# LUNG CANCER CLASSIFICATION USING DEEP LEARNING

PRESENTATION BY

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# AGENDA

Problem statement

Why lung cancer?

Cure for cancer

Dataset CT scans of lungs

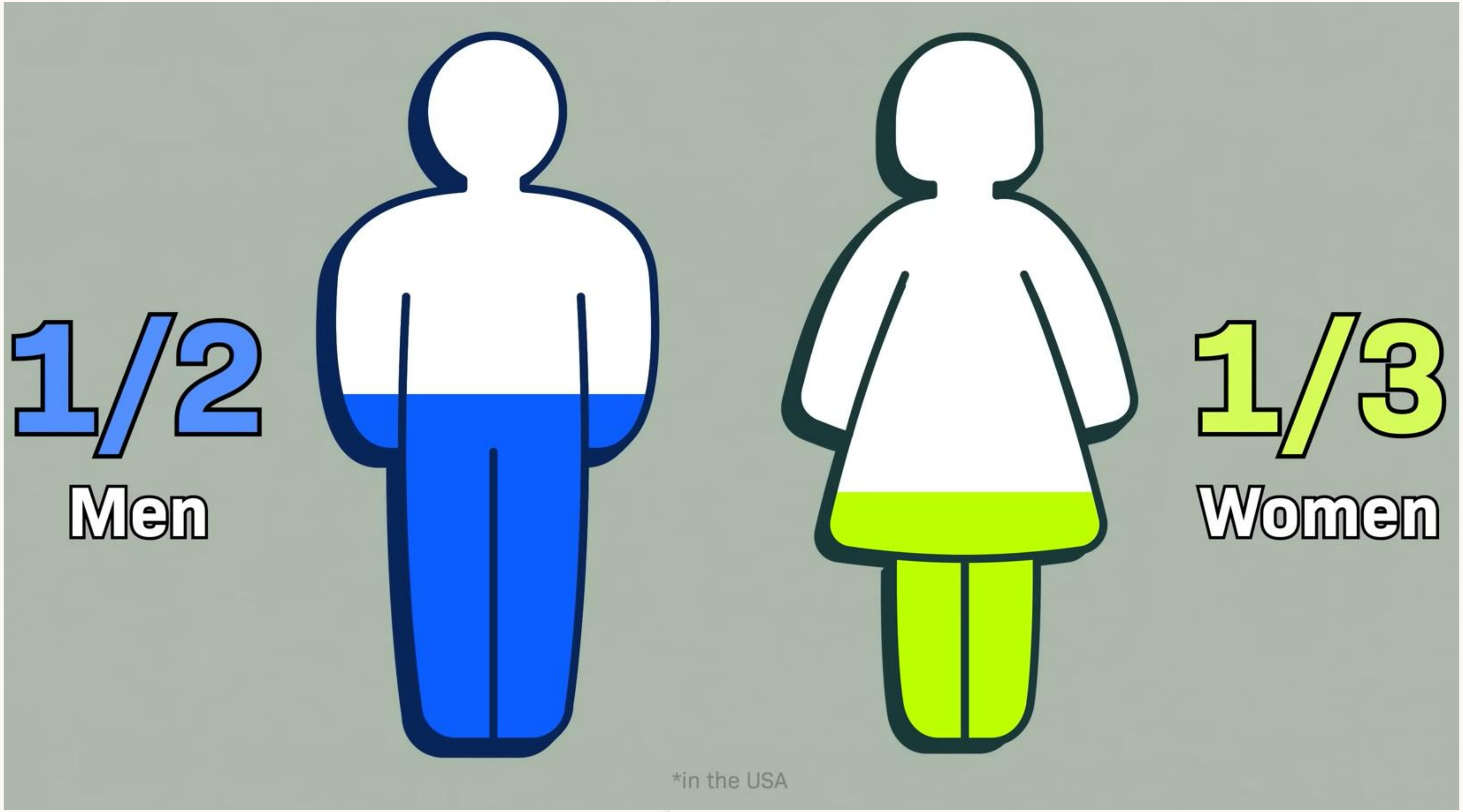
Why this Dataset?

