



# Artificial Intelligence (AI) for Medical Innovation

ภาควิชา บัญชี ประดิษฐ์ สำหรับนักวิเคราะห์การแพทย์

CHSC 1262 Artificial Intelligence (AI) for Medical Innovation

# Agenda :

## FUNDAMENTALS

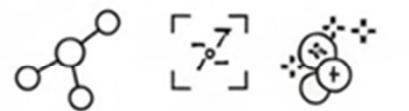
1. What is Medical AI Image Analysis? 

2. Why is this Field Exploding? 

3. What Makes Medical Images Unique? 

4. Key Imaging Modalities 

## AI CORE CONCEPTS



2. The Three Fundamental AI Tasks 

2. The Engine: CNNs Task

3. The Smart Shortcut: Transfer Learning

## PRACTICAL CONSIDERATIONS

2. The Dataset Lifecycle

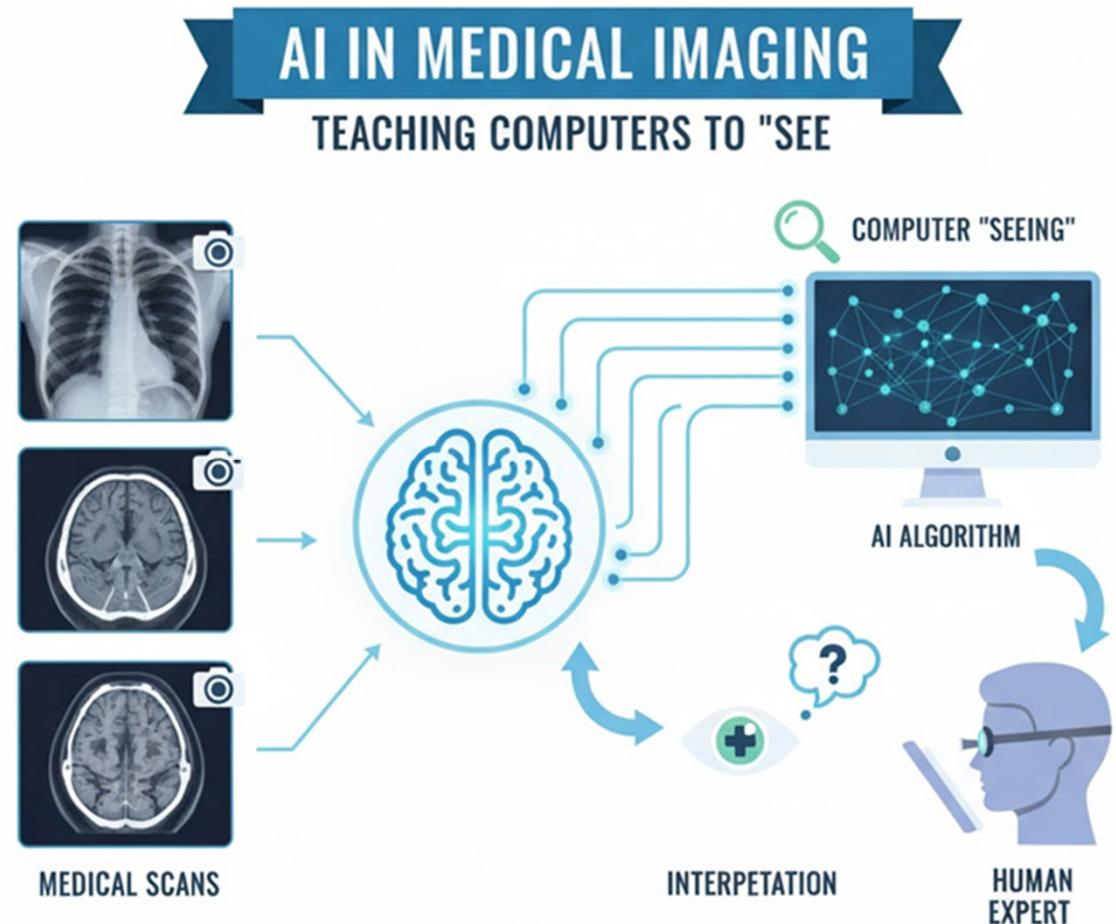
2. Key Challenges & What You MUST Know



3. Where to Find Data

# What is Medical AI Image Analysis?

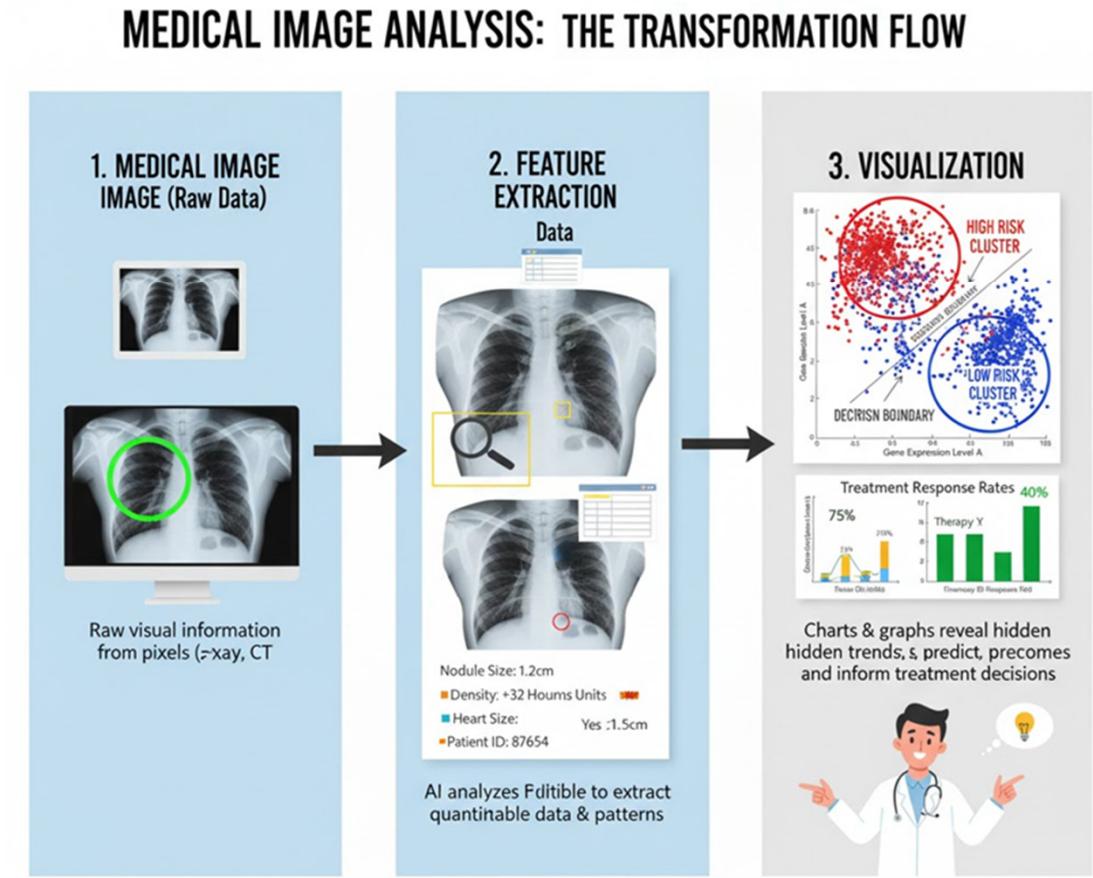
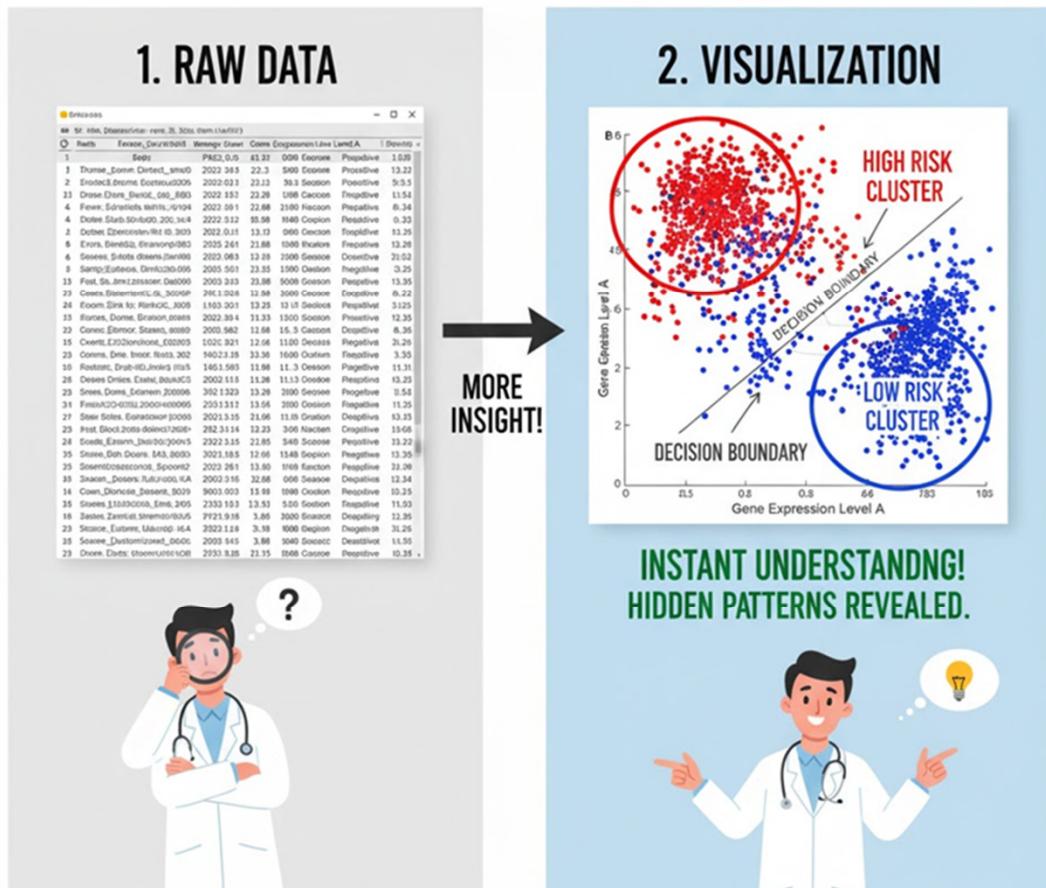
Think of the AI as a highly specialized assistant for radiologists or pathologists, capable of identifying patterns that might be too subtle for the human eye.



