



School of Electronic Engineering

## CB54: Machine Learning Algorithms for EM Wave Scattering Problems

### Appendix F: Source Code Listing

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# Declaration

I hereby declare that, except where otherwise indicated, this document is entirely my own work and has not been submitted in whole or in part to any other university.

Signed: Anthony James Mc Elwee

Date: 2023/08/20

## Source Code Location

All code is hosted on a GitHub repository at <https://github.com/spookworm/CB54> and will reside there until the final grade for the project is released. Aside from code, the repository also contains the documents required for the final portfolio, legacy code that was used as raw reference during development and compilation commands that generate the conda environment and wrap the final documents together into the submission template.

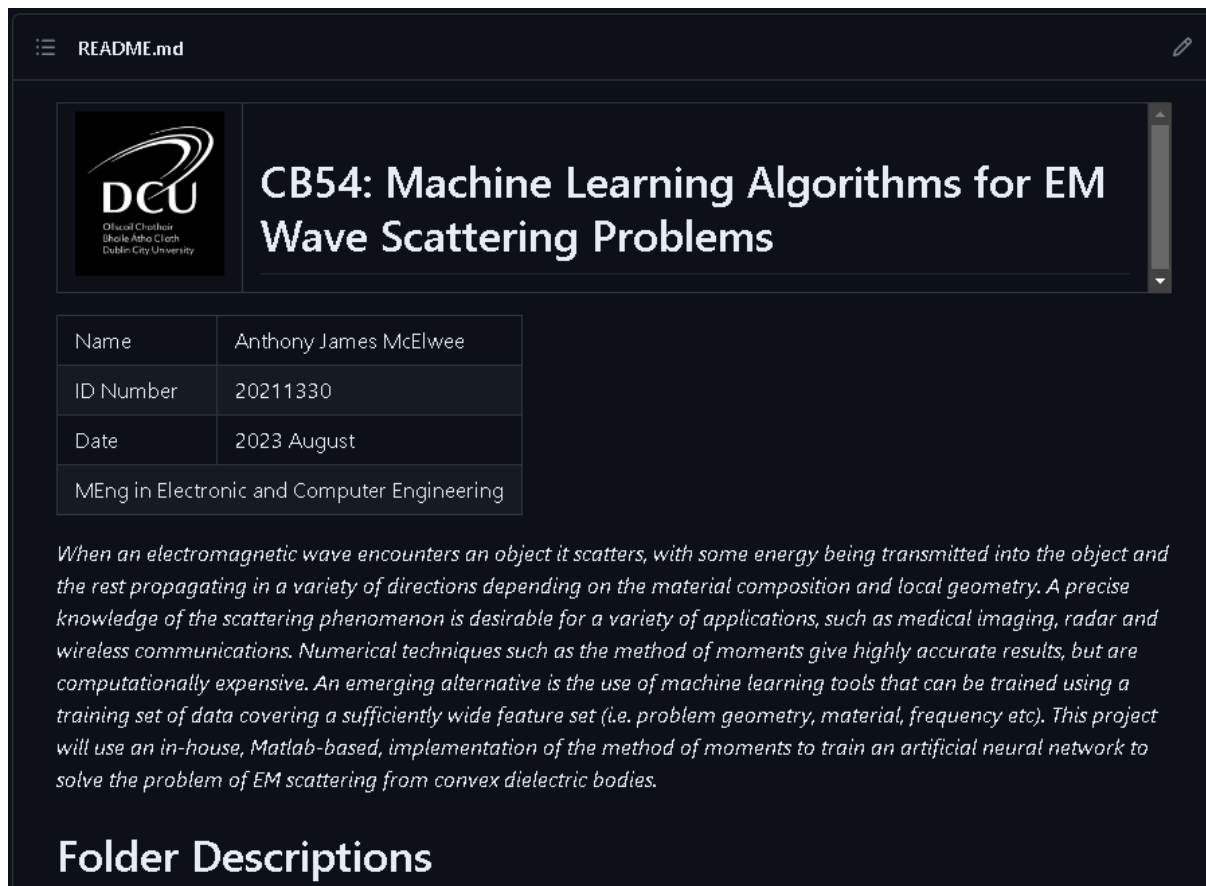


Figure 1 The presentation of the portfolio materials on GitHub.

## Code Description

The important code files with brief description are as follows:

- Main Folder: ForwardBiCGSTABFFTwe.py: This is actually SolverEMF2, due to changes in the development scheme the code for generating the data reside here rather than the scripts with “solveremf2” in their name.
- Main Folder: prescient2dl.py: This is the deep learning model development part of the code. The training files are assembled here too.

- Lib Folder: `custom_architectures_EM.py`: This is where the various deep learning model architectures were saved during development. Some plotting functions for the predictions and loss curves also reside here.
- Lib Folder: `custom_functions_EM.py`: This is where the van den Berg code, adapted from [1] resides along with support scripts for generating reports and plotting diagrams etc. The student stresses that they tried to keep the code in the same structure as the original MATLAB code to enable referral to the main text if required by future developers. No plagiarism is intended and credit and referencing of [1] is frequent throughout the documentation.
- Lib Folder: `custom_tensorboard.py`: Basic code to terminate the Tensorboard instance before refreshing the deep learning model. This caused some trouble on Windows as the instance was blocking anything from running in the background unless the previous session was terminated first.

All other code is either reference/legacy code used in the development process or documentation code that does not apply to the project problem of electromagnetic wave scattering.

Note: Even more code exists that was developed during the course of the project but it has not been posted on GitHub as there was no time to implement it directly in the main code bodies. For example, the student had developed code to tie in the Python library Gradio to demonstrate the models with a user input geometry file.

[1] P. M. van den Berg, *Forward and inverse scattering algorithms based on contrast source integral equations*. Hoboken, NJ: Wiley, 2020. [Online]. Available: <https://onlinelibrary.wiley.com/doi/book/10.1002/9781119741602>