Dissertation submitted in partial fulfilment of requirements for the award of the Masters Of Business Administration

TITLE OF THE PROJECT

DEEP LEARNING, MACHINE LEARNING, AI FOR PREDICTIVE MODELLING, PREDICTION AND DETECTION OF LUNG DISEASE OR PULMONARY DISEASE

BY

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ROLL NUMBER- 20212MBA0429

Under the guidance of-

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DECLARATION BY THE STUDENT

I hereby declare that "DEEP LEARNING, MACHINE LEARNING, AI FOR PREDICTIVE MODELLING, PREDICTION AND DETECTION OF LUNG DISEASE OR PULMONARY DISEASE" is the result of the project work carried out by me under the guidance of Dr. R Muruganandham associate professor in School of management Master's Degree in Business Administration Presidency University.

I also declare that this project is the outcome of my own efforts and that it has not been submitted to any other university or Institute for the award of any other degree or Diploma or Certificate.

Name- ASHISH KUMAR

ROLL NO.- 20212MBA0429

DATE- 25/05/2023

PLACE- BANGALORE

CERTIFICATE BY THE GUIDE

Date: 25/05/2023

This is to certify that the dissertation "DEEP LEARNING, MACHINE LEARNING, AI FOR PREDICTIVE MODELLING, PREDICTION AND DETECTION OF LUNG DISEASE OR PULMONARY DISEASE" is an original work of Mr./Ms. ASHISH KUMAR is bearing University Register Number 20212MBA0429 and is being submitted in partial fulfilment for the award of the Master's Degree in Business Administration of Presidency University. The report has not been submitted earlier either to this university/ Institution for the fulfilment of the requirement of the course of the study Mr./Ms. ASHISH KUMAR is guided by Mr./Ms/Dr. R Muruganandham associate professor who is the faulty guide as per the regulations of Presidency University.

Signature of the Guide　　　　　　Signature of HOD

Date- 25/05/2023

ACKNOWLEDGEMENT

I Would like to express my sincere gratitude to my Faculty Guide Prof. Dr. R Muruganandam, for providing me with guidance, support, and feedback throughout this dissertation process. His experience, guidance, and motivation have been extremely valuable to me. Thank you for your time and insights in this dissertation.

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making this dissertation report a success.

ABSTRACT

The field of healthcare has witnessed significant advancements in recent years with the integration of machine learning and artificial intelligence (AI) techniques. These technologies have proven to be valuable in predictive modeling, prediction, and detection of lung diseases and pulmonary disorders. This abstract explores the application of machine learning and AI in these areas.

The utilization of machine learning algorithms and AI in predictive modeling enables healthcare professionals to develop models that can analyze large datasets and identify patterns or trends associated with lung diseases and pulmonary disorders. By leveraging historical data, these models can accurately predict disease progression, exacerbation events, and even mortality risk in patients with chronic lung conditions such as chronic obstructive pulmonary disease (COPD) or pulmonary fibrosis. The predictive capabilities of these models facilitate personalized healthcare interventions and timely treatment decisions, ultimately improving patient outcomes.

In addition to predictive modeling, machine learning and AI techniques play a crucial role in disease detection. By leveraging various imaging modalities like computed tomography (CT) scans or chest X-rays, deep learning algorithms can analyze medical images to identify abnormalities, lesions, or nodules associated with lung diseases, including lung cancer. These automated detection systems assist radiologists and physicians in making accurate and timely diagnoses, leading to early interventions and improved patient prognosis.

Furthermore, the integration of AI in pulmonary medicine enables the development of intelligent decision support systems. These systems can assist healthcare providers in diagnosing and managing lung diseases by considering various factors such as patient symptoms, medical history, and laboratory results. By providing evidence-based recommendations, AI-powered decision support systems enhance clinical decision-making, improve treatment planning, and optimize patient care.

In conclusion, machine learning and AI have revolutionized the field of predictive modeling, prediction, and detection in lung diseases and pulmonary disorders. By harnessing the power of these technologies, healthcare professionals can develop accurate predictive models, facilitate early disease detection, and improve clinical decision-making in the management of lung diseases. The integration of machine learning and AI in pulmonary medicine holds great promise for enhancing patient outcomes and advancing the field of respiratory healthcare.

INTRODUCTION

In recent years, the intersection of machine learning, artificial intelligence (AI), and healthcare has paved the way for significant advancements in predictive modeling, prediction, and detection of lung diseases and pulmonary disorders. The ability of machine learning algorithms and AI systems to analyze complex data sets and extract meaningful insights has revolutionized the field of respiratory healthcare. This introduction provides an overview of the application of machine learning, artificial intelligence, and AI in the context of predictive modeling, prediction, and detection in lung disease and pulmonary disease.

Lung diseases and pulmonary disorders pose significant challenges to healthcare providers worldwide. Conditions such as chronic obstructive pulmonary disease (COPD), pulmonary fibrosis, and lung cancer have a profound impact on patient health and quality of life. Timely and accurate prediction, detection, and monitoring of these diseases are crucial for effective management and improved patient outcomes.

Machine learning, a subfield of AI, offers a powerful set of tools and techniques that enable the development of predictive models capable of analyzing large and diverse data sets. By utilizing historical patient data, including clinical information, medical imaging, and genetic profiles, machine learning algorithms can identify patterns, correlations, and risk factors associated with lung diseases. These predictive models can assist healthcare professionals in estimating disease progression, exacerbation events, or treatment response, providing a basis for personalized healthcare interventions and decision-making.

AI algorithms, particularly deep learning models, have shown remarkable capabilities in the detection of lung diseases. By training on vast amounts of medical imaging data, such as computed tomography (CT) scans and chest X-rays, these algorithms can automatically identify abnormalities, nodules, or lesions indicative of lung diseases, including lung cancer. This automated detection aids radiologists and physicians in making accurate and timely diagnoses, facilitating early interventions and improving patient outcomes.

Moreover, the integration of AI in pulmonary medicine has led to the development of intelligent decision support systems. These systems combine the power of machine learning, clinical knowledge, and patient data to provide evidence-based recommendations for diagnosis, treatment planning, and disease management. By leveraging AI algorithms, healthcare providers can benefit from enhanced decision-making, optimized treatment strategies, and improved patient care.

The application of machine learning, artificial intelligence, and AI in the context of lung disease and pulmonary disease holds immense promise for the field of respiratory healthcare.