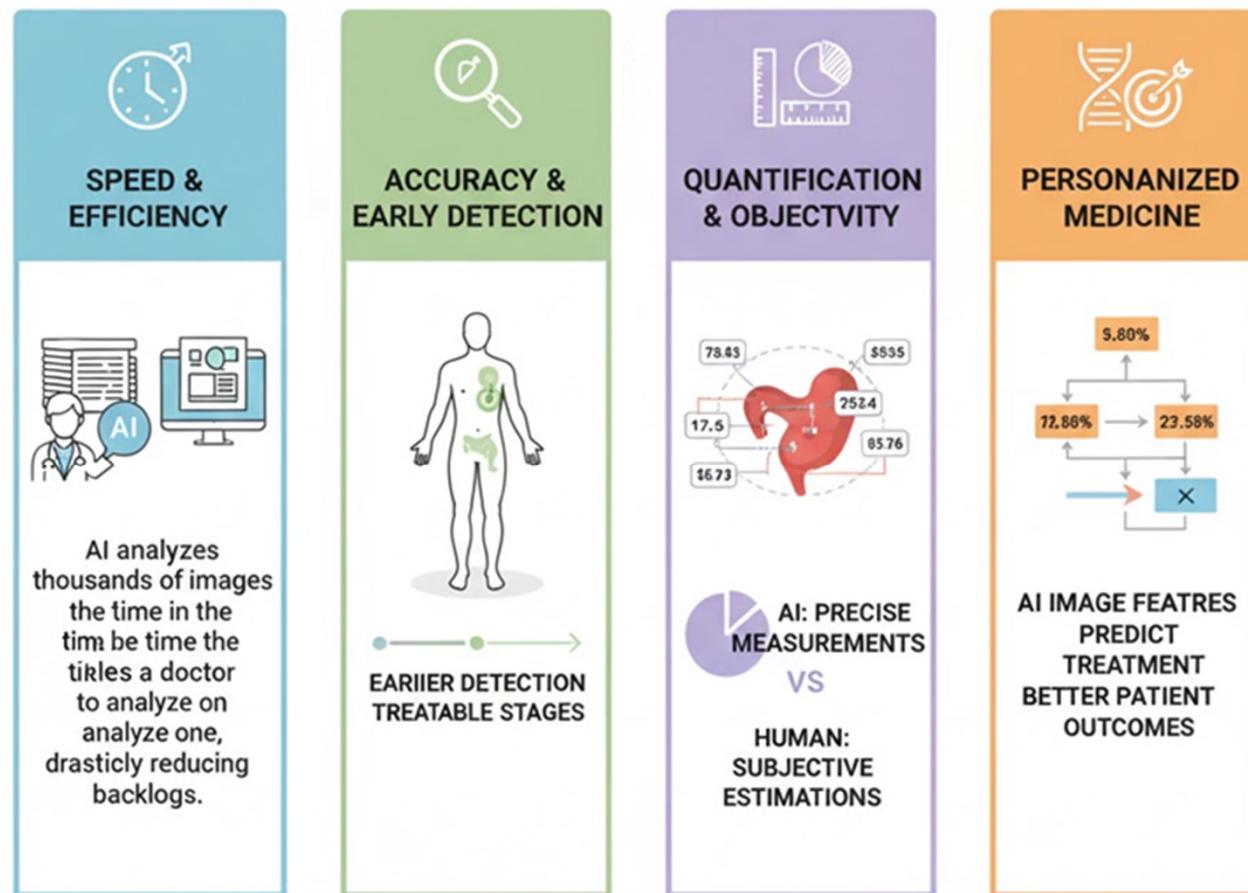
# What is Medical AI Image Analysis?