Deep learning model

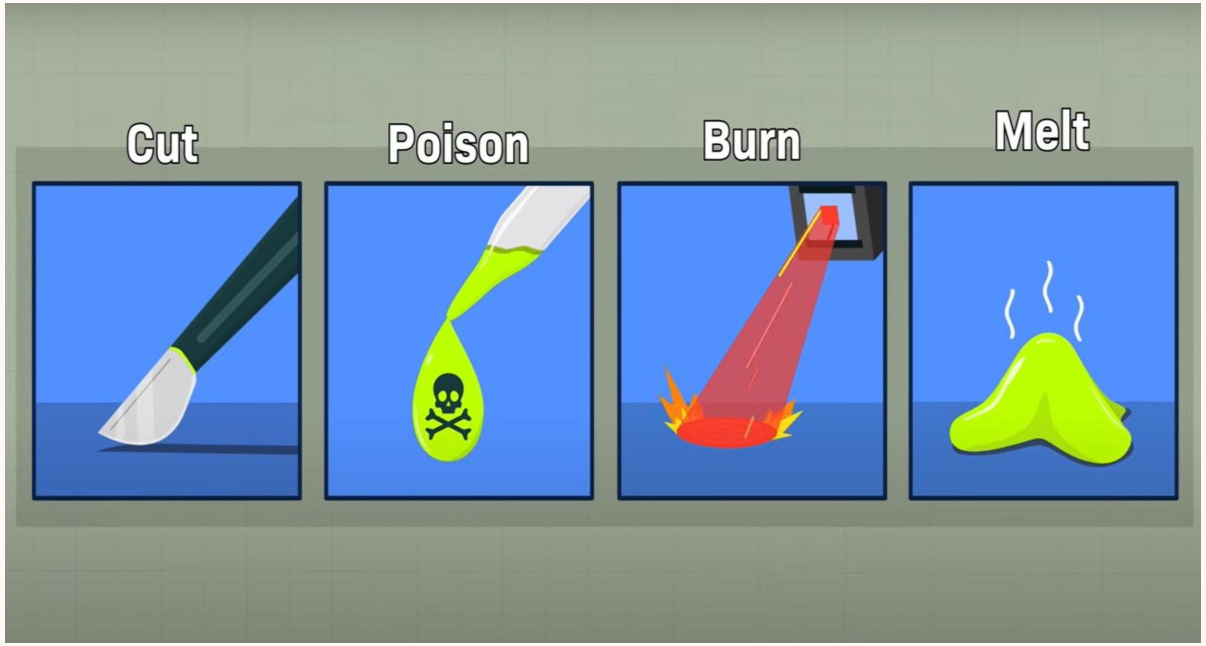
# PROBLEM STATEMENT

**Lung Cancer Classification using Chest CT-Scan images.**

The goal of this project is to develop a deep learning model that can accurately classify chest CT-Scan images into different categories representing lung cancer types (adenocarcinoma, large cell carcinoma, squamous cell carcinoma) or normal CT-Scan images. Early and accurate detection of lung cancer can significantly improve patient outcomes and guide appropriate treatment strategies.


1/2
Men
1/3
Women
*in the USA

# 4 WAYS TO CURE



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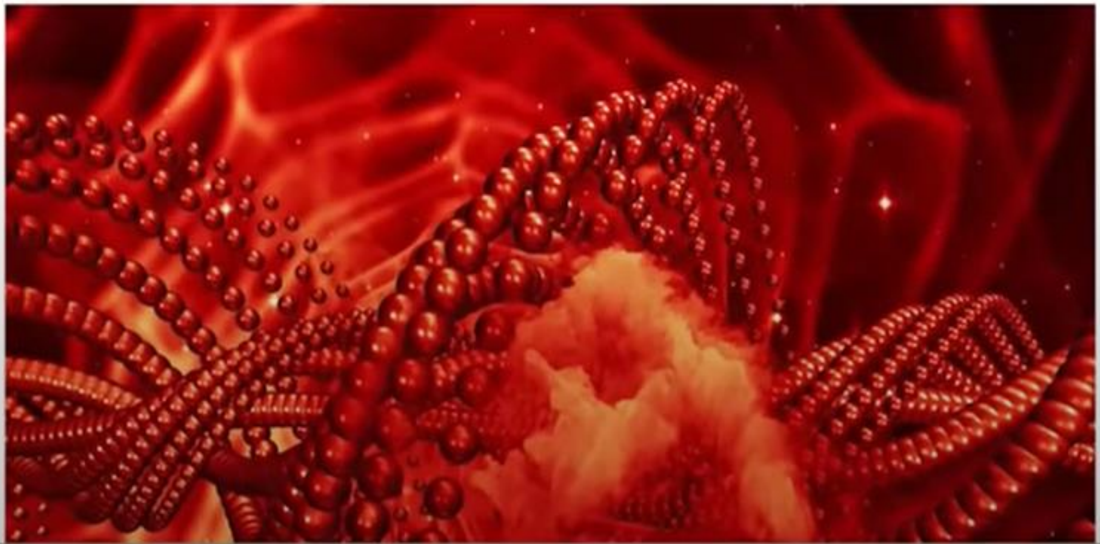