Objective of analysis:

- Early detection: Developing models that can accurately identify early signs or patterns of lung disease, enabling timely intervention and treatment.
- Accurate diagnosis: Creating algorithms that can accurately diagnose different types of lung diseases based on medical imaging data, such as chest X-rays or CT scans.
- Disease progression prediction: Building models that can predict the progression of lung diseases over time, helping healthcare professionals anticipate the course of the disease and plan appropriate interventions.
- Personalized treatment: Developing models that can analyze patient data, including medical history, genetic information, and lifestyle factors, to recommend personalized treatment plans for individuals with lung diseases.
- Risk assessment: Creating models that can assess an individual's risk of developing lung diseases based on various factors, such as smoking history, environmental exposure, and genetic predisposition.
- Biomarker discovery: Using AI techniques to analyze large datasets and identify potential biomarkers for specific lung diseases, which can aid in early detection and targeted therapies.

- Prognosis estimation: Building models that can estimate the prognosis of individuals with lung diseases, providing insights into survival rates, disease progression, and potential complications.
- Treatment response prediction: Developing models that can predict how individuals with lung diseases are likely to respond to different treatment options, enabling personalized treatment strategies.

- Decision support system: Creating AI-powered decision support systems that assist healthcare professionals in interpreting complex lung disease data, improving accuracy and efficiency in diagnosis and treatment planning.
- Public health management: Utilizing AI techniques to analyze population-level data and identify trends, patterns, and risk factors associated with lung diseases, aiding in public health planning, resource allocation, and preventive measures.

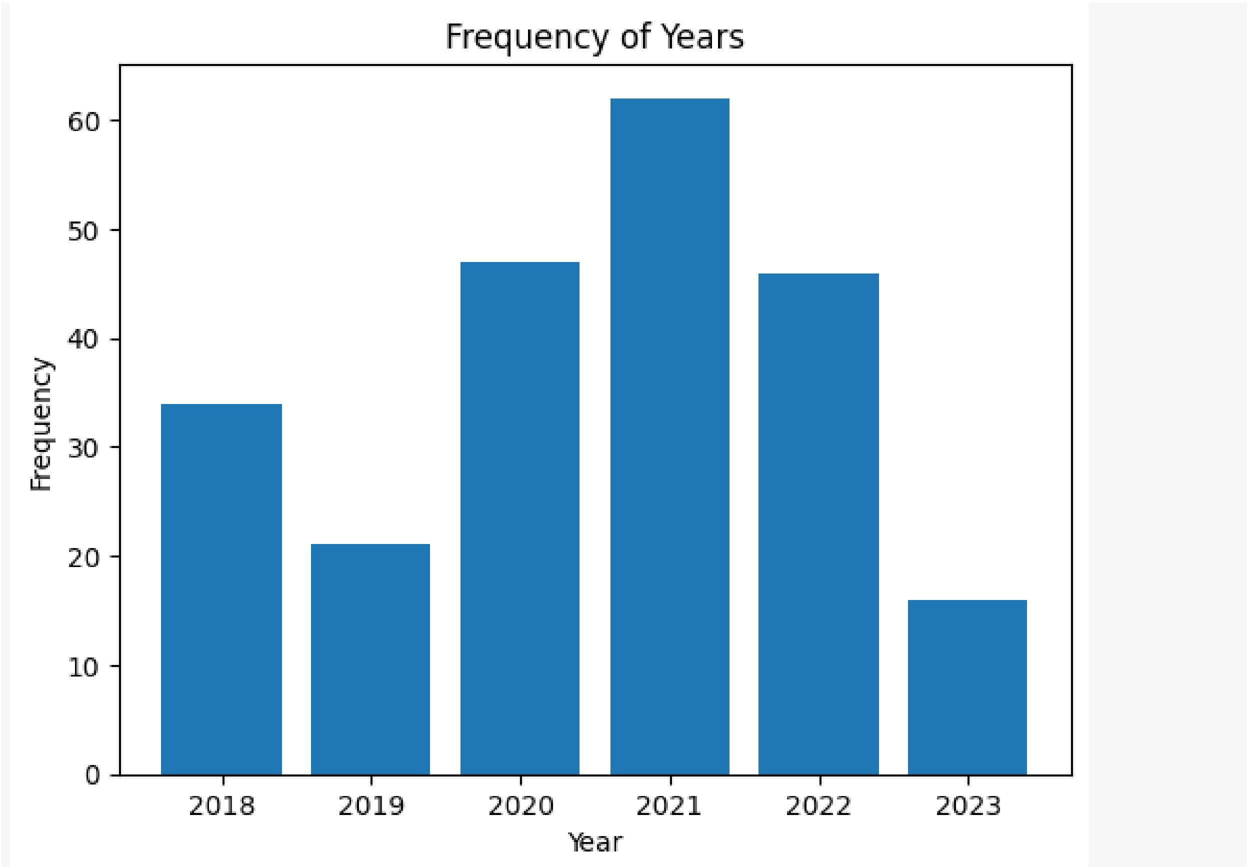
These objectives aim to improve the accuracy, efficiency, and effectiveness of lung disease detection, diagnosis, and treatment, ultimately leading to better patient outcomes and reduced healthcare burdens.

Country wise resrearch articles

Country	No. of Articles
USA	45
India	40
China	33
UK	10
Taiwan	8
Italy	7
South korea	4
Japan	4
Spain	4
France	4
Switzerland	4
Pakistan	3
Canada	3
Bangladesh	3
Singapore	2
Iraq	2
Iran	2
Germany	2
Poland	2
Greece	2
Indonesia	2
Turkey	2
California	2
Mexico	2
Australia	2
Nigeria	2
Brazil	2
Korea	2
Europe	2
Malaysia	2
Jordan	2
Saudi Arabia	1
Egypt	1
New York	1
Norway	1
England	1
Belgium	1
Netherlands	1
Russia	1
Africa	1
Serbia	1
Hong Kong	1
Finland	1
Austria	1
Israel	1
Morocco	1
Benanon	1
Saudi Arabia, India	1
Croatia	1
Ethiopia	1
Thailand	1
Grand Total	**226**

