Chapter 1

Requirements Analysis

In order to answer the question proposed in the literature review, several objectives must be met. As this project cover two stages: Application of deep learning model on medical images and visualisation, this requirements analysis is split up into two sections: first section relating to requirement analysis of the implementation of deep learning model and the second being visualisation.

These requirements have been gathered based on the MoSCoW rule, which prioritises different requirements by stating the project must, should or could achieve the detailed requirements by the end of the implementation stage. A requirement that the project "must" achieve has the highest priority, where if this requirement is not met, the developed product will not be fit for purpose. The ones that "should" be completed are next in the priority hierarchy, whereby the project will still be functional without them, but their addition to the project would improve the end product. The requirements that "could" be completed are those that are not necessary to the overall functionality. However, these would benefit the project.

1.1 Deep Learning Model

1.1.1 Functional Requirements

1.1.1.1 Dateset

Must pre-process data from the dataset as each chest X-ray has a report associated to it within the dataset. A supplied Natural Language Processor (NLP) given from the authors of the dataset will be supplied to get the class label values representing the presence of Pneumonia.

1.1.1.2 Convolutional Neural Network

Must build a model using image classification algorithms like CNN.

1.1.1.3 Improve Performance of model

Must look into ways of tweaking model parameters, and evaluating the results of these improvements, as per the ones described in the literature review.

1.1.1.4 Comparison of different algorithms

A report showing a comparison of different algorithm employed to build a model and predict could be created depending on the time.

1.1.1.5 Extending classification

The model's architecture could be further extended to diagnose more than one pathology.

1.1.2 Non-Functional Requirements

1.1.2.1 Programming Language and Libraries

Must use Python for rapid development and prototyping of CNN model via libraries such as Keras and sci-kit learn for visualisation and explanation of results.

1.1.2.2 Proof of Concept

Must be fully functional by the proof of concept stage

1.1.2.3 Anonymised Date

Must use anonymised patient data from publicly available datasets in order to conform to GDPR rule.

1.1.2.4 Accuracy

Model should diagnose images with an acceptable accuracy rate

1.2 Web App for visualisation

1.2.1 Functional Requirements

1.2.1.1 Visualisation

If the model evaluation shows promising performance, visualisation and explainability of results must be used in the form of a web application:

- Must show a classification probability to the user when a chest X-ray is tested on the deployed model

- Should show a localisation of where the model believes the Pneumonia is present in the X-ray.

1.2.1.2 User Input

User must be allowed to upload an image through the interface and get back results from the image being tested on the model.

1.2.2 Non-Functional Requirements

1.2.2.1 Programming Language and Libraries

Must use Javascript,HTML,CSS and cloud services for web application development:

- Should use Amazon Web Services(AWS) Sage Machine and AWS Lambda to deploy trained and tested model. The model should be accessed via the deployed RESTful API

1.2.2.2 Completion Date

Must be completed by the project demonstration day or could be operational by proof of concept deadline

1.2.2.3 Compatibility

Should be compatible with all major web browsers

1.2.2.4 Image quality

Must not reduce image quality when passing image to cloud service where the model has been deployed upon

1.3 Methodology

The requirements in the previous section will be delivered in an agile manner. Using an agile approach consists of implementing the model, testing it against the test set, evaluating and reporting on the results of the performance. This process will be iterative until satisfactory results from the model are achieved, then leading to the deployment of the model onto a cloud service. The image shown in 1.1, demonstrates the steps that will be taken to build a model that can accurately detect the presence of Pneumonia in chest X-rays.

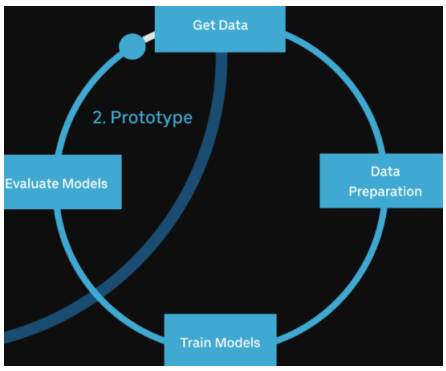

Figure 1.1: Iterative process of building deep learning model