Problem Statement and Goals
Software Engineering

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Table 1: Revision History

Date	Developer(s)	Change
09/23/2023	Nathaniel Hu	Updated project header information, began initial drafting of various sections and subsections
09/24/2023	Ibrahim Issa	Revised Problem Statement, expanded on Environment and Goals subsections
09/24/2023	Mohaansh Pranjal	Added to Stakeholders subsection, revised Environment subsection
09/24/2023	Tushar Aggarwal	Final review of entire document, corrected spelling errors, formatting
09/25/2023	Mohaansh Pranjal	Revised Outputs and Environment subsections
09/25/2023	Nathaniel Hu	Transferred Problem Statement and Goals document text from collaborative document into this LaTeX document; Did some finishing touches
...	...	...

1 Problem Statement

In this section, the **problem** that this project's proposed solution aims to solve will be introduced and discussed in more detail. In particular, the problem will be **abstracted and characterized** in terms of its **high-level inputs and outputs**. The **stakeholders** of the proposed solution who are impacted by

this problem (either **directly or indirectly**) are also identified and described in more detail. The **environment** that this problem exists in, and that the proposed solution is expected to work in, will also be described in further detail here. Environmental **constraints** will also be identified and discussed in relation to the problem and potential solution.

1.1   Problem

Chest X-rays are the most common medical imaging modality, and they constitute **40%** of the **3.6 billion** medical imaging procedures performed worldwide every year. Chest X-rays are taken for a wide variety of reasons, **including** (but not limited to) the following:

- For the discovery of a wide range of **cardiac and lung conditions**

- To verify the **position of lines and tubes** in patients in the ICU or during/after interventions

- For ruling out diseases for **regulatory reasons** such as immigration and occupational health assessments

This huge traffic of data becomes very tedious and time-consuming for **radiologists** and **healthcare professionals** to review and analyze. They need to manually examine each chest X-ray **carefully** to diagnose a patient's symptoms or even check for normality. This arduous process can cause delays for patients who are waiting on their test results. This is especially problematic for patients in **time-sensitive situations**, such as those with serious conditions whose symptoms could become worse over time.

1.2   Inputs and Outputs

The high-level **inputs and outputs** of this problem are described as follows:
Inputs:

- Chest X-ray **image samples**

Outputs:

- **Diagnosis and identification of detected diseases** in the image samples

1.3   Stakeholders

The various **stakeholders** of this problem and this project's proposed solution are described in detail below:

- The **primary stakeholders** for this problem and potential solution are the **medical professionals** responsible for analyzing medical imaging

and performing diagnoses for the patients. These **medical profession-als** must review many medical images in detail to accurately perform diagnoses, and then document their findings into a **radiology report**.

- The **patients** themselves are the **secondary stakeholders**, as it will be their **chest X-rays** that will be analyzed. They are the **main benefi-ciaries** of the diagnoses performed on the x-ray images and subsequently produce radiology reports detailing any problems they might have. These will allow them to get the treatment they need, hopefully within an ideal timeframe.

- Additionally, the **data/IT departments** of the **hospitals/medical in-stitutions** using the software are also **(tertiary) stakeholders**, as **se-cure access** to X-ray samples is of importance in such institutions. The software using medical data is concerned with the department that docu-ments and provides such data.

1.4 Environment

The **environment** of this problem and project's proposed solution are described below:

- **Software**: The web application would have a **user-friendly** interface, that can also **interface with** the hospital's/medical institution's system using **secure APIs** as needed.

- **Hardware**: The web application would be running on a device that has access to the **web and the hospital's/medical institution's server(s)**, as it would need to pull patient's chest X-ray images **securely**.

2 Goals

The **goals** of this project's proposed solution are described in detail below:

- **Accurate image detection**: Given an X-ray image, the application should **accurately detect** normality or abnormality with a **certain range of precision**.

- **Intuitive user interface**: The user interface should **facilitate interac-tion** with the user and should allow the user to **easily input** an x-ray image and **output** the diagnostic report.

- **Diagnostic report generation**: Generate a report **outlining** any ab-normalities in the given X-ray if any.

- **Remote access**: The user should be able to **access** the application through a web browser regardless of location.

- **Security**: The application should **protect** user-sensitive user information and be only accessible by **authorized parties**.

3   Stretch Goals

The **stretch goals** of this project's proposed solution are described in detail below:

- **NLP Report**: Given an X-ray image, generate a **structured or free-form** radiology report of the diagnostic findings using **NLP**.