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Drug TARGET REVIEW

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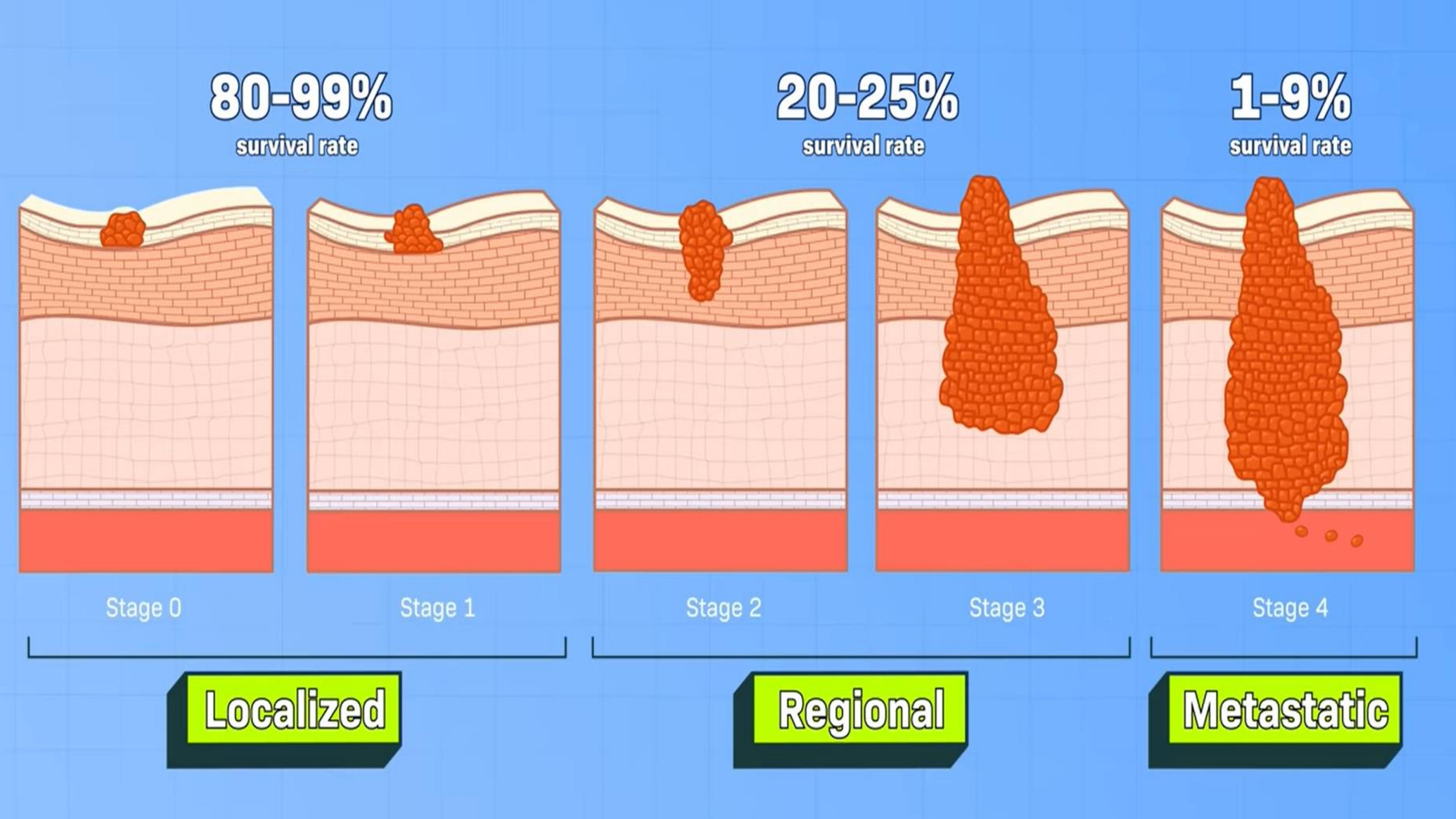
ARTICLE

# Ovarian cancer breakthrough: the potential of rhenium tricarbonyl (TRIP) as a promising anti-tumour drug

In this exclusive article, *Drug Target Review*'s Izzy Wood highlights ground-breaking ovarian cancer research, after speaking with Dr Benjamin Neuditschko, from the Institute Krems Bioanalytics at IMC Krems.

