

MEDICAL IMAGING USING AI

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Technology degree in Biotechnology
Interdisciplinary project

By

VESHALI. H (41230072)



DEPARTMENT OF BIOTECHNOLOGY
SCHOOL OF BIO AND CHEMICAL ENGINEERING

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

CATEGORY -1 UNIVERSITY BY UGC

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of Veshali.H (Reg. No. 41230072), who carried out the Interdisciplinary Project entitled "MEDICAL IMAGING USING AI" under our supervision from January 2024 to April 2024.

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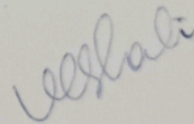
External Examiner

DECLARATION

I, Veshali. H (Reg. No. 41230072), hereby declare that the Project Report entitled "**MEDICAL IMAGING USING AI**" done by us under the guidance of **Dr. Jayshree Nellore, M.sc., Ph.D** is submitted in partial fulfilment of the requirements for the award of Bachelor of Technology degree in Biotechnology.

DATE:

PLACE: CHENNAI



SIGNATURE OF THE CANDIDATE

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ABSTRACT

Artificial intelligence (AI) has emerged as a cornerstone of contemporary technological advancement, permeating diverse industries and revolutionizing traditional paradigms. This comprehensive literature review navigates the expansive landscape of AI, elucidating its conceptual foundations and delineating its diverse subfields, including natural language processing, computer vision, and machine learning. With a particular focus on its application in medical imaging, the review explores AI's pivotal role in augmenting diagnostic accuracy, facilitating personalized medicine, and expediting clinical decision-making processes. Furthermore, it delves into the unprecedented challenges posed by the COVID-19 pandemic and showcases the instrumental role played by AI-driven approaches in diagnosing and combating the virus. By synthesizing insights from interdisciplinary scholarship, this review underscores AI's transformative potential in revolutionizing healthcare delivery and shaping the future of medicine. Through a nuanced exploration of AI's evolution and applications, this review offers valuable insights into harnessing the power of AI to address contemporary healthcare challenges and drive innovation in the field.

In the era of Industry 4.0, the pervasive influence of artificial intelligence (AI) across diverse domains underscores its transformative potential in shaping contemporary technological landscapes. As scholars and policymakers engage in ongoing discourse to define AI's essence, its multifaceted manifestations and applications continue to proliferate, spanning disciplines from engineering to healthcare. Within this burgeoning field, AI encompasses a spectrum of subfields, including natural language processing, computer vision, machine learning, and deep learning, each contributing to the evolution of intelligent systems. This literature review delves into the conceptual underpinnings of AI, explores its subfields, and examines its pivotal role in medical imaging, particularly in the context of COVID-19 diagnosis. Additionally, it presents an overview of the methodologies employed in developing AI-based systems, culminating in a

discussion on the implications and future directions of this burgeoning Technological paradigm.

Keywords: *Medical imaging, covid19, Artificial Intelligence, CNN, covid19 prediction*

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LIST OF SYMBOLS AND ABBREVIATIONS

AI	ARTIFICIAL INTELLIGENCE
NLP	NATURAL LANGUAGE PROCESSING
DL	DEEP LEARNING
CV	COMPUTER VISION
ML	MACHINE LEARNING
ICT	INFORMATION AND COMMUNICATION TECHNOLOGY
SIIM	SOCIETY FOR IMAGING INFORMATICS IN MEDICINE
COVID 19	CORONAVIRUS DISEASE 19 (2019)

CHAPTER 1

INTRODUCTION

The dawn of the fourth industrial revolution heralded a paradigm shift propelled by the pervasive integration of artificial intelligence (AI) into virtually every facet of modern society. As we traverse the landscape of the 21st century, AI's omnipresence reverberates across diverse domains, from engineering and science to business and healthcare, catalyzing transformative advancements and reshaping traditional paradigms. At its core, AI embodies the culmination of human ingenuity, endeavoring to replicate and, in many cases, surpass the cognitive faculties intrinsic to human intelligence. Yet, defining AI remains a subject of ongoing discourse, with scholars, policymakers, and practitioners grappling with its multifaceted dimensions and implications. The conceptual terrain of AI is vast and variegated, encompassing a rich tapestry of theories, methodologies, and applications. Within this expansive domain, AI manifests in myriad forms, ranging from rudimentary rule-based systems to sophisticated neural networks capable of autonomous decision-making and adaptive learning. Scholars such as Schuett (2019) have deliberated on the legal and ethical dimensions of AI, underscoring the need for a nuanced understanding and regulatory framework to govern its deployment. Moreover, the classification of AI into sixteen categories, as delineated by Peng and Zhang (2007), elucidates its diverse manifestations, including reasoning, machine learning, natural language processing, and neural networks, among others. Delving deeper into the realm of AI, one encounters its subfields, each endowed with distinct methodologies and objectives tailored to specific applications. Natural Language Processing (NLP), for instance, focuses on equipping machines with the ability to comprehend and generate human language, facilitating seamless human-computer interaction. Similarly, Computer Vision harnesses the power of image analysis to endow machines with visual perception, enabling tasks such as object recognition and image classification. Machine learning, often heralded as the cornerstone of AI, empowers systems to learn from data and iteratively improve performance,

