

## **Part 1 Developing a Research Question**

1. **My topic of interest is** the application of computer vision, deep learning techniques and AI for the diagnosis of lung diseases such as pneumonia and COVID-19 using chest X-ray and CT images.

### **2. 5Ws technique :**

#### **- Who does your topic impact? Who cares about your topic?**

Doctors, radiologists, and healthcare providers who need some help to get accept to more accurate and fast diagnosis.

Patients who is ill lung diseases who will benefit from better and faster detection.

Researchers in computer vision and AI in healthcare because of the fact that this topic for research is still too poor and have to develop.

Policymakers and public health organizations to understand how law should control and organize work of this technik in future .

#### **- What is influenced by or influences your topic?**

Influenced by: medical imaging technology (X-ray, CT), availability of annotated datasets, AI model architectures.

Influences: diagnostic accuracy, treatment decisions, healthcare efficiency, patient outcomes.

#### **- When was or is your topic relevant?**

Became highly relevant during the COVID-19 pandemic .

Continues to be relevant today for pneumonia, tuberculosis, lung cancer, and other lung diseases.

Will remain relevant in the future as AI tools are integrated into clinical practice.

#### **- Where is your topic relevant?**

Globally: in hospitals, clinics, and research institutions.

Especially critical in regions with limited access to radiologists but high disease prevalence.

#### **- Why is your topic important?**

Lung diseases are among the leading causes of morbidity and mortality worldwide.

Early and accurate diagnosis can save lives.

AI can help reduce diagnostic errors, speed up workflows

Make healthcare more accessible.

Now this industry is only just developing, so its improvement and development requires a lot of contribution right now for the future

### **3. Your preliminary research question:**

"How can deep learning-based computer vision methods be optimized to achieve accurate, interpretable, and clinically applicable diagnosis of lung diseases (e.g., pneumonia and COVID-19) using chest X-ray and CT imaging?"

## **Part 2**

### **Research Objectives:**

#### **1. Collect articles on AI for lung diseases.**

Each team member searched online (Google Scholar, PubMed, IEEE, and other sites) and found studies about computer vision for chest X-rays and CT scans. In total, 20 articles were collected.

#### **2. Read and summarise the articles.**

Each member read their papers and made a short summary according to articles they found

#### **3. Prepare for the second assignment.**

After finishing second part, the team chose a common topic for all and divided the tasks for Assignment 2. Each member took a different part to work on so the whole project would be covered.

### **Research Gaps:**

The analysis of previous articles has some research gaps that need to be mention. In most of the articles names and sources of datasets are not provided or not detaily specified, making it impossible to verify and reproduce the results. There is also a lack of information or insufficient information about the training algorithms for the models that is mention, leading misinformation about how they are trained they are model. Comparisons of new models with older ones are considered biased. For example, YOLOv8 is compared only with older models (Faster R-CNN, RetinaNet). The same public datasets are used for research. Models are trained and educated on the same datasets. It's means that in the real situation or on the other dataset model could not be show performant as documented in the reseach. The one article used technologies, such as chatGPT and Grammarly, the research calls into question the article's objectivity. Limited focus on "explainability": While the article correctly emphasizes the importance of "explainable AI," it does not offer an in-depth review of existing explainability techniques. Other authors use their own "5-

Trial Confirmatory Test" method in analyze. While this is an attempt to demonstrate the stability of the results, it is not a standard method. Also some articles uses their technologies and models to advertise it example: LungPrecheck.io, showing models limitations and dominations in some prospectives leading it to research gaps. One article states that they cannot reliably predict COVID-19 disease using data because the pathologies of pneumonia are similar, and their model can only solve one problem: the presence or absence of COVID-19. Low quality of the original data labels: The CheXNet model was trained on the ChestX-ray14 dataset, where labels were automatically obtained from radiologist reports using natural language processing (NLP). This method is known for its noisiness and lower accuracy compared to manual labeling by experts.

Mainly in different articles different type of research gaps such as: analysis of personalized medicine (taking into account the individual characteristics of the patient), description of specific clinical cases of implementation in pulmonology, limited information about training doctors to work with AI and interdisciplinary aspects, no analysis of the ethical and legal issues of using patient data, attention to real clinical trials and their results.

## **Research aim**

We will study how AI and computer vision are used to detect lung diseases from X-rays and CT scans, compare methods and data, note strengths and weaknesses.

## **Proposing Research Paper Titles**

1. AI for Lung Diseases on Chest X-ray and CT: A Review (2016–2025)
2. How Well Does AI Find Lung Diseases? A Review of X-ray and CT Studies
3. AI for Lung Diseases: A Review of Pneumonia, Tuberculosis, COVID-19, and Lung Cancer

## **Key terms:**

**X-rays** - are a type of electromagnetic radiation used to create images of inside of the body.

**CT** (computed tomography) - is a non-invasive medical imaging test that uses a computer to combine a series of X-ray images into detailed, 3D cross-sectional pictures of organs.