code

```
import matplotlib.pyplot as plt
from collections import Counter

years = [2020, 2022, 2023, 2022, 2022, 2018, 2018, 2022, 2022, 2021, 2021,
2018, 2019, 2020, 2021, 2021, 2020, 2021, 2018, 2021, 2020, 2020, 2019,
2022, 2021, 2021, 2023, 2023, 2021, 2018, 2018, 2023, 2020, 2018, 2020,
2020, 2022, 2022, 2022, 2022, 2022, 2021, 2018, 2021, 2021, 2021, 2022,
2021, 2018, 2022, 2021, 2021, 2022, 2022, 2020, 2018, 2022, 2020, 2021,
2018, 2019, 2020, 2018, 2019, 2020, 2021, 2019, 2020, 2021, 2018, 2020,
2018, 2019, 2019, 2020, 2020, 2022, 2020, 2018, 2021, 2021, 2021, 2019,
2022, 2022, 2022, 2022, 2020, 2022, 2022, 2018, 2021, 2021, 2018, 2019,
2019, 2022, 2020, 2022, 2021, 2019, 2021, 2021, 2023, 2019, 2023, 2023,
2021, 2022, 2018, 2021, 2020, 2021, 2020, 2022, 2018, 2020, 2021, 2019,
2023, 2022, 2020, 2022, 2020, 2021, 2021, 2018, 2021, 2020, 2019, 2020,
2023, 2018, 2022, 2020, 2023, 2019, 2020, 2020, 2018, 2018, 2020, 2018,
2018, 2018, 2021, 2020, 2018, 2020, 2023, 2020, 2021, 2022, 2021, 2020,
2020, 2020, 2019, 2018, 2022, 2020, 2023,2019, 2021, 2022, 2021, 2021,
2018, 2021, 2021, 2019, 2021, 2018, 2021, 2021, 2022, 2019, 2020, 2021,
2020, 2020, 2023, 2022, 2021, 2019, 2021, 2022, 2021, 2018, 2022, 2020,
2023, 2022, 2021, 2021, 2022, 2022, 2021, 2021, 2021, 2020, 2021, 2020,
2018, 2020, 2021, 2018, 2018, 2023, 2022, 2022, 2023, 2022, 2021, 2021,
2021, 2019, 2022, 2020, 2021, 2020, 2022, 2021, 2020, 2022, 2021 ]
year_freq = Counter(years)
x = list(year_freq.keys())
y = list(year_freq.values())
year_freq = Counter(years)
x = list(year_freq.keys())
y = list(year_freq.values())
plt.bar(x, y)
plt.xlabel('Year')
plt.ylabel('Frequency')
plt.title('Frequency of Years')
plt.show()
```



<u>Year wise Research Articles</u>

Year	No. of Articles
2023	16
2022	46
2021	62
2020	47
2019	21
2018	34
Grand Total	**226**

Counrty wise wordcloud and frequency

Frequency

```
import matplotlib.pyplot as plt
from wordcloud import WordCloud

# Input data
data = """
USA
India
China
UK
Taiwan
Italy
South Korea
Japan
Spain
France
Switzerland
Pakistan
Canada
Bangladesh
```

```
Singapore
Iraq
Iran
Germany
Poland
Greece
Indonesia
Turkey
California
Mexico
Australia
Nigeria
Brazil
Korea
Europe
Malaysia
Jordan
Saudi Arabia
Egypt
New York
Norway
England
Belgium
Netherlands
Russia
Africa
Serbia
Hong Kong
Finland
Austria
Israel
Morocco
Benanon
Saudi Arabia, India
Croatia
Ethiopia
Thailand
"""
```

```
# Generate word cloud
wordcloud = WordCloud(width=800, height=400,
background_color='white').generate(data)

# Display the word cloud
plt.figure(figsize=(10, 5))
plt.imshow(wordcloud, interpolation='bilinear')
plt.axis('off')
plt.show()
```

keywords

predictive models, lungs, AI, ML, COPD chronic obstructive pulmonary disease; forecasting; machine learning; patient care management COPD, Deep learning Deep learning, radiography, prediction model, Mycobacterial Pulmonary Disease artificial intelligence, COPD, diagnosis, lipoprotein, metabolomic COPD, Deep recurrent Neural network, Classification and Prediction, LSTM, ANN pulmonary hypertension Chronic obstructive pulmonary disease (COPD), deep belief network (DBN), deep learning Spirometry, Pulmonary diseases, Random forest, Support vector machine, Naive Bayes, Neural network lung disease, machine learning, deep learning, CT-images, CNN, Covid-19 Deep learning, ct scans AI, non small cell lung cancer Deep learning, ct scans Computed tomography Coronavirus infections COVID-19 Deep learning Lung diseases Pneumonia Machine learning COVID-19 Computed tomography (CT) Radiomics Prognosis Modeling COVID-19 X-ray Deep learning Pre-processing Capsule network CNN COVID-19 Vanilla NN VDSNet VGG lung cancer; prediction model; early diagnosis; health prevention; machine learning; deep neural network model Decision support · Artificial intelligence · Computed tomography · Imaging · Informatic Thoracic Surgery, Data Mining, Multilayer Perceptron Algorithm, J48 Decision Tree Algorithm, Naive Bayes Algorithm, Machine Learning Algorithm COVID-19, CT, infection region segmentation, deep learning, human-in-theloop Artificial intelligence, pulmonary medicine MACHINE LEARNING, LUNG CANCER lung cancer, pre- processing, support vector machine, deep learning, classification accuracy artificial intelligence; esophageal dilatation; HRCT chest; machine learning; systemic sclerosis deep learning; lung cancer detection; colon cancer detection; histopathological image analysis; image classification Artificial intelligence Machine learning Pulmonary hypertension Diagnostic delay Early diagnosis Electronic health record classification, cnn, deep learning, image segmentation, lung cancer, lung nodule detection Lung segmentation Mask R-CNN Fine-tuning Generalization of models CAD idiopathic pulmonary fibrosis disease; machine learning; soft voting ensemble;