**TECHNOLOGICALLY THERE IS A HUGE BREAKTHROUGH AND IT'S HAPPENING EVERY YEAR IN ALL KINDS OF DIFFERENT CANCERS. BUT HERE'S WHAT'S NOT HAPPENING: WE'RE NOT DETECTING PEOPLE EARLY.**


80-99%
survival rate
20-25%
survival rate
1-9%
survival rate
Stage 0
Stage 1
Stage 2
Stage 3
Stage 4
Localized
Regional
Metastatic

JUST LOOK AT HOW SURVIVAL RATES DROP ACROSS THE SAME KIND OF CANCER IF YOU DISCOVER IT LATER. BASICALLY YOU CAN HAVE THE SAME KIND OF CANCER AND HAVE THESE COMPLETELY DIFFERENT OUTCOMES - AND TREATMENTS.

IF YOU DETECT CANCER EARLY, YOU CAN DO SURGERY AND MOST OF THE TIME YOU'RE DONE. IF YOU DETECT CANCER LATE, YOU CAN YOU NEED TO DO SURGERY, RADIOTHERAPY, CHEMOTHERAPY, AND THE FIVE-YEAR SURVIVAL RATES DECREASE SIGNIFICANTLY.

## Table 8. Five-year Relative Survival Rates* (%) by Stage at Diagnosis, US, 2012-2018

| | All stages | Local | Regional | Distant |
|---|---|---|---|---|
| Breast (female) | 91 | 99% | 86 | 30% |
| Colon & rectum† | 65 | 91 | 73 | 14 |
| Colon | 63 | 91 | 72 | 13 |
| Rectum | 68 | 90 | | 17 |
| Esophagus | 21 | 47 | 26 | 6 |
| Kidney & renal pelvis | 77 | 93 | 72 | 15 |
| Larynx | 61 | 78 | 46 | 34 |
| Liver‡ | 21 | 36 | 13 | 3 |
| Lung & bronchus | 23 | 61 | 34 | 7 |
| Melanoma of the skin | 94 | >99 | 71 | 32 |

| | All stages | Local | Regional | Distant |
|---|---|---|---|---|
| Non-Hodgkin lymphoma | 74 | 86% | 77 | 67% |
| Oral cavity & pharynx | 68 | 86 | 69 | 40 |
| Ovary | 50 | 93 | 74 | 31 |
| Pancreas | 12 | 44 | | 3 |
| Prostate | 97 | >99 | >99 | 32 |
| Stomach | 33 | 72 | 33 | 6 |
| Thyroid | 98 | >99 | 98 | 53 |
| Urinary bladder§ | 77 | 70 | 39 | 8 |
| Uterine cervix | 67 | 92 | 59 | 17 |
| Uterine corpus | 81 | 95 | 70 | 18 |

*Rates are adjusted for normal life expectancy and are based on cases diagnosed in the SEER 17 areas from 2012-2018, all followed through 2019. Rates by stage reflect Combined Summary Stage (2004+). †Excludes appendix. ‡Includes intrahepatic bile duct. §Rate for in situ cases is 96%.

**Local:** an invasive malignant cancer confined entirely to the organ of origin. **Regional:** a malignant cancer that 1) has extended beyond the limits of the organ of origin directly into surrounding organs or tissues; 2) involves regional lymph nodes; or 3) has both regional extension and involvement of regional lymph nodes. **Distant:** a malignant cancer that has spread to parts of the body remote from the primary tumor either by direct extension or by discontinuous metastasis to distant organs, tissues, or via the lymphatic system to distant lymph nodes.

**Source:** SEER*Explorer, National Cancer Institute, 2022. Available from https://seer.cancer.gov/explorer/. Colon & rectal cancer – SEER*Stat software (version 8.4.0.1), National Cancer Institute, 2022.