**PET** - is a medical method that shows how organs work (for example, how active cells are).

**MR** - is a medical method that shows the structure and shape of organs and tissues.

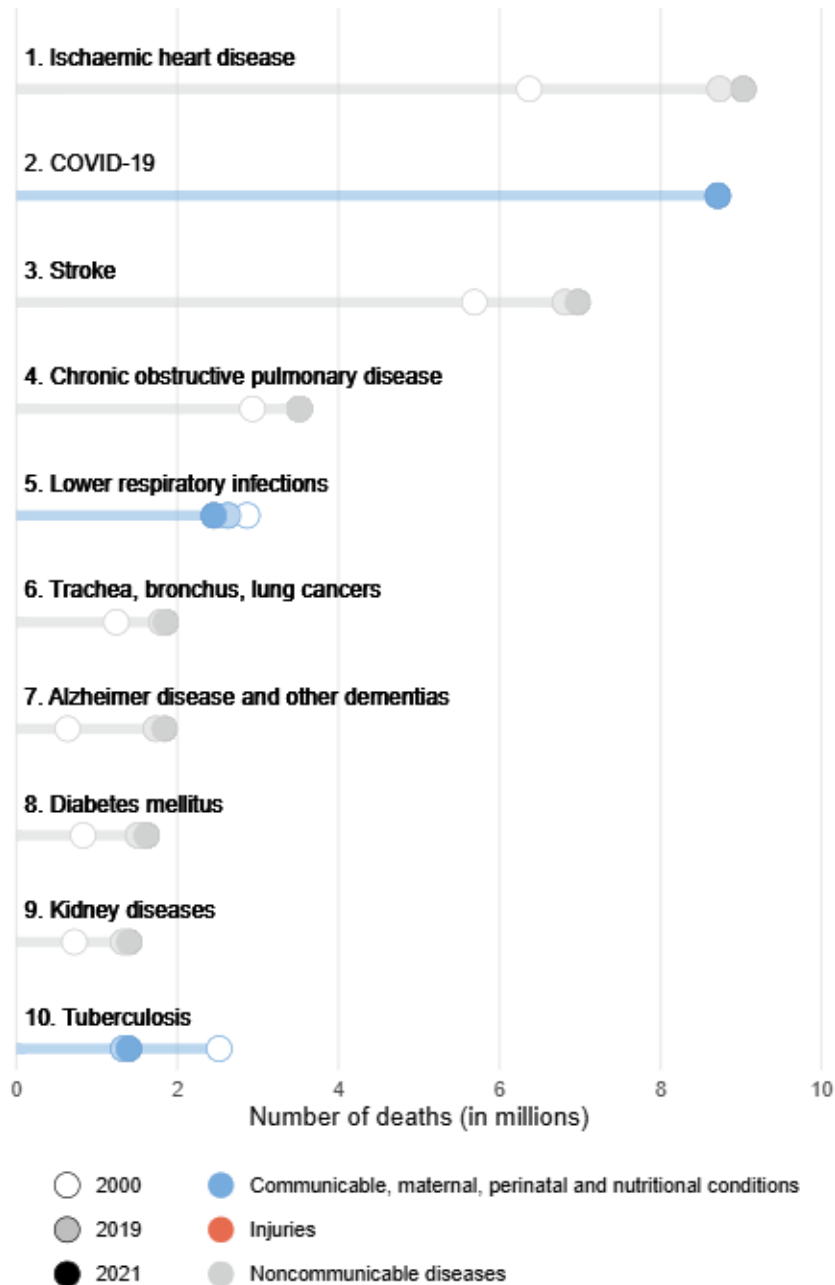
**CNN** - (Convolutional Neural Network) is a type of neural network in machine learning that understands pictures well: it finds lines, shapes, and objects.

**KNN** - (k-Nearest Neighbors) is a simple **machine learning algorithm** that looks at the k nearest neighbors and decides which class an object belongs to.

## **Introduction**

### **1.1 The Broader Context: The Global Burden of Lung Disease**

We live in an era of advanced technology and computers, and they are still developing. Technology has given people many opportunities in various are of our life. But it is not a secret that we are not using all opportunities, for example, people are dying because of late detection that they have lung disease. According to the World Health Organization, millions of people die every year from lung diseases such as tuberculosis, COVID-19, and lung cancer. We believe that early detection of the disease will significantly reduce the number of deaths.



<https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death>

## 1.2 The Problem: Limitations of Traditional Diagnosis

Traditionally, diagnoses are based on the knowledge and experience of a doctor. This in turn creates several challenges, for example, doctors have limited working hours and cannot spend all day

looking at X-rays or CT scans. In addition, people are prone to fatigue, and we cannot prevent it also we cannot blame them. Also in their research Ernestov & Shaiakhmetov (2025) note that radiologist-driven diagnosis in resource-limited settings is time-consuming and error-prone, especially under high workload .

### **1.3 The Solution: The Promise of AI and Computer Vision**

To address the issues mentioned above, we concluded that artificial intelligence, including computer vision, should be trained to detect lung diseases and integrated into the healthcare sector. Divya (2023) reports that deep learning on chest X-rays achieved high accuracy in detecting COVID-19 and pneumonia, demonstrating AI's potential . Also, Lumamba et al. (2024) show that CNNs and hybrid models (CNN + LSTM, RegNetX4) outperform traditional ML in TB detection .

### **1.4 The Research Gap and Significance**

Despite technology and artificial intelligence have advanced, there are still gaps in research. We believe that this is because artificial intelligence models are not yet fully integrated and supported in the medical field. In general, this field is as important as human life, because we believe that artificial intelligence and computer vision can help to detect different types of lung diseases.

### **1.5 The Contribution of This Study**

The contribution and benefit of this study is that it compares the results of previous studies and articles and provides comprehensive information and guidance not only to programmers and medical worker but also to people from all groups interested in this topic. Liguera et al. (2022) and Divya (2023) show successful X-ray based AI detection of pneumonia and COVID-19, proving feasibility.

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