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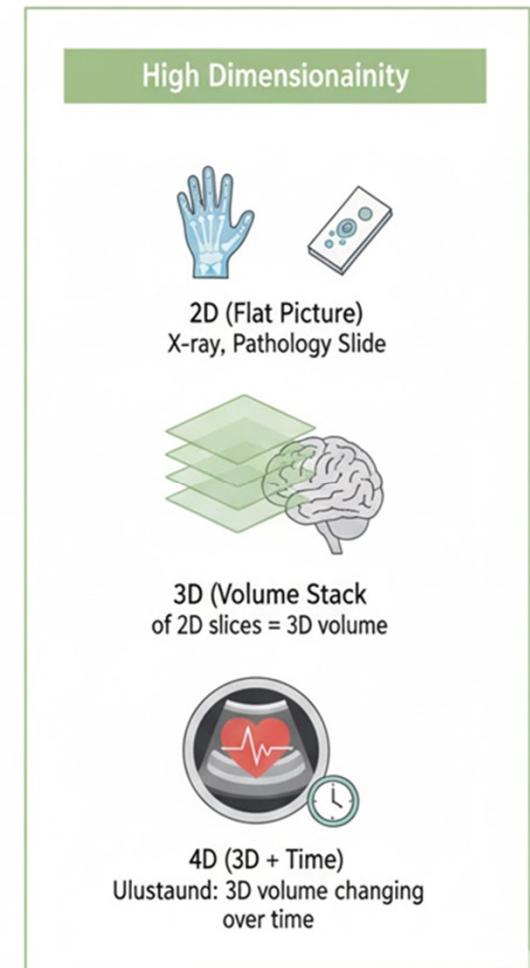
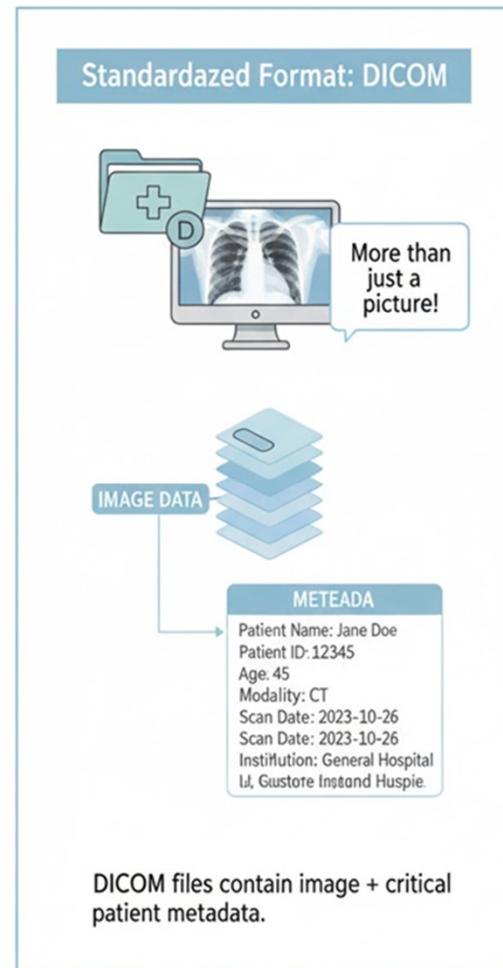


# Why is this Field Exploding? (The Motivation)

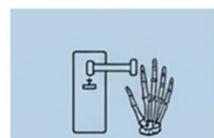


# What Makes Medical Images Unique?

It's more than just a picture; it's a file containing the image plus critical patient metadata (name, age, scan settings).



