cu118

# Hugging Face Datasets
# pip install datasets

# TIMM - PyTorch image models (used for ViT)
# pip install timm

# Albumentations - data augmentation library
# pip install albumentations
```

3 Project Structure

- **train.py** - Standard training script (ViT or ResNet) (*deprecated*)
- **train_format_test.py** - Training script for JPEG-normalised dataset (used in final model)
- **evaluate_models.py** - Evaluates trained models on the test set and saves metrics
- **Thesis.ipynb** - Jupyter notebook for:
 - Dataset exploration
 - Visualising sample images
 - Loading model results
 - Plotting confusion matrices, ROC curves, and metrics tables
- ***.pth** - Trained model weights
- **vit_results.json** - Evaluation metrics (Accuracy, F1, AUC, etc.) for all models
- **.pt files** - Saved model predictions, probabilities, and true labels for analysis

4 Running the Notebook

- Open `Thesis.ipynb` in Jupyter Notebook or VS Code
- Some libraries (e.g., `datasets`) may need to be installed if running in a new environment, installation commands are included and commented at the start of the notebook, remove the `#` from lines beginning with `pip` to install.
- The notebook can then be run as-is because the trained model weights and output files are already included in the project folder
- **Optional:** If you want to reproduce the results from scratch, first install the necessary libraries, then run the training and evaluation scripts, then re-run the notebook to update the visualisations (see section 5)

5 Run Scripts (Optional)

Before running any scripts:

- Open a terminal (Command Prompt, PowerShell, or your IDE's integrated terminal)

Step 1 – Activate Environment

If you're using conda

```
conda activate myenv
```

If you're using venv:

```
.venv\Scripts\activate
```

Step 2 - Navigate to the project folder:

Example (change to your downloaded folder location):

```
cd "C:\Users\Brian\Desktop\College\Thesis_Code"
```

Step 3 – Confirm the scripts are in the folder

```
dir *.py
```

Step 4 – Check required libraries are installed

```
python -c "import torch, torchvision, timm, albumentations, datasets, sklearn, cv2, PIL, matplotlib, pandas; print('All dependencies OK')"
```

If there is an ImportError, install the missing library with:

```
pip install <library-name>
```

Step 5 – Run the Scripts

Example of running script after setting the directory for Vit Model, remove `--convert-png` argument if you want to get results on original dataset, final models used – `convert-png`:

```
python train_format_test.py --model vit --batch-size 64 --epochs 5 --num-workers 4 --convert-png
```

For ResNet Model:

```
python train_format_test.py --model resnet --batch-size 64 --epochs 5 --num-workers 4 --convert-png
```

Evaluate Trained Models:

```
python evaluate_models.py ^  
  
--model-paths best_model_vit_formatcheck.pth best_model_resnet_formatcheck.pth ^  
  
--model-names "Vision Transformer" "ResNet-50" ^  
  
--model-types vit resnet ^  
  
--batch-size 64 --num-workers 4
```

(On Linux/Mac, replace ^ with \ for line continuation, or see readme.md file)