AI-POWERED LUNG CANCER SCREENING

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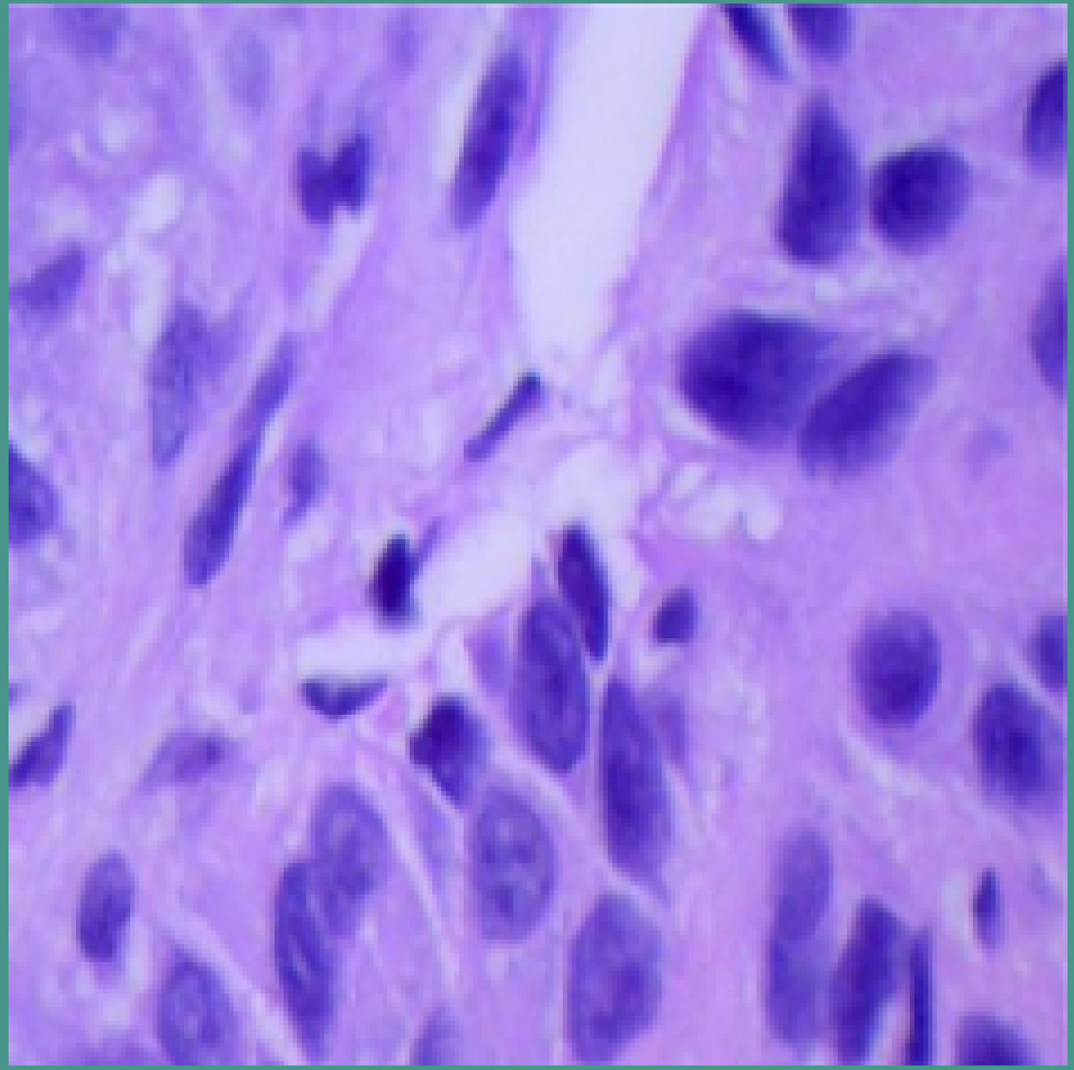
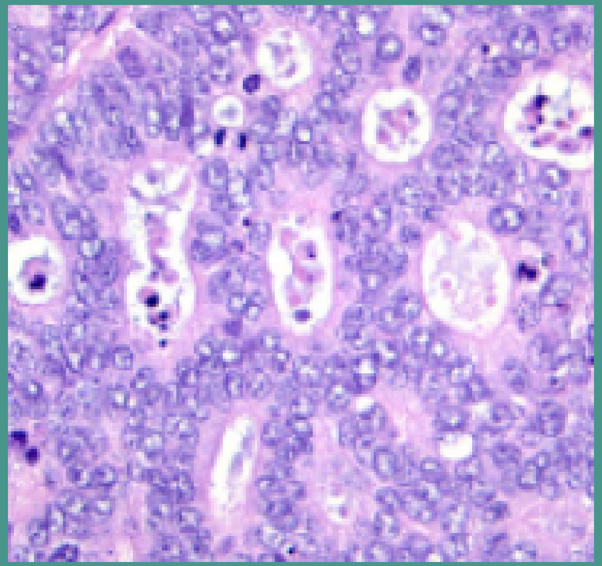
INTRODUCTION