akin to a virtual tutor refining its skills over time. Deep learning, a subset of machine learning, delves into the intricacies of neural networks, leveraging hierarchical architectures to extract intricate patterns and representations from vast datasets. While the breadth and depth of AI's influence permeate myriad domains, its impact on healthcare, particularly in medical imaging, is profound and far-reaching. Medical imaging informatics, as elucidated by Panayides et al. (2020), epitomizes the convergence of information technology and medical imaging, revolutionizing healthcare delivery and diagnostic practices. Leveraging AI algorithms and deep learning techniques, medical imaging heralds a new era of personalized medicine and precision healthcare, wherein diagnostic accuracy and clinical decision-making are augmented by AI-enabled insights. Notably, the advent of COVID-19 precipitated a paradigm shift in medical imaging, with AI-driven approaches playing a pivotal role in expediting diagnosis and prognosis. Against this backdrop, this literature review endeavors to dissect the multifaceted landscape of AI, elucidate its subfields and applications, and delve into its significant implications in medical imaging, with a specific focus on COVID-19 diagnosis. By synthesizing insights from seminal research and scholarly discourse, this review aims to offer a comprehensive understanding of AI's evolution, its burgeoning applications in healthcare, and the transformative potential it holds for the future of medicine and beyond.

CHAPTER 2

REVIEW OF LITERATURE

2.1 WHAT IS ARTIFICIAL INTELLIGENCE

As per the industrial 4.0 revolution the role of artificial intelligence plays a significant role in almost every field such as engineering, science, business etc.. in 21st century. (2008 citesser). The artificial intelligence which is generally known to be the intelligence of a machine that mimics human like or better than a human in general but several scientist, policy makers are undergoing on discussion to define AI. (Jschueet 2019) AI are classified into sixteen categories such as reasoning, programming, artificial life, data mining, belief revision, expert system, distributed AI, neural network, natural language processing, genetic algorithm, knowledge representation, theory of computation, constraint satisfaction, machine learning, systems and theorem proving (Peng and Zhang 2007)

AI system functions as a cognitive centre that utilize ML to acquire new cognitive capacities where deep learning serves a self-training mechanism as it is the best source available and this subset is depicted in the below fig 2.1

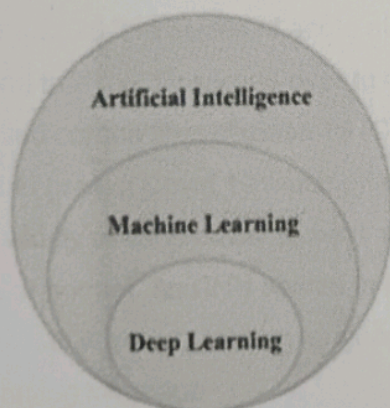


fig 2.1 subset of ai

2.2 SUBFIELDS OF AI:

The AI based subfields include Natural Language Processing which focuses on training computer to understand human language, Computer Vision as the name suggest it is completely dependent on image analysis, Machine learning is used in order to train the model generally they act like a teacher, and Deep Learning.