machine learning prediction pulmonary disease, chronic obstructive,", neural networks (computer), Disease progression, Data science deep learning, artifcial intelligence, pulmonary hypertension COVID-19, CT, deep learning, weak label, SARS-CoV-2, DeCoVNet COPD; acute exacerbation; telehealth; respiratory sounds; early detection; prediction; telemonitoring Pulmonary Fibrosis Progression Prediction AUTOMATIC SEGMENTATION, DEEP LEARNING Machine learning convolutional neural network; optimizer methods; lung disease; image classification; image processing; Mish activation function Covid-19 Epidemic CT scans Lung cancer Artificial intelligence Machine learning Algorithms Techniques COPD Artificial intelligence Medical applications Predictive models artificial intelligence; machine learning; lung cancer; radiomics; whole slide imaging; survival prediction pulmonary function test, flow-volume loop, machine learning, artificial intelligence, spirometry, lung volumes, DLCO predictive models, lungs, AI, ML, COPD artificial intelligence; machine learning; chronic airway diseases; asthma; chronic obstructive pulmonary disease AI,ML,Respiratory Diseases, COPD, Pulmonary fibrosis airtificial intelligence, chronic obstructive pulmonary disease, thoracic imaging hrct, ILD, medical image analysis, ipf, radiologic diagonsis CT, Pulmonary nodules,AI , lung tumors AI, ML , Medical Diagnosis, obstructive lung disease AI, ML, ML, Magnetic resonance imaging, computed tomography scan, molecular imaging, lung imaging Artificial intelligence (AI); lung cancer; prognosis; drug efficacy artificial intelligence; lung cancer screening; electronic medical record computed tomography,segmentation, long- term recurrent convolutional network, classfication, clinicial decision support systerm Artifcial intelligence, Emergency radiology, Pulmonary embolism, Deep learning, Automated detection CAD, IDNN, Hybrid Swarm intelligent rough set appraoch, Ensemble classfier lung cancer, chest X-ray, deep learning healthcare; lung cancer; prediction; machine learning; data analysis Pulmonary adenocarcinoma; deep learning; tumor invasiveness; peritumoral region; X-ray computed tomography (X-ray CT) blood counts; lung cancer; response; survival; prediction; machine learning classification, deep learning machine learning, VAE, RP Pulmonary disease Chronic obstructive Exacerbation Machine learning ML,COPD, Select relevant attributes, Accuracy, prediction idiopathic pulmonary fibrosis, computed tomograpgy, ml, dl Convolutional neural network Machine learning Deep learning Pneumonia detection Chest x-ray images COVID-1 copd, ml cad,ct,cnn Coronavirus Deep Learning · Pulmonary Imaging · Medical Image Analysis · Convolutional Neural Networks deep learning, COPD, DL, respiratory sound analysis AI, artificial intelligence; AUC, CT, computed tomography FDR, GSEA,ICC, non-small-cell lung cancer; PET deep learning,ct scans radiology, deep learning lung disease, bio medical quipment, AI, lung, pneumodynamics lung cancer,Medical Imaging, deep learning deep learning, pulmonary hytertension, chest x ray deep learning, radiology idiopathic pulmonary fibrosis, radiology, deep learning copd, lung disease detection Convolutional neural networks, medical image analysis, machine learning, deep learning ACC, Accuracy; AI, Artificial Intelligence; ARDS, Acute Respiratory Distress Syndrome Covid-19 · Lung disease prediction · Deep learning · Soft computing · Machine learning breath tests; bronchogenic cancer; electronic nose; volatile organic compounds deep learning, machine learning chronic obstructive pulmonary disease; machine learning; forecasting; symptom exacerbation; patient care managemen Classical computers, Quantum computers, Quantum machine learning, Qubits, Qiskit. lung cancer; survival; prediction models; real-world data; artificial intelligence; machine learnin Pulmonary embolism • Electrocardiogram • Machine learning • Deep learning deep learning, pulmonary disease, chest x ray artificial intelligence (AI), radiomics, computed tomography, interpretability, idiopathic pulmonary fibrosis, interstitial lung disease —Lung cancer, Naive Bayes, ODANB, NCC2, Data Mining, Classification artificial intelligence (computer vision systems); neural networks; chronic obstructive pulmonary disease; X-ray computed tomography Nontuberculous mycobacterium · Mycobacterium tuberculosis · Deep learning · Computed tomography · Man– machine comparison lung cancer, machine learning machine learning chest computed tomography, deep learning, lung screening CAD, Lung Disease, CT Scans deep learning, pediatrics, pulmonary disease, lung, Transfer learning Coronavirus COVID-19 Chest Deep learning Transfer learning Artificial intelligence interpretable machine learning; explainable artificial intelligence; lung cancer screening; personalized medicine Machine learning, Medical decision support system, Real-world data, Chronic obstructive pulmonary disease radiomics, machine learning, CT image, biomarkers, lung cance radiomics, machine learning, survival, lung cancer, brain metastases, brain MRI, artificial intelligence chronic obstructive pulmonary disease (COPD); machine learning; features set; disease severity; prediction models copd ,deep learning deep learning, radiomics Prediction Mode, deep learning, lung cancer Mobilelungnetv2, CNN, Lung disease, deep learning non-small-cell lung carcinoma; EGFR mutation; KRAS mutation; genetic algorithm; eXtreme Gradient Boosting; feature selection, ML Deep learning, covid-19, lung disease prediction machine learning; telemedicine; chronic obstructive pulmonary disease deep learning, pulmonary disease, predictive models, task analysis COVID-19, CT image, infection segmentation, semi-supervised learning. ARF, acute respiratory failure; AUC, area under the curve; LUS, lung ultrasonography; PLS Lung cancer; Nodule malignancy; Deep learning; Machine learning IOT, Deep learning, Covid-19 COPD, lUNG CANCER, SCREENING CT SCANS Chronic diseases; prediction models; pathologies; accuracy; disease classification computed tomography images, Deep learning Lung Ultrasonography, Deep learning pulmonary nodules, lung cancer prediction "Lung Cancer, Classification, Prediction, Machine Learning and Image Processing" lung cancer, deep learning VGG lung cancer, prediction model Deep Learning, Lung Cancer Prediction, AlexNet, Softmax layer, CT images ReLU Modeling, Artificial Intelligence & Neural Networks, Dataset Analyzing with Caps Net, Lung Disease Classification Ultrasound, Medical ultrasonography, Machine learning, Decision theory, Surface waves, Viscoelasticity, Convolutional neural networks, interstitial lung diseases, texture classification. machine learning, deep learning COPD; machine learning, exacerbation events; mobile health, remote monitoring; chronic disease; digital health; health care applications ADL: activities of daily