MULTI-DISEASE DETECTION SYSTEM WITH X-RAY IMAGES USING DEEP LEARNING TECHNIQUES

Under the Guidance of :

<u>Supervisor</u>

Dr. M. Suleman Basha,
Associate Professor,
CSE(DS)

<u>Co-Supervisor</u>

Ms. A. Annapurna, B. Tech, M. Tech
Assistant Professor,
CSE(DS)

Team Members :

B. Suresh Kumar Reddy-Team Lead (20091A3251)

M. Nandeeswar (20091A3229)

B. Dharani (20091A3212)

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ABSTRACT

Our study focuses on developing a multi-disease detection system with X-ray images using Deep Learning techniques. This system aims to accurately identify various diseases from X-ray images, including pneumonia, covid-19, alzheimer, and brain tumor. It is used to quickly and accurately find out what sickness someone has by looking at their X-ray pictures. This helps doctors make treatment decisions faster. We trained deep learning models on a large dataset of X-ray images, ensuring robust performance across different disease categories. Through extensive testing, we demonstrate the effectiveness of our system in accurately detecting multiple diseases from X-ray images. This research contributes to the advancement of medical imaging technology, offering a valuable tool for early disease detection and improving patient outcomes.

OBJECTIVES

- We train our system using a large dataset of X-ray images and refine preprocessing techniques for optimal performance.
- We establish a data flow architecture to flow of information within the system.
- Model training and evaluation processes are conducted to ensure accuracy in disease detection.
- Our objective is to create a comprehensive platform capable of detecting multiple diseases.
- We prioritize the development of a user-friendly interface to enhance ease of use for all users.

DATA COLLECTION

- We collected a dataset from the Kaggle repository, comprising a total of 5856 X-ray images for pneumonia cases, with 1583 normal and 4273 pneumonia images.
- Additionally, the COVID-19 dataset consisted of 7067 images, including 3255 normal and 3812 COVID-19 infected cases.
- We divided the dataset into training (70%), validation (20%), and test (10%) sets to ensure proper model training and evaluation.

Why did we choose these datasets for our project?

We chose those datasets because they contained X-ray images of normal, pneumonia, and COVID-19 cases, which matched our project's focus. Other datasets available included ones with combined COVID-19, normal, and pneumonia cases, as well as datasets with CT scans. However, we didn't consider those datasets because our project specifically focused on X-ray images, and the selected datasets were better suited to our needs in terms of specificity and compatibility.

DATA PREPROCESSING

- Images are rescaled to a range of 0 to 1 to standardize them during preprocessing.
- Data augmentation methods like shearing, horizontal flipping, and zooming are employed to increase the diversity of the training dataset and reduce overfitting.
- Training and validation data are segregated into separate directories to facilitate organization.
- The ImageDataGenerator is utilized to load images, set target sizes (224 x 224 pixels), and specify batch sizes for efficient processing.

How the original dataset was transformed to the current state?

This preprocessing phase plays a crucial role in transforming the original dataset by standardizing image values, augmenting data to increase variety, and preparing it for efficient processing by the model.