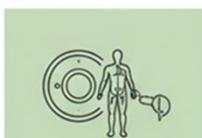
# Key Imaging Modalities (The "Flavors" of Medical Scans)



1. Radiographiy  
(X-ray)



- Uses radiation to see dense structures.
- Great for bones and chest pathologies.



2. Computed  
Tomorropy (CT  
(CT)



- A 360-degree X-ray machine that creates detaiel 3D cross-sections.
- Excellent for viewing organs, blood vessels, and tumors.



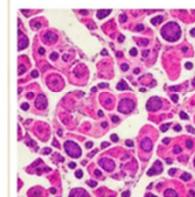
3. Magnetic  
Resornce  
Inaging  
MRI



- Uses powerful magnets and radio waves to see soft tissue detail.
- The gold standard for brains, joints, and certain cancers.



4. Histopatoaphy



- Microlopic images stained tissue samples on glass slides.
- This is how pathologists diagnose cancer.

# The Three Fundamental AI Tasks:

**Classification:** Answers a "what is it?" question. The output is a single label.

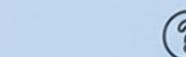
**Example:** *Is there pneumonia in this chest X-ray? (Yes/No)*

**Segmentation:** The most precise task. Answers "what is its exact shape?" by outlining an object pixel-by-pixel.

**Example:** *Trace the exact border of the brain tumor in this MRI. [Image comparing detection bounding box vs. segmentation mask on a tumor].*

**Detection:** Answers a "where is it?" question by drawing a **bounding box** around an object.

**Example:**  
*Draw a box around the lung nodule in this CT scan.*



## 1. CLASSIFICATION

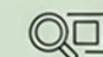
Answers a "what is it? question.

Output: A single label.



PNEUMONIA  
DETECTED  
(Yes/No)

Example: Is there pneumonia in this chest X-ray?



## 2. DETECTION

Answers a "where is it? question

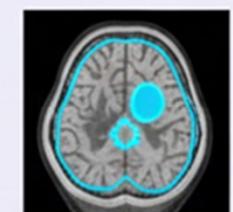
Output: Bounding box(es).



## 3. SEGMENTATION

Answers "what is its exact shape?"

Output: Pixel-wise mask.