living; COPD: Artificial intelligence (AI); machine learning (ML); pulmonary nodule machine learning, copd machine learning, radiomics, imaging COPD; acute exacerbation; explainable machine learning; SHapley Additive exPlanations (SHAP); local explanation COPD, SNP, AQCI, Allele frequencies, Machine learning tools machine learning, copd, unbalanced data Machine learning, small cell lung cancer Texture, Morphological, Machine learning, Feature extraction, Classifcation, COVID-19 disease prediction , lung cancer, IOT, ML deep learning; medical diagnosis; segmentation; CNN ct scan, lung nodule ct scan, deep learning AI, lung pattern analysis,CT images Chronic Obstructive Pulmonary Disease, COPD, Cough, Machine Learning, Algorithms, Classification Deep learning, ct scans, lung cancer Deep learning, CNN based classification, Medical-assistive technology, Respiratory sound analysis, Machine learning Deep learning, CNN, lung disease Lung disaese, Deep learning,EGFR Cancer Deep learning ML ANN SVM Decision tress Pulmonary thromboembolism, ML, Deep learning KNN · ML · RBF · Lung cancer · ANN lung metastasis, machine learning, partial dependency plot, prediction, thyroid cancer machine learning, chronic obstructive pulmonary disease, quantitative image analysis, natural language processing lung cancer, machine learning, radiation pneumonitis, prediction, radiotherapy COPD, Heealth risk assesment Pulmonary diseases; deep learning; lung opacity; classification; majority voting; ensemble feature Lung sounds · Pulmonary diseases · Deep learning · Stethoscope · Convolutional neural network · Long shortterm memory copd, respiratory sound, machine learning AI, Lung cancer Lung disease Pneumonia COVID-19 Tuberculosis Deep learning Transfer learning Multichannel Stacking Chest X-ray Artificial intelligence; COPD, Computed tomography; Critical care; Machine learning; Mechanical ventilation; Neural networks; Pulmonary; Sepsis lung disease diagnosis , AI deep segmentation, non small cell lung cancer Deep learning, ct scans, lung cancer Radiomics and deep learning deep learning, covid-19, ct scans Radiomics,lung adenocarcinoma prognosis, CT Scans Radiomics Prognosis Analysis, Non-Small Cell Lung Cancer COPD, ML, confusion matrix, decision tree, logistic regression diseases, health care, AI, medical computing, medical disorders, neaural nets AI, lung disease Deep learning, pulmonary disease, transfer learning, imaging, lung, tools machine learning, radiomic, predicting treatment , non-small cell lung cancer, radiation therapy Chronic pulmonary aspergillosis (CPA) · CT imaging · Artifcial intelligence (AI) lung disease, machine learning, deep learning, CT-images, CNN, Covid-19 Lung cancer, ML CT Image, Performance, Neural Network, AI artificial intelligence, convolutional neural network, deep learning, lung adenocarcinoma, pathological invasivenesS analytical platforms; markers of respiratory diseases; lung cancer; chronic obstructive pulmonary disease; asthma maachine learning, lung cancer, Radiomics Features, neaural network NN RSNA, Deep Learning, Convolutional Neural Network, Xception Model, ImageNet Dataset, Object Detection. COPD; machine learning; mortality; prediction; random survival forest Lung cancer, Machine learning Machine learning; Deep learning; Medical images; Classification. COVID-19, whole lung radiomics, multi-view, radiomics model, machine learning, particle swarm optimization-deep extreme learning machine Radiomic Features, Lung CT Images, Perinodular and Intranodular idiopathic pulmonary fibrosis; lung cancer; radiomics; risk factors Covid-19, CT-Images, Lung involvement in Covid-19 images, PostAcute Sequelae of COVID-19 (PASC), Pulmonary Fibrosis (PF), PASC-P radiomics; artificial intelligence; lung diseases; precision medicine image patch, hide unit, unlabeled data, misclasification error exhalation; lung capacity forecasting; machine learning Convolutional neaural networks CNN, Deep convolutional autoencoder, interstitial lung disease ILD, Transfer learning. Machine learning; computed tomography (CT); pulmonary function; lung cancer; assessment auscultation, classification, denoising, discrete wavelet transform, feature extraction, lung diseases, lung sounds covid-19, lung diesease, deep learning Measurement,COVID-19,Pulmonary disease,Lung,Bones,Convolutional neural networks,AI data preprocessing is one of the pertinent steps while classifying images via CNN models. Chronic Lung Disease, Lung Segmentation, Lung Magnetic Resonance Imaging, BPD Severity Prediction, DL, Lung Topology. pulmonary infectious disease, COVID-19, deep learning, computed tomography, pneumonia Deep learning Multidector computed tomography Lung Lung cancer ,Deep neural network with adaptive sine cosine ,crow search, Grey-level run length matrix Convolutional neural network; Deep learning algorithms; Grading model; Normal fetal lung; Fetal lung maturity; Gestational age; Artificial intelligence Deep learning, Interstitial Lung Diseases, Computer Vision, Artificial Intelligence "COPD classification, AI in medicine, personalized healthcare, permittivity spectroscopy, precision diagnostic, saliva characterization, medical machine learning," lung diseases, deep learning, feature extraction COVID-19, CT imaging, deep learning, multi-class pneumonia screening, weakly-supervised learning, lesion localization. "Artificial Intelligence, Lung Cancer Pathology, Deep Learning Algorithms" deep learning,lung cancer automated quantification, high resolution computed tomography, interstitial lung disease Lung cancer, Machine leraning classification, x ray , patient diagnosis deep learning, pulmonary disease, AI, pulmonary embolism, ML, CT images, DenseNet pulmonary fibrosis, lung disease MACHINE LEARNING, CONVOLUTIONAL NEURAL NETWORKS (CNN), TRANSFER LEARNING, CROSS VALIDATION, MFCC, VGG16. combination algorithm; support vector machines; extreme gradient boosting; onedimensional convolutional neural network; lung disease; chest X-ray image; convolutional neural network; heat map deep learning, x ray, task analysis, transfer learning, AI, lung disease, chest radiography mechanical ventilation; respiratory health; machine learning; artificial neural networks; particle swarm optimization interstitial lung disease, deep learning, convolutional neural network, densenet, SK- DenseNet deep learning, lung cancer, breast cancer, PSO, COPD, CT, transfer learning, convolutinal neural netwroks, multiple instance learning Mycophenolate mofetil , interstitial lung disease, Treatment, radiographic model machine learning, lung adenocarcinoma, radiomics total lung capacity, resriction, spirometry, lung volumne testing, machine learning, interstitial lung disease, Deep learning, pulmonary disease, sppechSpiro, COPD Machine learning algorithms, x ray imaging, tumors, cancer, lung cancer typology machine learning, machine learning, lung disease.