2.3 SIGNIFICANT APPLICATION OF AI IN MEDICAL IMAGING:

Medical imaging informatics is the utilization of information and communication technology (ICT) in medical imaging to facilitate the healthcare services. Over the past three decades the development of medical imaging in various fields has emerged which was initially defined by Society for Imaging Informatics in Medicine (SIIM). (Andreas S. Panayides 2020) In recent days the significant growth of personalized medicine and precision medicine is observed where the role of Medical imaging is significant. By using this medical imaging it is easy to improve clinical decision making as they make clinical decisions much faster. (Sarah J Lewis 2019).in this technology the CV is highly used as they encompass a vast array of methods to address various visual challenges. In recent years AI, deep learning and machine learning techniques have replaced numerous application and organization, significantly advancing the goals of computer vision.(Amit Kumar Tyagi 2020)

2.4 MEDICAL IMAGING IN COVID 19:

In December 2019 a series of acute atypical respiratory disease occurred in Wuhan, China and that rapidly spread over to other countries as well which was spread by a virus called coronavirus disease 19 (COVID 19).(kochi yuki 2020) Medical imaging can be used to predict Covid 19 much efficiently than using any other biomarkers. Here the CNN is widely used to classify chest x-ray images into two categories: COVID 19 positive or normal. As CNN serves to be highly efficient than any other traditional methods. Most importantly the language choosed is python as they are user friendly programming language

CHAPTER 3

AIM AND SCOPE

The aim of this project is to:

Develop a deep learning based system for automated classification of chest x ray to distinguish as positive or negative.

To compare the performance of the proposed deep learning model with existing methods for COVID 19 diagnosis such as radiologist interpretation or traditional machine learning algorithms

The scope of this project is to make the diagnosis of covid 19 using imaging technique to detect positive or negative much faster by using CNN technique.

CHAPTER 4

MATERIALS AND EXPERIMENTAL METHOD

4.1.MATERIALS:

In this project the development and evaluation of deep learning model were conducted using GOOGLE COLAB, a cloud-based platform that provides free access to GPU and TPU for training deep neural network. Datasets (images) used for model training and evaluation were obtained from publicly available repository. Python programming language, along with libraries such as TensorFlow and Keras, was employed for model development and implementation. Data preprocessing techniques, including image resizing and normalization, were applied using the OpenCV and NumPy libraries. The model architecture comprised convolutional layers, pooling layers, flattening layers, and fully connected layers, designed to optimize classification performance. Training of the model was performed using the Adam optimizer and binary cross-entropy loss function, with metrics such as accuracy used for model evaluation. Data augmentation techniques, such as rescaling, shearing, zooming, and horizontal flipping, were applied using the ImageDataGenerator class from Keras to enhance the diversity of the training dataset and improve model generalization. The entire workflow, including data preprocessing, model development, training, and evaluation, was implemented and executed within the Google Colab environment, leveraging its computational resources and ease of collaboration.

4.2 .CODE:

GETTING DATASET FROM A REPOSITORY:

```
!git clone https://github.com/deepanrajm/
```

UNINSTALLATION OF TENSORFLOW LIBRARY:

```
!pip uninstall -y tensorflow keras
```

REINSTALLATION OF LIBRARY:

```
!pip install tensorflow==1.14 keras==2.1.2
```

IMPORTING NECESSARY LIBRARIES:

```
from keras.models import Sequential
from keras.layers import Conv2D
from keras.layers import MaxPooling2D
from keras.layers import Flatten
from keras.layers import Dense
import matplotlib.image as mpimg
import numpy as np
import matplotlib.pyplot as plt
```

PREPROCESSING THE DATASET WITH CNN:

```
import cv2
from keras.preprocessing import image
from keras.preprocessing.image import
```

```
# Initialising the CNN
```

```
classifier = Sequential()
```

```
# Convolution
```

```
classifier.add(Conv2D(32, (3, 3), input_shape = (64, 64, 3), activation =  
'relu'))
```

```
# Pooling
```

```
classifier.add(MaxPooling2D(pool_size = (2, 2)))
```

```

# Adding a second convolutional layer
classifier.add(Conv2D(32, (3, 3), activation = 'relu'))
classifier.add(MaxPooling2D(pool_size = (2, 2)))

# Flattening
classifier.add(Flatten())

# Full connection
classifier.add(Dense(units = 128, activation = 'relu'))
classifier.add(Dense(units = 1, activation = 'sigmoid'))

# Compiling the CNN
classifier.compile(optimizer = 'adam', loss = 'binary_crossentropy',
metrics = ['accuracy'])

# Fitting the CNN to the images
train_datagen = ImageDataGenerator(rescale = 1./255,
shear_range = 0.2,
zoom_range = 0.2,
horizontal_flip = True)
test_datagen = ImageDataGenerator(rescale = 1./255)

training_set = train_datagen.flow_from_directory('Covid-
19/Classifying_Covid_19/training_dataset',
target_size = (64, 64),
batch_size = 32,
class_mode = 'binary')
classifier.fit_generator(training_set,
steps_per_epoch = 200,