Lung cancer is a major worldwide health threat, accounting for one of the main causes of cancer-related death. The stage at which the cancer is identified is a crucial factor influencing patient survival. Hence, early identification is a challenge as it broadens therapy choices and improves patient outcomes.



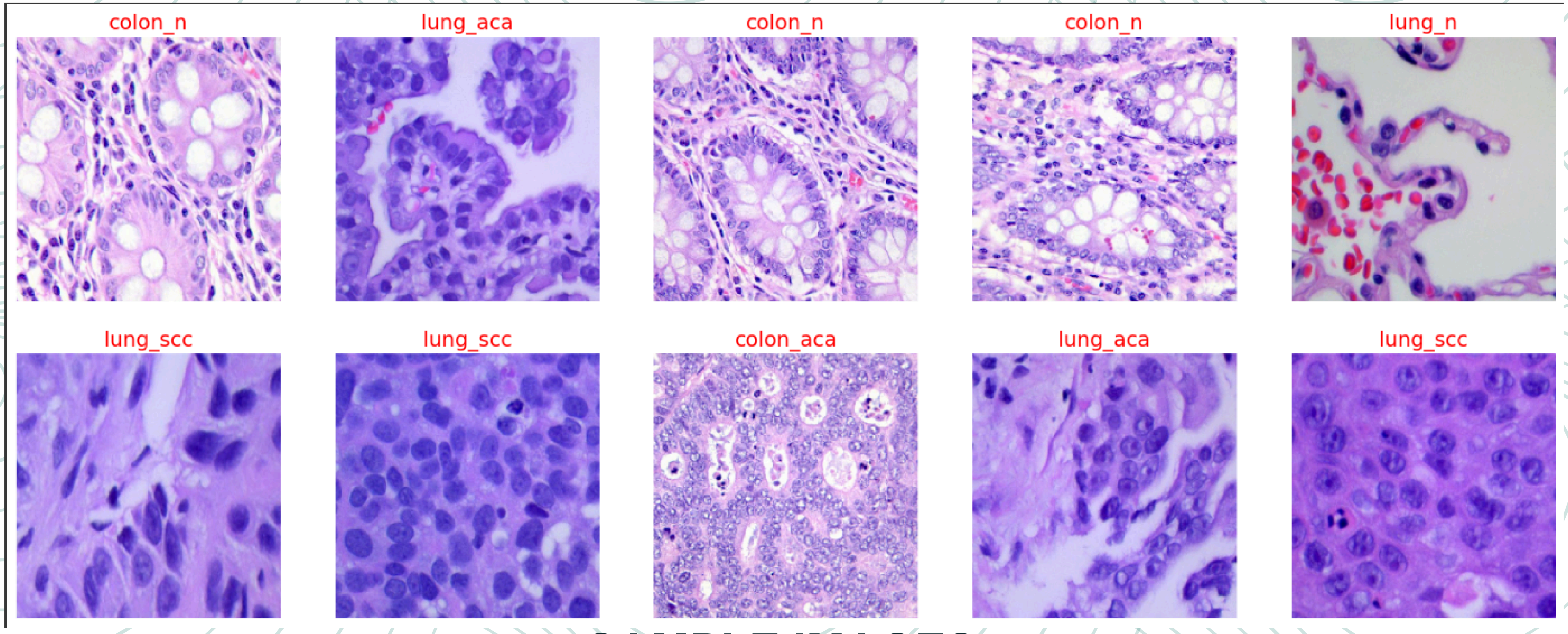


PROOF OF CONCEPT

This project demonstrates the viability of using sophisticated computer vision algorithms for histopathology image categorization in the medical area. The project is divided into two parts: a merger of the Xception and MobileNet architectures, and a Vision Transformer (ViT) model. Leveraging a diverse dataset of medical images, the hybrid model exhibits robust performance in accurately detecting lung cancer. By combining the feature extraction capabilities of Xception and MobileNet, the model captures intricate patterns and efficiently represents both complex and lightweight features. The implementation of a dynamic learning rate strategy further optimizes the training process. Comparative analysis against a ViT-based model provides insights into the strengths and trade-offs of each approach. These results underscore the potential of our hybrid model and ViT model as an advanced tool for precise and efficient lung cancer detection, laying the groundwork for further refinement and real-world deployment in medical industry.

DATASET DESCRIPTION

The dataset contains 25,000 histopathological images with 5 classes. All images are 768 x 768 pixels in size and are in jpeg file format. The images were generated from an original sample of HIPAA compliant and validated sources, consisting of 750 total images of lung tissue (250 benign lung tissue, 250 lung adenocarcinomas, and 250 lung squamous cell carcinomas.