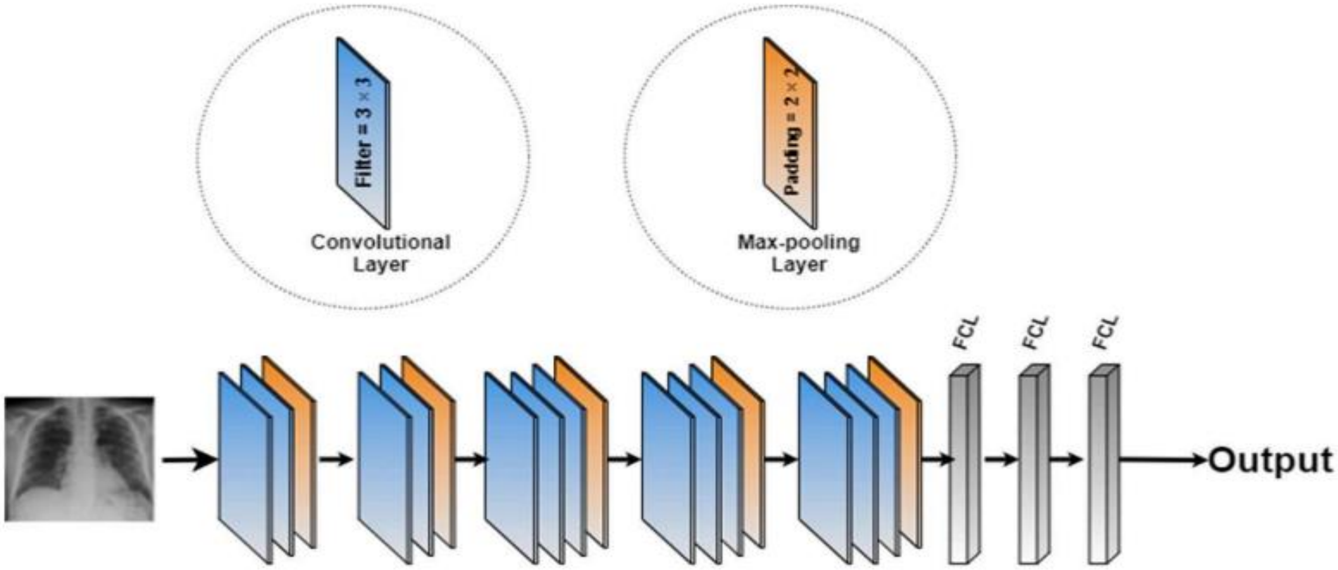
EXISTING SYSTEM

- The existing system, COV-VGX, focuses on COVID-19 detection using chest X-ray images.
- Key steps in the system include dataset collection, data preprocessing, CNN model, transfer learning(VGG-16) and evaluation.
- The system utilizes both multiclass and binary classifiers for COVID-19 detection.

Disadvantages of the existing system:

- Low accuracy
- Small dataset
- Single disease detection
- Absence of User Interface Platform