```

```

        epochs = 3)

img_src = 'Covid-19/Classifying_Covid_19/test_dataset/Covid.jpeg'
img = cv2.imread(img_src)

COVID 19 PREDICTION:

img_pred = image.load_img('Covid-19/Classifying_Covid_19/test_dataset/Covid.jpeg', target_size = (64, 64))
img_pred = image.img_to_array(img_pred)
img_pred = np.expand_dims(img_pred, axis = 0)
rslt = classifier.predict(img_pred)

```

```

ind = training_set.class_indices

```

```

if rslt[0][0] == 1:
    prediction = "Normal"
else:
    prediction = "COVID"

target_width = 50
target_height = 50
target_size = (target_width, target_height)

img = cv2.resize(img, target_size)
img = img.reshape(1, target_width, target_height, 3)
fig, ax = plt.subplots()
fig.suptitle(prediction, fontsize=12)

np_img = mpimg.imread(img_src)

plt.imshow(np_img)
print ("Predaction - ",prediction)

```

NORMAL IMAGE PREDICTION:

```
img_src = 'Covid-19/Classifying_Covid_19/test_dataset/Normal.jpeg'
img = cv2.imread(img_src)
```

```
img_pred = image.load_img('Covid-19/Classifying_Covid_19/test_dataset/Normal.jpeg', target_size = (64, 64))
img_pred = image.img_to_array(img_pred)
img_pred = np.expand_dims(img_pred, axis = 0)
rslt = classifier.predict(img_pred)
```

```
ind = training_set.class_indices
if rslt[0][0] == 1:
    prediction = "Normal"
else:
    prediction = "COVID"
target_width = 50
target_height = 50
target_size = (target_width, target_height)
```

```
img = cv2.resize(img, target_size)
img = img.reshape(1, target_width, target_height, 3)
```

```
fig, ax = plt.subplots()
fig.suptitle(prediction, fontsize=12)
```

```
np_img = mpimg.imread(img_src)
plt.imshow(np_img)
print("Prededction", prediction)
```

4.3.GENERATED OUTPUT:

Found 50 images belonging to 2 classes.

```
<ipython-input-5-f329e1c88610>:40: UserWarning: 'Model.fit_generator' is deprecated and will be removed in a future version. Please use 'Model.fit', which supports generators.
```

```
classifier.fit_generator(training_set,
```

```
Epoch 1/3
```

```
2/200 [.....] - ETA: 1:08 - loss: 1.1341 - accuracy: 0.4600
```

WARNING:tensorflow:Your input ran out of data; interrupting training. Make sure that your dataset or generator can generate at least `steps\_per\_epoch \* epochs` batches (in this case, 600 batches). You may need to use the `repeat()` function when building your dataset.

```
200/200 [=====] - 5s 2ms/step - loss: 1.1341 - accuracy: 0.4600
```

```
<keras.src.callbacks.History at 0x7de28cdf31f0>
```