SAMPLE IMAGES

DESCRIPTION OF CLASSES IN DATASET

Lung adenocarcinoma:

This class represents histopathological images of lung tissue affected by adenocarcinoma. Adenocarcinoma is a type of cancer that originates in the glandular cells lining the lung's airways. It is a common type of non-small cell lung cancer.

Lung squamous cell carcinoma:

This class represents histopathological images of lung tissue affected by squamous cell carcinoma. Squamous cell carcinoma is another type of non-small cell lung cancer that begins in the flat cells lining the airways.

Lung benign tissue:

This class represents histopathological images of benign (non-cancerous) lung tissue. Benign tissue refers to cells that do not exhibit characteristics of cancer and are not harmful.

Colon adenocarcinoma:

This class represents histopathological images of colon tissue affected by adenocarcinoma. Adenocarcinoma in the colon refers to cancer originating in the glandular cells lining the inner surface of the colon.

Colon benign tissue:

This class likely represents histopathological images of benign (non-cancerous) colon tissue. Similar to the "Lung benign tissue" class, this refers to cells in the colon that do not exhibit characteristics of cancer.

METHODOLOGY

1. ***XCEPTION+MOBILENET:*** A hybrid model combining the Xception and MobileNet architectures was employed for image classification. This model use the depth wise distinct convolutional layers from MobileNet for productivity and the component extraction force of Xception.
2. ***VISION TRANSFORMER:*** For the purpose of image classification, the Vision Transformer (ViT) model was utilized. ViT replaces conventional convolutional layers with self-consideration components, permitting the model to catch long-range conditions in the pictures.