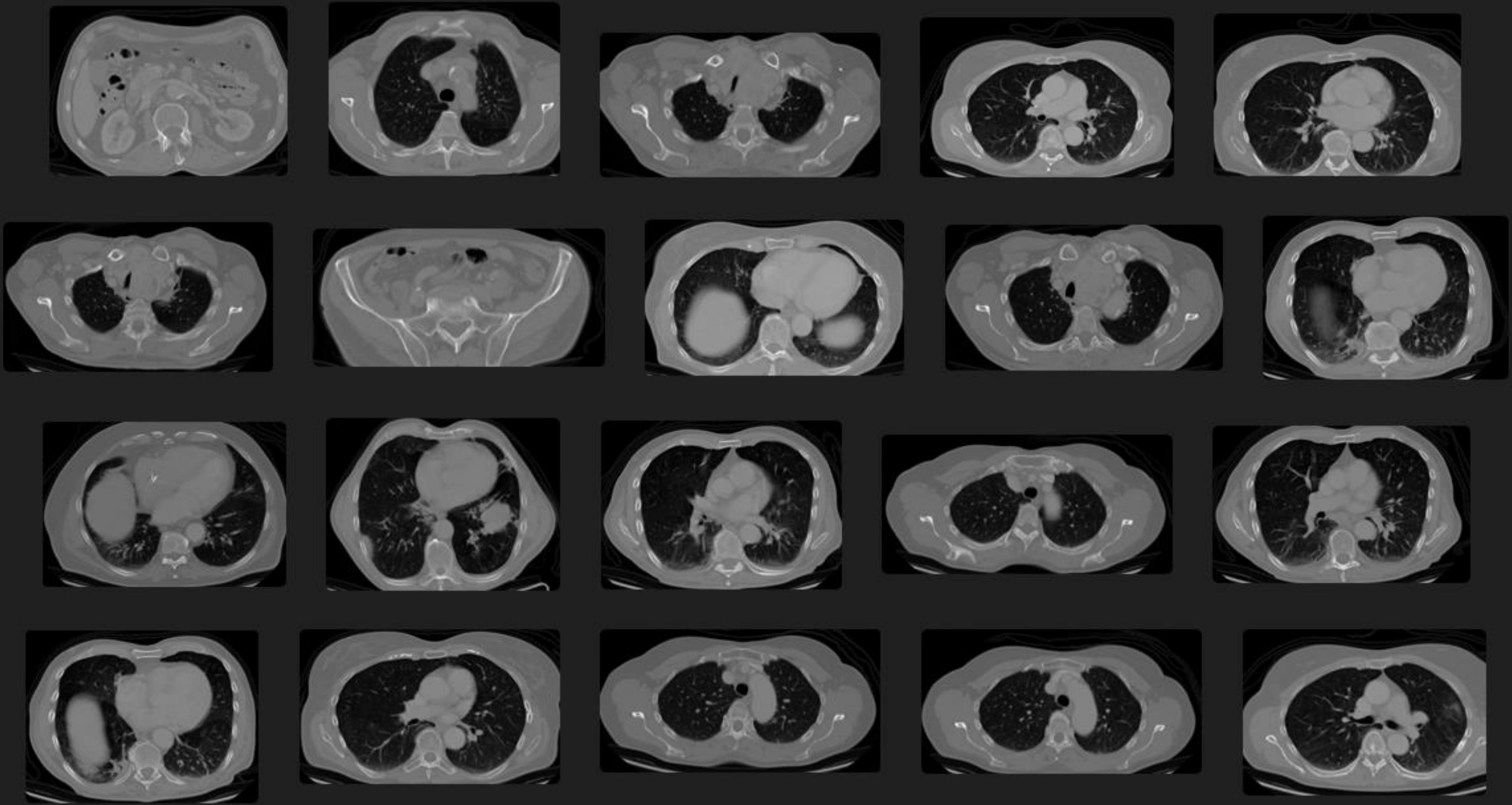
I STRONGLY BELIEVE WE HAVE A CURE FOR CANCER. IT'S EARLY DETECTION.

# DATASET NEEDED

A dataset of chest CT-Scan images with corresponding labels indicating the presence of different lung cancer types (adenocarcinoma,large cell carcinoma,squamous cell carcinoma) or normal CT-Scan images is required for training and evaluating the deep learning model. The dataset should include a diverse range of high-resolution chest X-ray images, adequately representing each class and encompassing variations in patient demographics, imaging techniques, and disease stages.