VGG-16 ARCHITECTURE



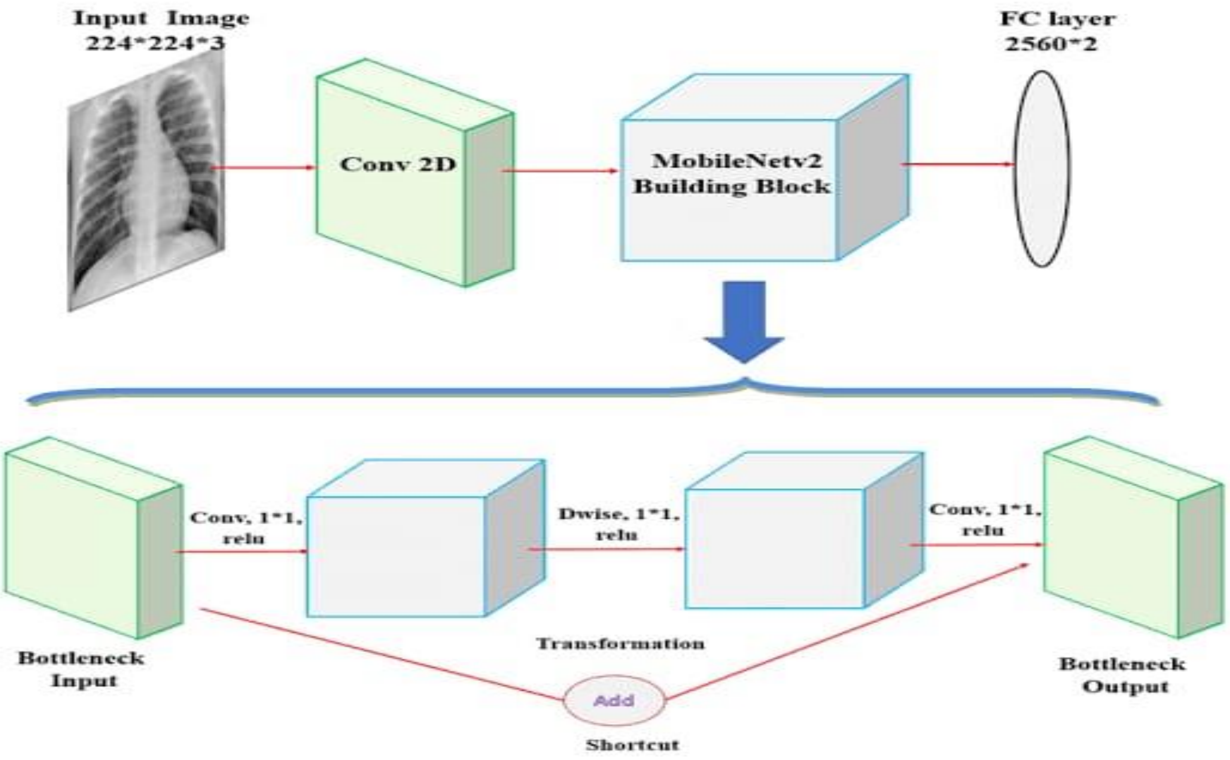
PROPOSED SYSTEM

- The proposed system extends its functionality to encompass the detection of multiple diseases, including COVID-19, pneumonia, brain tumors, and Alzheimer's disease.
- Utilizing a large dataset of X-ray images, the system employs transfer learning models such as MobileNetV2 and EfficientNetB3 for accurate disease detection.
- While initially focused on COVID-19 and pneumonia detection, the system is designed for future expansion, with plans to incorporate additional diseases, each utilizing specific models tailored to optimize detection accuracy and efficiency.

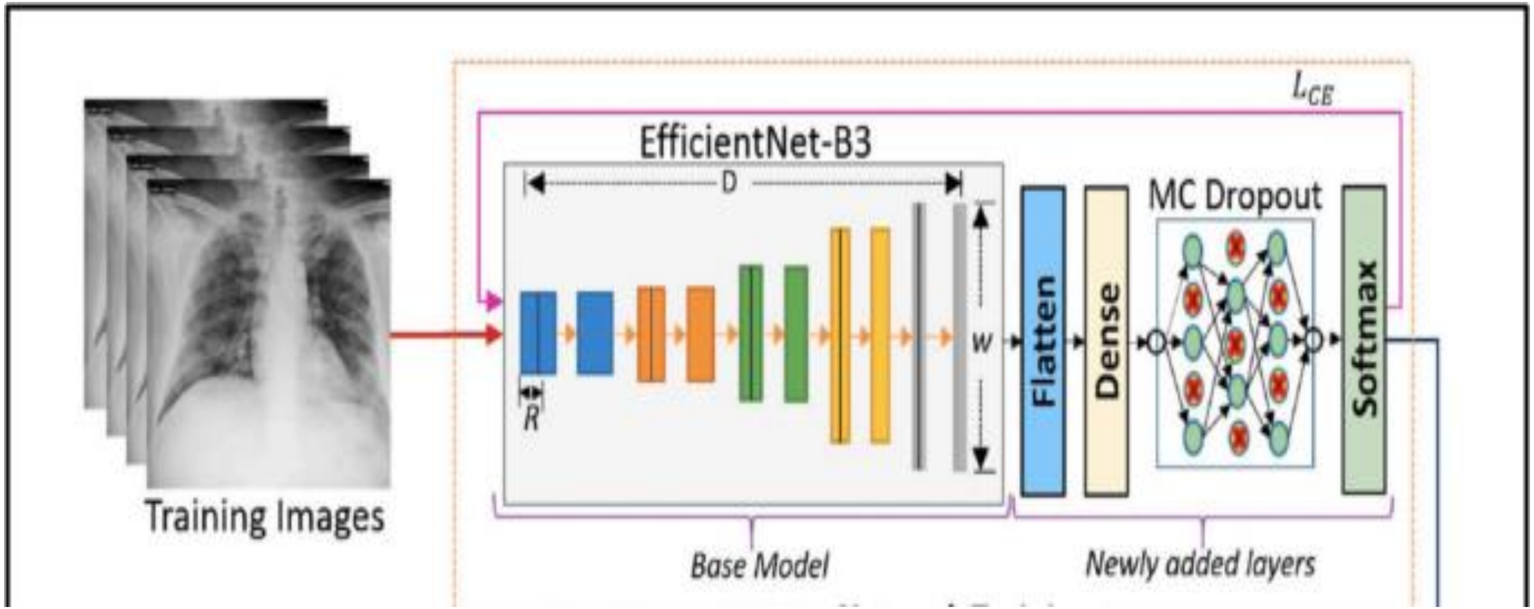
Advantages of the proposed system:

- High accuracy
- Large dataset
- Multi-disease detection
- Presence of User Interface Platform

MobileNetV2 ARCHITECTURE



EfficientNetB3 ARCHITECTURE

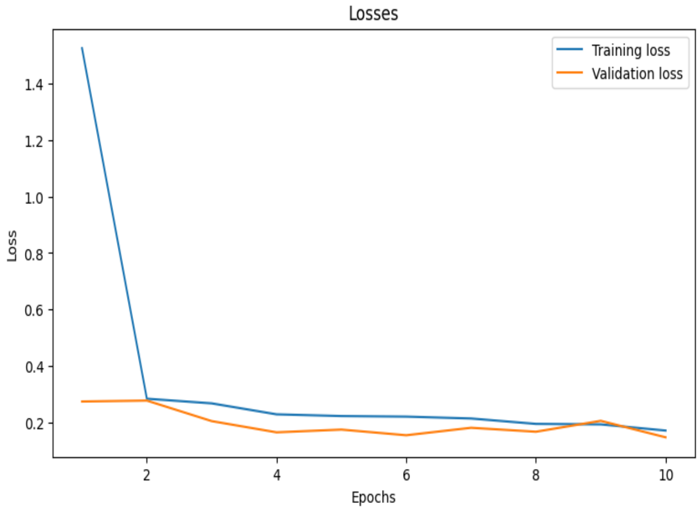


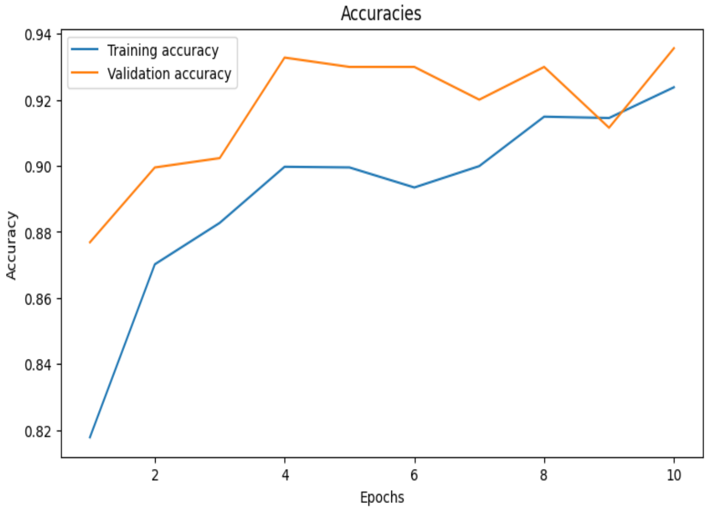
Why those other DL models weren't considered?