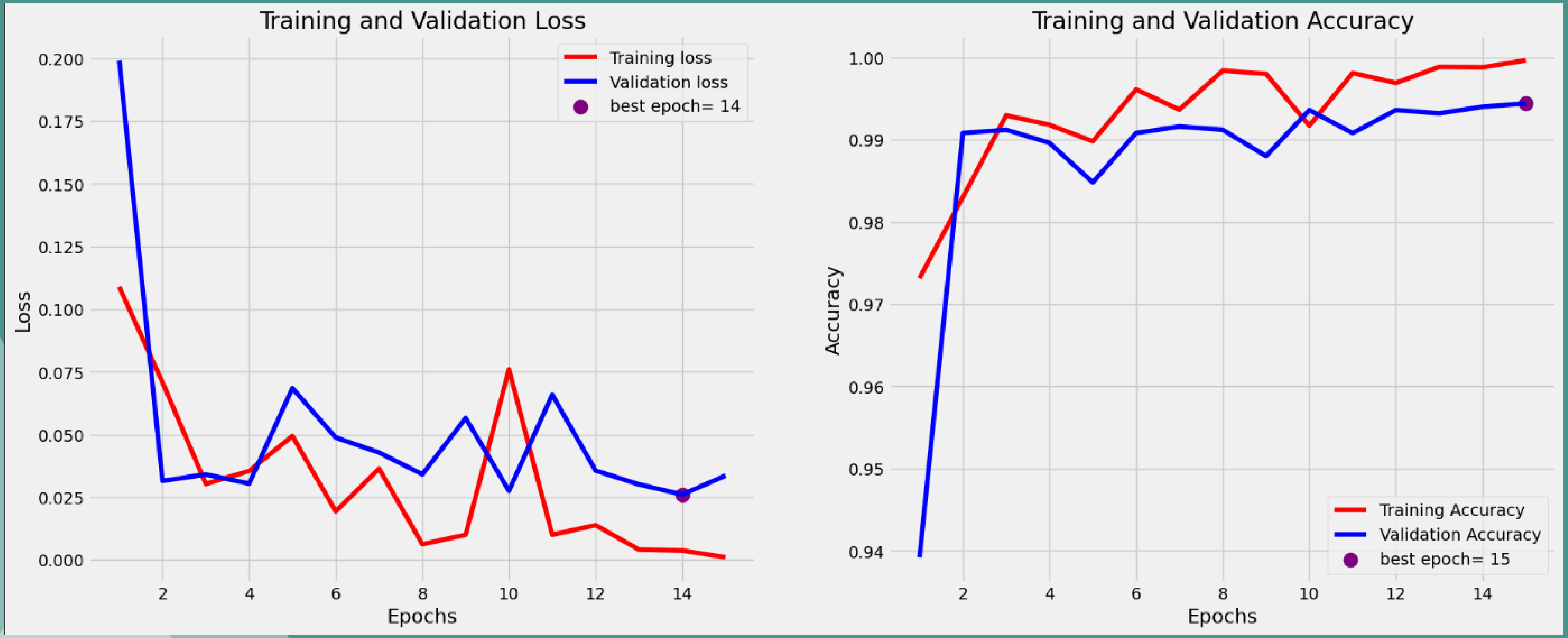
TRAINING PARAMETERS FOR CNN & ViT

The Adam optimizer and a categorical cross-entropy loss function were used to train the model. In order to improve training efficiency, learning rate schedules and early stopping were implemented.