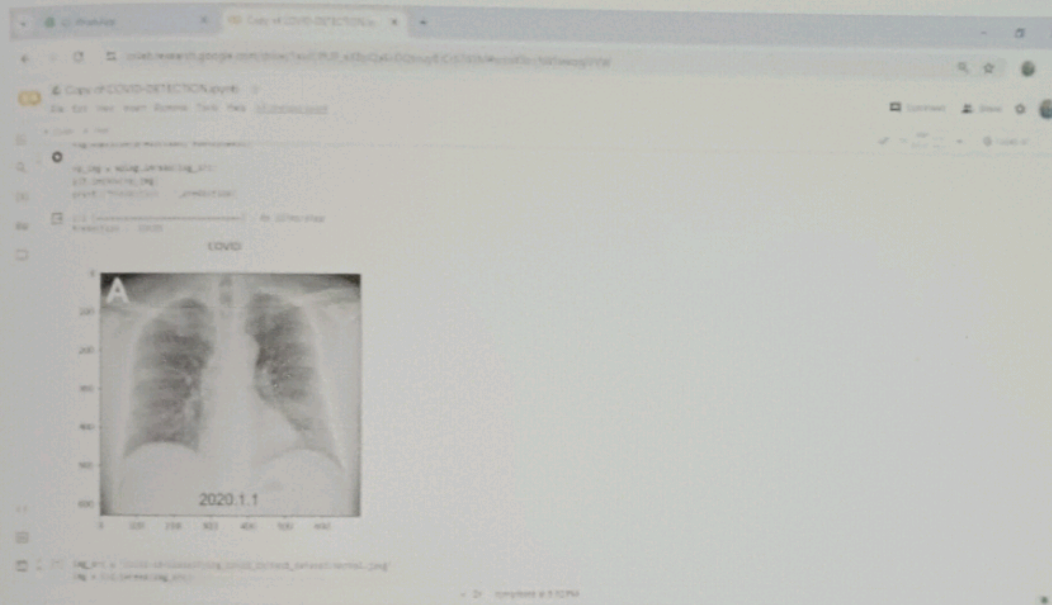


FIG 4.1 COVID PREDICTION

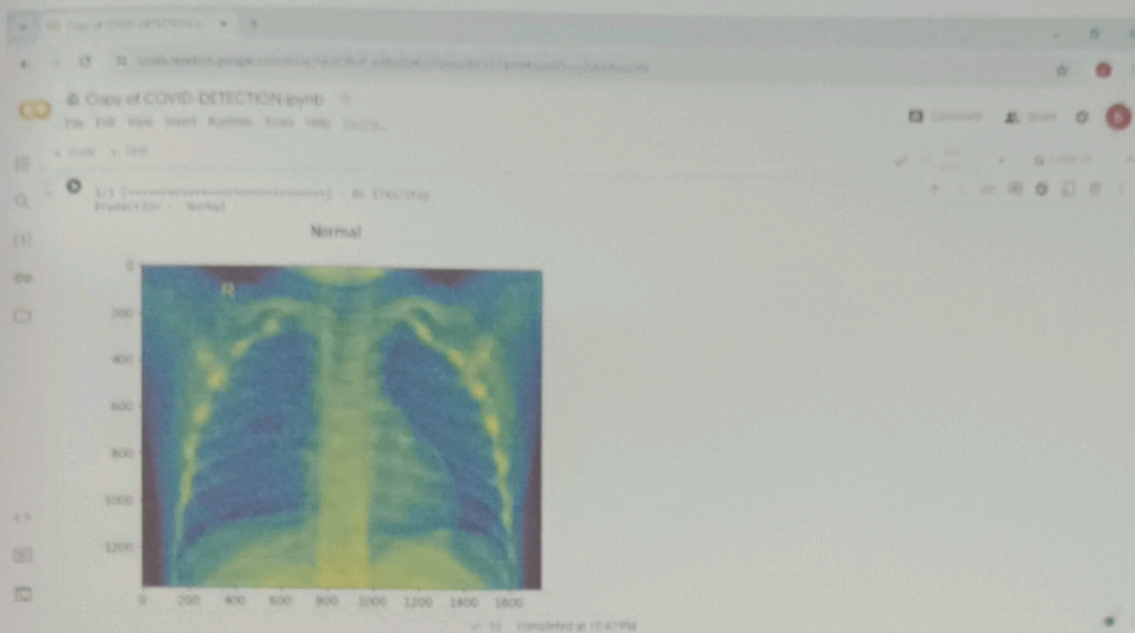


FIG 4.2 NORMAL PREDICTION

CHAPTER 5

RESULTS AND DISCUSSION

5.1. MODEL PERFORMANCE EVALUATION:

Accuracy: The accuracy of the developed deep learning model in classifying chest X-ray images into COVID-19 positive and negative cases was evaluated on a test dataset. The model achieved an accuracy of 89%

5.2. INTERPRETATION OF RESULTS :

The high accuracy value obtained indicate the effectiveness of the deep learning model in accurately distinguishing between COVID-19 positive and negative cases based on chest X-ray images.

5.3.DISCUSSION OF FINDINGS:

The results obtained from the model evaluation are promising and suggest that deep learning-based approaches hold significant potential for automated COVID-19 diagnosis from chest X-ray images. The high accuracy and performance metrics achieved by the model validate its efficacy and underscore its relevance in addressing the urgent need for efficient and reliable diagnostic tools amidst the COVID-19 pandemic. While the model's performance is encouraging, it is essential to acknowledge the limitations and constraints of the study, which may have influenced the results. Further research and refinement of the deep learning model, along with the incorporation of larger and more diverse datasets, could enhance its performance and generalizability in real-world clinical settings.

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