2023 keywords wordcloud

```
import matplotlib.pyplot as plt

from wordcloud import WordCloud


# Combine all the given data into a single string

data = """

COPD, Deep learning

Artificial intelligence Machine learning Pulmonary hypertension Diagnostic delay Early diagnosis Electronic health record

classification, cnn, deep learning, image segmentation, lung cancer, lung nodule detection

deep learning, artificial intelligence, pulmonary hypertension

copd, deep learning

Prediction Mode, deep learning, lung cancer

Mobilelungnetv2, CNN, Lung disease, deep learning

pulmonary nodules, lung cancer prediction

machine learning, copd

machine learning, copd, unbalanced data

Pulmonary thromboembolism, ML, Deep learning

lung disease diagnosis, AI

Lung cancer, Machine learning
```

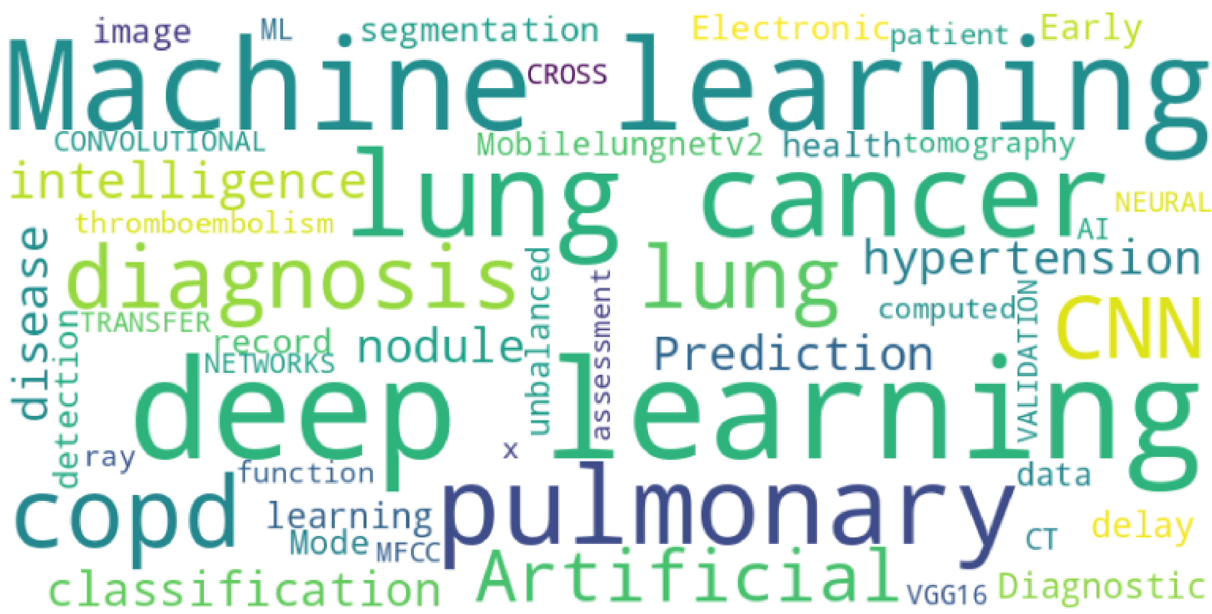
Machine learning; computed tomography (CT); pulmonary function; lung cancer; assessment

Lung cancer, Machine learning classification, x ray, patient diagnosis

MACHINE LEARNING, CONVOLUTIONAL NEURAL NETWORKS (CNN), TRANSFER LEARNING, CROSS VALIDATION, MFCC, VGG16.

"""

```
# Create a WordCloud object

wordcloud = WordCloud(width=800, height=400, background_color='white').generate(data)


# Plot the word cloud

plt.figure(figsize=(10, 5))

plt.imshow(wordcloud, interpolation='bilinear')

plt.axis('off')

plt.show()
```