**The dataset should be divided into the following folders:**

- **Train: This folder contains the training images, including the subfolders for each class (adenocarcinoma, large cell carcinoma, squamous cell carcinoma, normal).**
- **Test: This folder contains the testing images, allowing the evaluation of the trained model's performance on unseen data.**
- **Valid: This folder contains the validating images, serving as a separate dataset for validating the model's performance during training and tuning hyperparameters.**



# WHY THIS DATASET?

1. REPRESENTATION: THE DATASET COVERS DIVERSE LUNG CANCER TYPES, ENABLING THE MODEL TO LEARN DISTINCTIVE FEATURES AND DIFFERENTIATE BETWEEN THEM DURING DETECTION.
2. BASELINE COMPARISON: INCLUDING NORMAL CT-SCAN IMAGES ALLOWS THE MODEL TO UNDERSTAND HEALTHY LUNG CHARACTERISTICS AND DIFFERENTIATE BETWEEN CANCEROUS AND NON-CANCEROUS PATTERNS.
3. REALISM: THE DATASET REFLECTS REAL-WORLD SCENARIOS ENCOUNTERED BY MEDICAL PROFESSIONALS, IMPROVING THE MODEL'S ABILITY TO GENERALIZE TO UNSEEN DATA.
4. DIAGNOSTIC RELEVANCE: TRAINING ON A DATASET ALIGNED WITH COMMON DIAGNOSTIC MODALITIES ENHANCES THE MODEL'S IDENTIFICATION OF RELEVANT LUNG CANCER FEATURES.
5. GENERALIZABILITY: A WELL-TRAINED MODEL ON THIS DATASET CAN AUTOMATE THE DETECTION AND CLASSIFICATION OF LUNG CANCER TYPES IN REAL-WORLD SETTINGS, AIDING MEDICAL PROFESSIONALS IN DECISION-MAKING.

# DEEP LEARNING MODEL

TO ADDRESS THIS PROBLEM, A DEEP LEARNING MODEL BASED ON CONVOLUTIONAL NEURAL NETWORKS (CNNS) SHOULD BE EMPLOYED. THE FOLLOWING STEPS OUTLINE THE PROCESS FOR BUILDING AND TRAINING THE MODEL:

- MODEL ARCHITECTURE: SELECTING A SUITABLE CNN ARCHITECTURE SUCH AS RESNET, DENSENET, INCEPTION, OR EFFICIENTNET. THE CHOSEN MODEL SHOULD BE CAPABLE OF LEARNING AND EXTRACTING RELEVANT FEATURES FROM THE CHEST X-RAY IMAGES.

- DATA PREPROCESSING: PREPROCESS THE INPUT IMAGES BY RESIZING THEM TO A CONSISTENT SIZE, NORMALIZING PIXEL VALUES, AND CONVERTING THEM TO A SUITABLE FORMAT (E.G., RGB OR GRAYSCALE) BASED ON THE MODEL'S REQUIREMENTS.

# DEEP LEARNING MODEL

- MODEL TRAINING: SPLIT THE TRAINING DATASET INTO BATCHES AND FEED THEM INTO THE MODEL FOR TRAINING. UTILIZE APPROPRIATE OPTIMIZATION ALGORITHMS (E.G., ADAM, RMSPROP) AND LOSS FUNCTIONS (E.G., CATEGORICAL CROSS-ENTROPY) DURING THE TRAINING PROCESS. MONITOR THE MODEL'S PERFORMANCE USING VALIDATION DATA AND FINE-TUNE THE HYPERPARAMETERS AS NEEDED.

- MODEL EVALUATION: ASSESS THE TRAINED MODEL'S PERFORMANCE ON THE TESTING DATASET BY MAKING PREDICTIONS ON THE UNSEEN CHEST X-RAY IMAGES. CALCULATE EVALUATION METRICS SUCH AS ACCURACY, PRECISION, RECALL, AND F1-SCORE TO MEASURE THE MODEL'S EFFECTIVENESS IN CLASSIFYING LUNG CANCER TYPES.

# CONCLUSION

IT IS CRUCIAL TO FOLLOW GOOD PRACTICES FOR DATASET SPLITTING, HANDLE CLASS IMBALANCES IF PRESENT, AND PERFORM PROPER MODEL VALIDATION TO ENSURE THE MODEL'S RELIABILITY AND GENERALIZABILITY. REGULAR MONITORING AND ITERATION MAY BE REQUIRED TO ACHIEVE OPTIMAL RESULTS.

BY DEVELOPING AN ACCURATE DEEP LEARNING MODEL FOR LUNG CANCER CLASSIFICATION USING CHEST CT-SCAN IMAGES, THIS PROJECT AIMS TO PROVIDE A VALUABLE TOOL FOR ASSISTING MEDICAL PROFESSIONALS IN THE EARLY DETECTION AND DIAGNOSIS OF DIFFERENT LUNG CANCER TYPES, THEREBY FACILITATING TIMELY INTERVENTIONS AND IMPROVING PATIENT OUTCOMES.

# THANK YOU

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