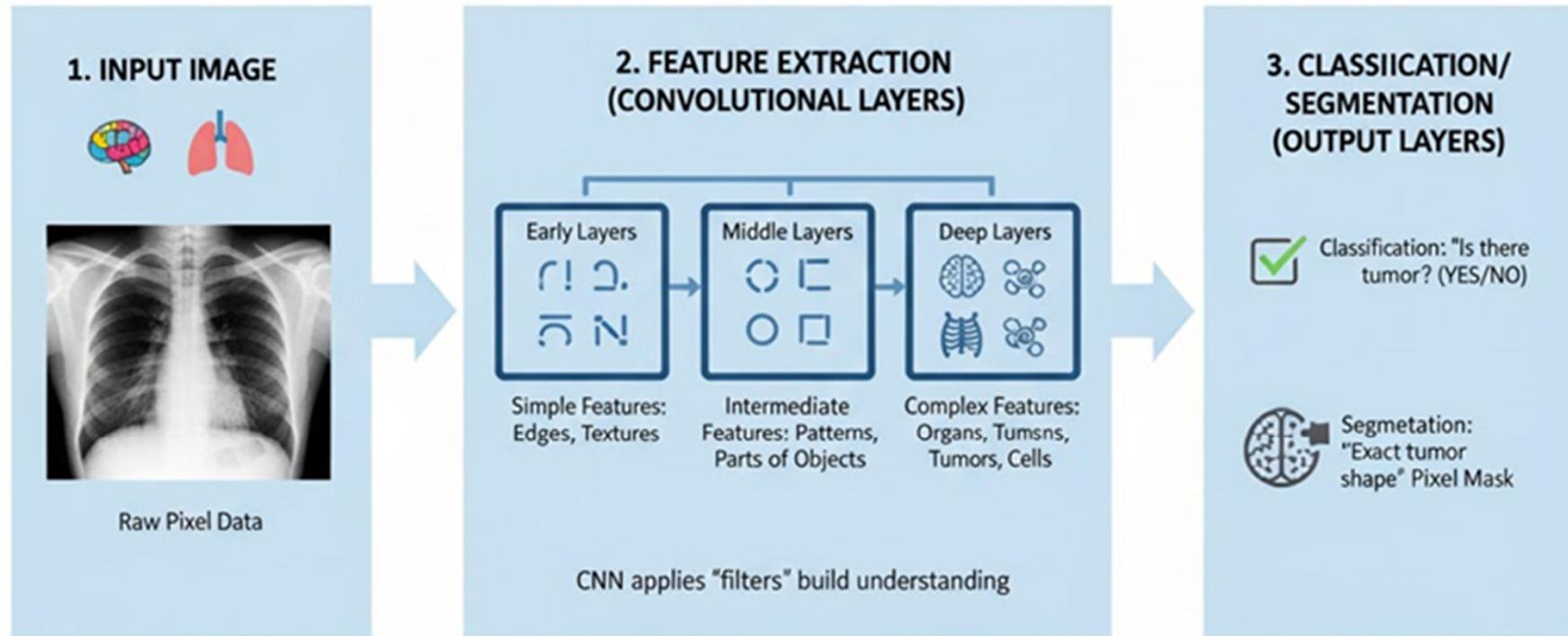


Detection vs.  
Segmentation

Example: Draw a box around the lung nodule.

Example: Trace the exact border of an brain tumor?

# The Engine: Convolutional Neural Networks (CNNs)



*From raw pixels to intelligent medical insights*

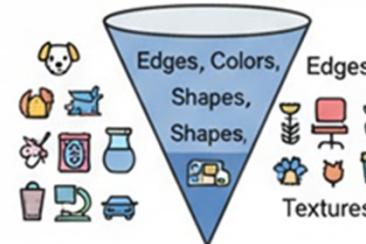
# The Smart Shortcut: Transfer Learning

**TRANSFER LEARNING:  
ACCELERATING MEDICAL AI**



## 1. General Feature Extraction

Pre-trained CNN  
Millions of General  
Photos (e.  
(e.g. ImageNet)



Learns basic visual  
intelligence from the world.