Frequency for 2023

COPD: 3

Deep: 8

learning: 10

Artificial: 1

intelligence: 2

Machine: 5

Pulmonary: 3

hypertension: 3

Diagnostic: 1

delay: 1

Early: 1

diagnosis: 4

Electronic: 2

health: 2

record: 2

classification: 3

cnn: 3

image: 2

segmentation: 2

lung: 8

cancer: 6

nodule: 2

detection: 2

artificial: 1

intelligence: 2

copd: 4

deep: 8

learning: 10

Prediction: 1

Mode: 1

Mobilelungnetv2: 1

CNN: 2

Lung: 2

disease: 3

pulmonary: 4

nodules: 2

prediction: 2

machine: 4

unbalanced: 1

data: 2

Pulmonary: 1

thromboembolism: 1

ML: 2

lung: 8

diagnosis: 2

AI: 1

Machine: 5

computed: 1

tomography: 1

CT: 1

function: 1

assessment: 1

Machine: 5

learning: 10

classification: 2

x: 1

ray: 1

patient: 1

MACHINE: 1

LEARNING: 1

CONVOLUTIONAL: 1

NEURAL: 1

NETWORKS: 1

(CNN): 1

TRANSFER: 1

CROSS: 1

VALIDATION: 1

MFCC: 1

VGG16: 1

2022 keywords wordcloud

```
import matplotlib.pyplot as plt
from wordcloud import WordCloud

data = """
chronic obstructive pulmonary disease; forecasting; machine
learning; patient care management
Deep learning, radiography, prediction model, Mycobacterial
Pulmonary Disease
artificial intelligence, COPD, diagnosis, lipoprotein, metabolomic
Chronic obstructive pulmonary disease (COPD), deep belief network
(DBN), deep learning
```

```
Spirometry, Pulmonary diseases, Random forest, Support vector
machine, Naive Bayes, Neural network
lung cancer, pre- processing, support vector machine, deep
learning, classification accuracy
Machine learning
convolutional neural network; optimizer methods; lung disease;
image classification; image processing; Mish activation function
Covid-19 Epidemic CT scans Lung cancer Artificial intelligence
Machine learning Algorithms Techniques
COPD Artificial intelligence Medical applications Predictive models
artificial intelligence; machine learning; lung cancer; radiomics;
whole slide imaging; survival prediction
hrct, ILD, medical image analysis, ipf, radiologic diagonsis
AI, ML, ML, Magnetic resonance imaging, computed tomography scan,
molecular imaging, lung imaging
computed tomography,segmentation,  long- term recurrent
convolutional network, classfication, clinicial  decision support
systerm
Artifcial intelligence, Emergency radiology, Pulmonary embolism,
Deep learning, Automated detection
healthcare; lung cancer; prediction; machine learning; data
analysis
idiopathic pulmonary fibrosis,  radiology, deep learning
chronic obstructive pulmonary disease; machine learning;
forecasting; symptom exacerbation; patient care managemen
Classical computers, Quantum computers, Quantum machine learning,
Qubits, Qiskit.
lung cancer; survival; prediction models; real-world data;
artificial intelligence; machine learnin
Pulmonary embolism,Electrocardiogram, Machine learning,Deep
learning
artificial intelligence (AI), radiomics, computed tomography,
interpretability, idiopathic pulmonary fibrosis, interstitial lung
disease
—Lung cancer, Naive Bayes, ODANB, NCC2, Data Mining, Classification
deep learning, pediatrics, pulmonary disease, lung, Transfer
learning
interpretable machine learning; explainable artificial
intelligence; lung cancer screening; personalized medicine
Deep learning, covid-19, lung disease prediction
```

```
IOT, Deep learning, Covid-19
"Lung Cancer, Classification,  Prediction,  Machine
Learning and Image Processing"
lung cancer,  prediction model
COPD; acute exacerbation; explainable machine learning; SHapley
Additive exPlanations (SHAP); local explanation
machine learning, chronic obstructive pulmonary disease,
quantitative image analysis, natural language processing
Lung disease  Pneumonia  COVID-19  Tuberculosis  Deep learning
Transfer learning  Multichannel  Stacking Chest X-ray
Radiomics and deep learning
Lung cancer, ML CT Image, Performance, Neural Network, AI
Machine learning; Deep learning; Medical images; Classification.
Covid-19, CT-Images, Lung involvement in Covid-19 images, PostAcute
Sequelae of COVID-19 (PASC), Pulmonary Fibrosis (PF), PASC-P
exhalation; lung capacity forecasting; machine learning
auscultation, classification, denoising, discrete wavelet
transform, feature extraction, lung diseases, lung sounds
data preprocessing is one of the pertinent steps while classifying
images via CNN models.
Chronic Lung Disease, Lung Segmentation, Lung Magnetic Resonance
Imaging, BPD Severity Prediction, DL, Lung Topology.
deep learning, pulmonary disease, AI, pulmonary embolism, ML, CT
images, DenseNet
pulmonary fibrosis, lung disease
combination algorithm; support vector machines; extreme gradient
boosting; onedimensional convolutional neural network;
deep learning, lung cancer, breast cancer, PSO,
total lung capacity, resriction, spirometry, lung  volumne testing,
machine learning, interstitial lung disease,
machine learning, machine learning, lung disease, segmentation
Generate word cloud using python
"""

# Generate word cloud
wordcloud = WordCloud(width=800, height=400,
background_color="white").generate(data)

# Display the word cloud using matplotlib
plt.figure(figsize=(10, 5))
```

```
plt.imshow(wordcloud, interpolation="bilinear")
plt.axis("off")
plt.show()
```

wordcloud = WordCloud(width=800, height=400, background_color='white').generate(text)

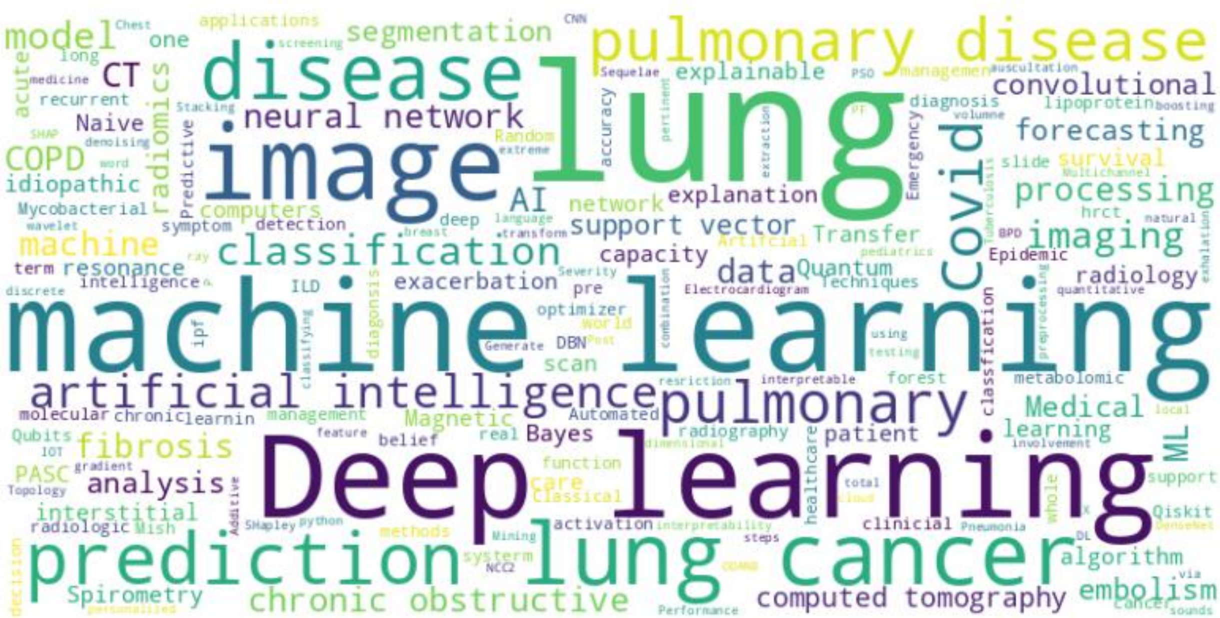
Display the word cloud using matplotlib

plt.figure(figsize=(10, 5))

plt.imshow(wordcloud, interpolation='bilinear')

plt.axis('off')

plt.show()