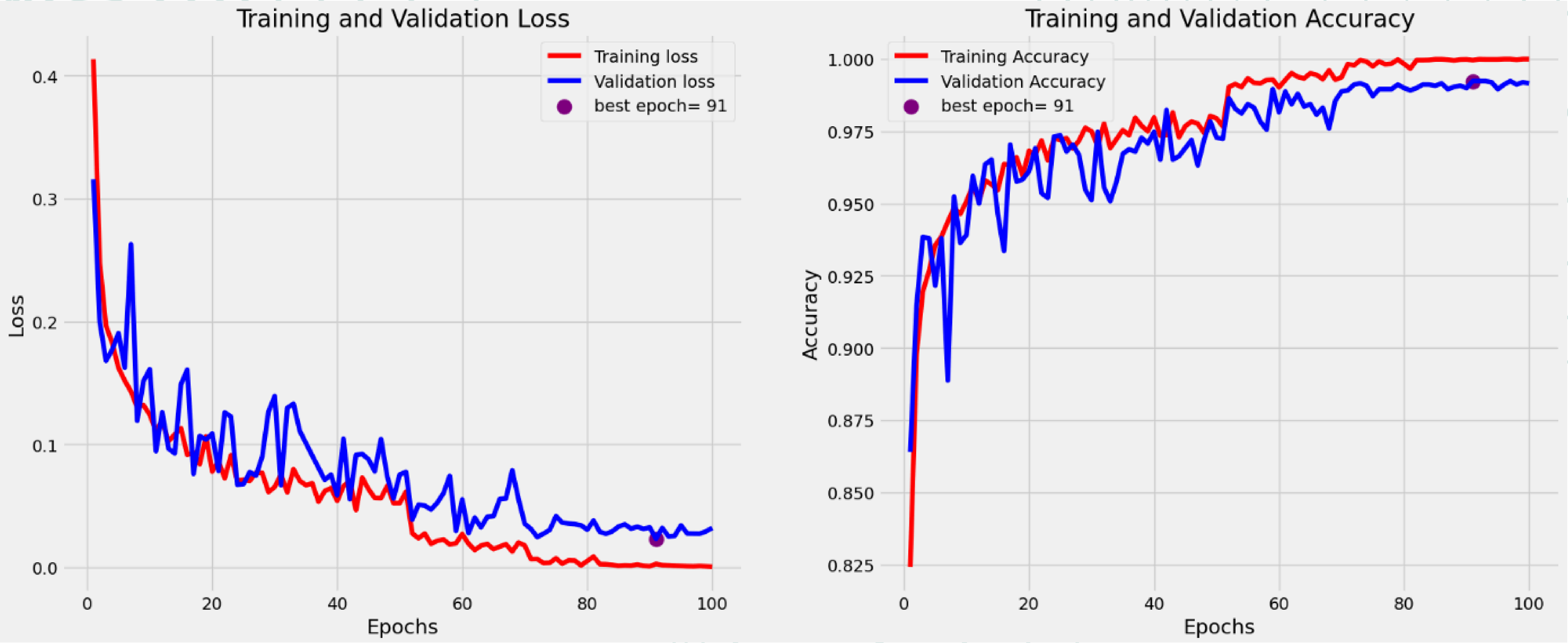
LEARNING RATE ADJUSTMENT

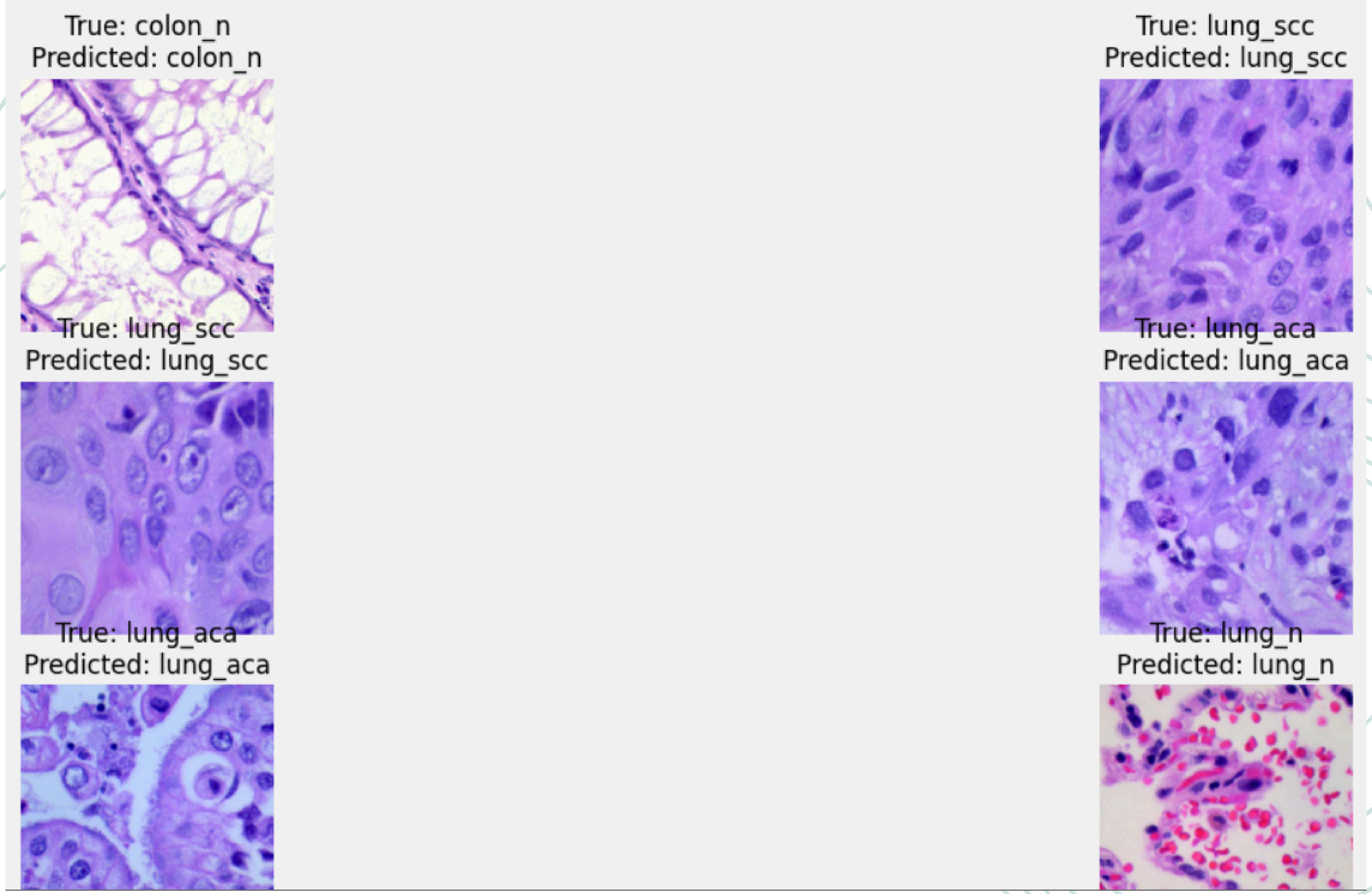
In order to adjust the learning rate in response to the training and validation data, a specialized learning rate function was implemented.

TRAINING & VALIDATION GRAPH FOR XCEPTION+MOBILENET



TRAINING & VALIDATION GRAPH FOR VISION TRANSFORMER





RESULTS OF XCEPTION+MOBILENET

RESULTS OF VISION TRANSFORMER

INDUSTRY USE

1. **Increase in Screening Programs:** Governments and healthcare organizations may implement lung cancer screening programs, especially for high-risk populations, using these detection systems. This would boost the adoption of such technologies and create a steady demand.
2. **Personalized Medicine:** The trend toward personalized medicine, where treatment is tailored to an individual's genetic and molecular profile, will drive the demand for advanced detection systems that can provide detailed information about a patient's tumor. This can lead to higher-value services and products.
3. **Patient Demand:** As patients become more educated about lung cancer and proactive about their health, there may be increasing demand for access to advanced detection technologies, leading to market growth.

CONCLUSION

In conclusion, the hybrid Xception + MobileNet and Vision Transformer (ViT) models had varying degrees of success in classifying histopathological images due to to a specialized learning rate adjustment function. The near examination gives important bits of knowledge to utilizing progressed designs in clinical picture order, establishing the groundwork for future refinements and headways in symptomatic applications.