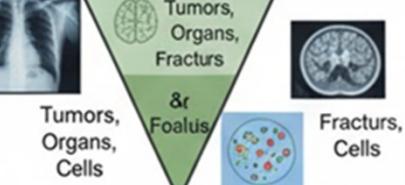
**FINE-TUNING**



## 2. Specialized Medical Task

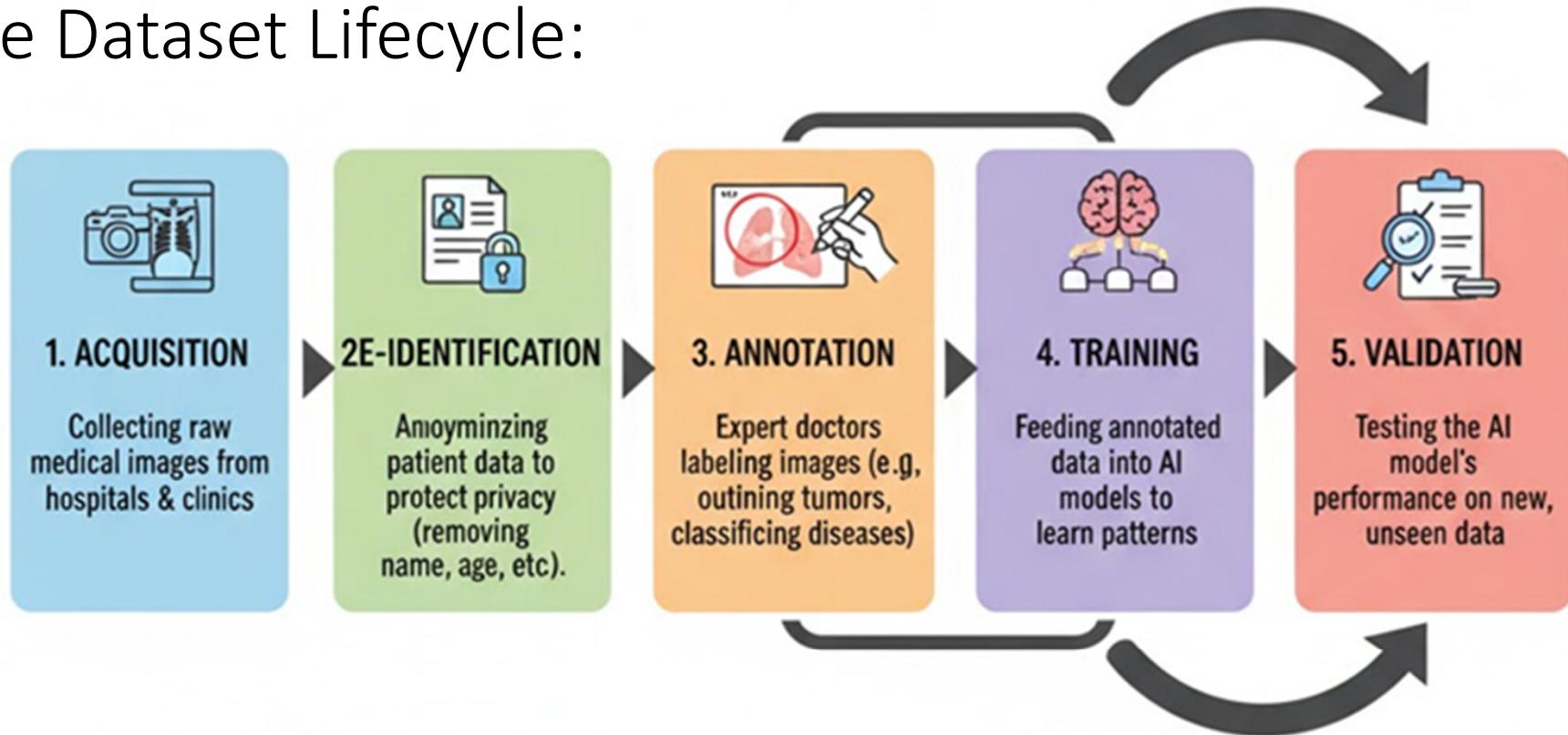


Same CNN  
Specialized  
Medical  
Dataset



Adapts knowledge to  
complex medical patterns

# The Dataset Lifecycle:



A continuous cycle of refinement for accurate & ethical AI

# Key Challenges & What you MUST Know:

## BUILDING ROBUST MEDICAL AI

### 1 PRIVACY & ETHICS



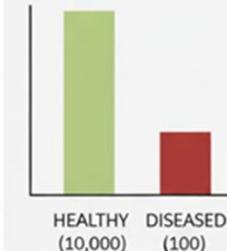
Anonymizing patient data (e.g., stripping info from DICOM files) is to comply with regulations like HIPA.

### 2 ANNOTATION: THE BOTOLTECK



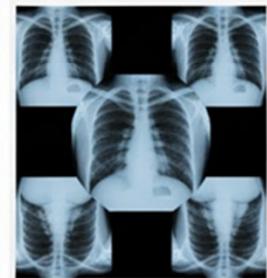
**PROBLEM:**  
Expert doctors must manually label data. This is SLOW, EXPENSIVE. &  
**RESULT:** Smaller medical datasets.

### 3 CLASS IMBALANCE



AI will be biased towards the majority class if not handled. It will just guess "healthy"

### 4 THSOUTON: DATA AUGMENTATION

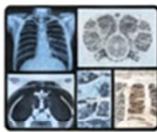


Artificially create more data by transforming existing images (rotate, flip, zoom, brightness). Makes the model more ROBUST.

Building reliable medical AI requires overcoming these critical hurdles through careful data management & smart techniques.

# Where to Find Data (Public Datasets):

**1. The Cancer Imaging Archive (TCIA)**



A large collection of cancer medical images (CT, MRI, X-ray) for public download. Focuses on oncology research.

[cancer.gov/tcia](https://cancer.gov/tcia)

**2. NIH Chest X-ray Dataset**



Over 100,000 chest Xrays with disease labels like pneumonia, used for classification tasks.

[nih.gov/chest-xray](https://nih.gov/chest-xray)

**3. BraTS (Brain Tumor Segmentation)**



A challenging dataset of multi-modal brain MRIs for tumor segmentation. Used in an annual competition.

[miccai.org/brats](https://miccai.org/brats)

**4. Grand Challenge Platform**



A platform hosting numerous medical AI challenges & datasets across various domains. Great for benchmarking!

[grand-challenge.org](https://grand-challenge.org)

Start your medical AI journey with these valuable open-access resources.



# Questions?