Frequency for 223

chronic: 3

obstructive: 2

pulmonary: 9

disease: 7

forecasting: 1

machine: 13

learning: 18

patient: 1

care: 2

management: 2

deep: 11

radiography: 1

prediction: 5

model: 4

mycobacterial: 1

artificial: 6

intelligence: 10

copd: 4

diagnosis: 1

lipoprotein: 1

metabolomic: 1

belief: 1

network: 5

dbn: 1

spirometry: 1

diseases: 2

random: 1

forest: 1

support: 2

vector: 2

naive: 2

bayes: 2

neural: 2

cancer: 8

pre: 1

processing: 2

accuracy: 1

convolutional: 2

neural: 2

optimizer: 1

methods: 1

lung: 14

image: 7

classification: 6

processing: 2

mish: 1

activation: 1

function: 1

covid: 3

19: 3

epidemic: 1

ct: 3

scans: 1

algorithms: 1

techniques: 1

medical: 3

applications: 1

predictive: 2

radiomics: 2

whole: 1

slide: 1

imaging: 4

survival: 2

hrct: 1

ild: 1

medical: 2

analysis: 2

ipf: 2

radiologic: 1

diagonsis: 1

ai: 2

ml: 4

magnetic: 1

resonance: 1

computed: 3

tomography: 3

scan: 1

molecular: 1

segmentation: 2

term: 1

recurrent: 1

classfication: 1

clinicial: 1

decision: 1

support: 1

systerm: 1

artifcial: 1

emergency: 1

embolism: 2

automated: 1

detection: 1

healthcare: 1

data: 2

idiopathic: 2

fibrosis: 3

interpretability: 1

interstitial: 2

—lung: 1

odanb: 1

ncc2: 1

mining: 1

pediatrics: 1

transfer: 2

learning: 18

interpretable: 1

explainable: 2

screening: 1

personalized: 1

medicine: 1

exhalation: 1

capacity: 2

auscultation: 1

denoising: 1

discrete: 1

wavelet: 1

transform: 1

feature: 1

extraction: 1

sounds: 1

preprocessing: 1

one: 1

dimensional: 1

breast: 1

pso: 1

total: 1

resriction: 1

spirometry: 1

volumne: 1

testing: 1

2021 keywords wordcloud

```
import matplotlib.pyplot as plt

from wordcloud import WordCloud

# Your data

data = """

lung disease, machine learning, deep learning, CT-images, CNN, Covid-19

Deep learning, ct scans

COVID-19 Computed tomography (CT) Radiomics Prognosis Modeling

...

# Process the data

wordcloud_data = " ".join(data.lower().split("\n"))

# Generate word cloud

wordcloud = WordCloud(width=800, height=400, background_color="white").generate(wordcloud_data)

# Display the word cloud using matplotlib

plt.figure(figsize=(10, 5))

plt.imshow(wordcloud, interpolation="bilinear")

plt.axis("off")

plt.show()
```

SUMMARY OF LITERATURE

The application of deep learning, machine learning, and artificial intelligence (AI) techniques in the field of lung disease or pulmonary disease has gained significant attention in recent years. Researchers have focused on developing models and algorithms that can aid in early detection, accurate diagnosis, disease progression prediction, personalized treatment, risk assessment, biomarker discovery, prognosis estimation, treatment response prediction, and decision support.

Early detection of lung diseases is crucial for timely intervention and treatment. Several studies have explored the use of deep learning algorithms to analyze medical imaging data, such as chest X-rays and CT scans, for the early detection of lung diseases. These algorithms have shown promising results in identifying subtle abnormalities and patterns indicative of lung diseases at an early stage.

Accurate diagnosis of lung diseases is another important aspect that deep learning and machine learning techniques have been employed for. Researchers have developed models that can accurately classify different types of lung diseases based on imaging data, clinical information, and even genetic markers. These models have demonstrated high accuracy in distinguishing between various lung diseases, enabling precise diagnosis and appropriate treatment planning.

Predicting the progression of lung diseases is a challenging task, but AI techniques have shown potential in this area. By leveraging longitudinal patient data and advanced machine learning algorithms, researchers have developed predictive models that can estimate disease progression over time. These models help healthcare professionals anticipate the course of the disease, identify high-risk patients, and optimize treatment strategies accordingly.

Personalized treatment approaches for individuals with lung diseases are gaining importance, and AI plays a significant role in this domain. By integrating various patient-specific factors, including medical history, genetic information, lifestyle factors, and treatment response data, researchers have developed models that can recommend personalized treatment plans. These models assist clinicians in tailoring therapies to individual patients, optimizing outcomes, and minimizing adverse effects.

Risk assessment of lung diseases is another area where AI techniques have been utilized. Researchers have developed models that can assess an individual's risk of developing lung diseases based on various factors, such as smoking history, environmental exposure, and genetic predisposition. These models aid in early intervention, preventive measures, and promoting healthy behaviors to reduce the incidence of lung diseases.

Prognosis estimation is essential for healthcare professionals to assess the expected outcomes and provide appropriate care for individuals with lung diseases. AI models have been developed to estimate the prognosis of patients based on various clinical and demographic factors. These models provide valuable insights into survival rates, disease progression, and potential complications, aiding in shared decision-making and patient counseling.

Predicting treatment response is a challenging task in lung disease management, but AI techniques have shown promise in this area. By leveraging patient data, including imaging, clinical, and genetic information, researchers have developed models that can predict how individuals with lung diseases are likely to respond to different treatment options. These models enable personalized treatment strategies and can guide clinicians in selecting the most effective therapies for individual patients.

CONCLUSION

The application of deep learning, machine learning, and artificial intelligence (AI) techniques in the field of lung disease or pulmonary disease holds great promise for improving early detection, accurate diagnosis, disease progression prediction, personalized treatment, risk assessment, biomarker discovery, prognosis estimation, treatment response prediction, and decision support.

The use of deep learning algorithms has shown significant potential in analyzing medical imaging data, such as chest X-rays and CT scans, for the early detection of lung diseases. These algorithms can identify subtle abnormalities and patterns indicative of lung diseases at an early stage, enabling timely intervention and treatment.

Machine learning models have demonstrated high accuracy in classifying different types of lung diseases based on imaging data, clinical information, and genetic markers, facilitating precise diagnosis and appropriate treatment planning.

Predictive models developed using AI techniques can estimate disease progression over time by leveraging longitudinal patient data. These models help healthcare professionals anticipate the course of the disease, identify high-risk patients, and optimize treatment strategies accordingly.

Personalized treatment approaches for lung diseases can be achieved through the integration of patient-specific factors using AI models. These models consider medical history, genetic information, lifestyle factors, and treatment response data to recommend tailored treatment plans, optimizing outcomes and minimizing adverse effects.

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