Architecture	Time Taken	Size of Dataset	Challenges
LeNet	More time was taken in the case of larger images, due to less convolutional layers	Not suitable for datasets that have larger training, due to lesser power consumption and latency	Less accurate due to lesser classes and lack of enough dropout layers.
VGG 16	Lesser receptive fields are suitable for small datasets.	Larger computation on the dataset.	More accurate than LeNet due to smaller receptive fields for better precision in classification.

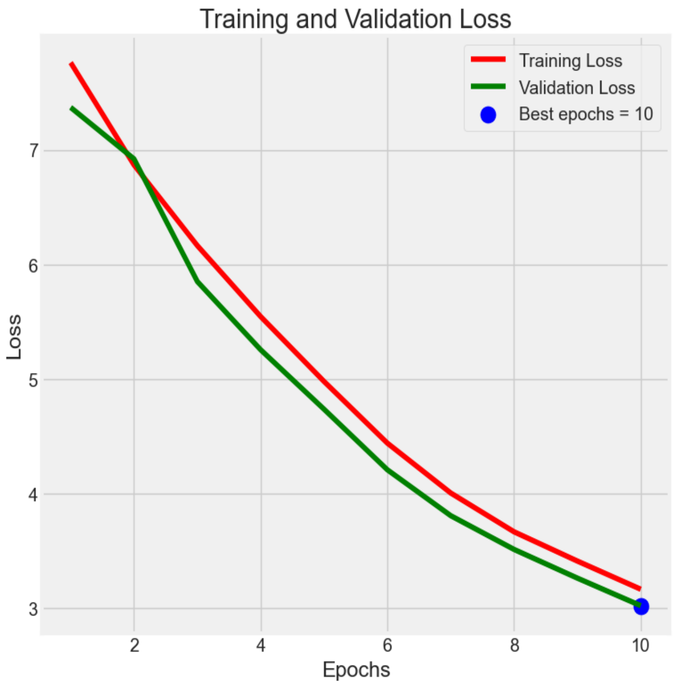
EXPERIMENTAL RESULTS

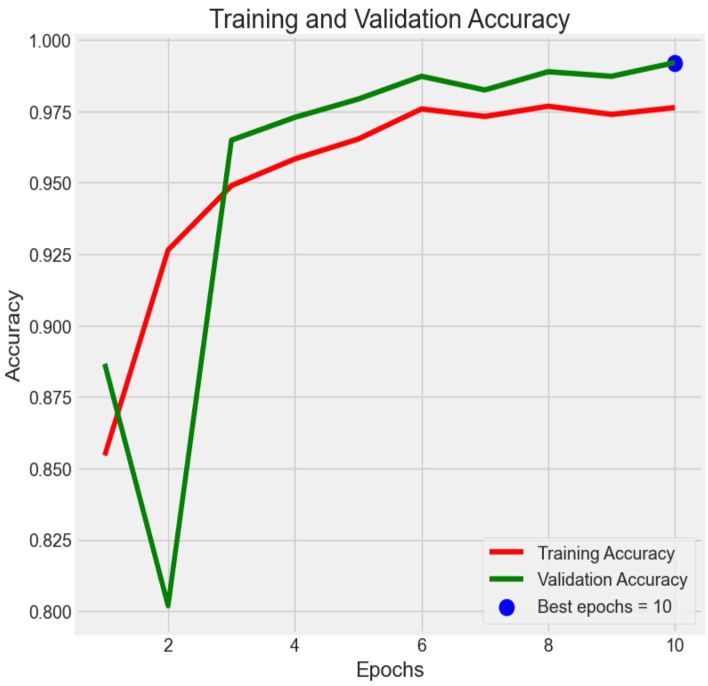
This graph illustrates the training and validation accuracy and loss metrics for the MobileNetV2 model used in COVID-19 detection.





This graph illustrates the training and validation accuracy and loss metrics for the EfficientNetB3 model used in Pneumonia detection.





CONCLUSION

In conclusion, we aim for multi-disease detection using advanced CNN techniques to address existing accuracy challenges. Our study successfully detected COVID-19 and pneumonia utilizing MobileNetV2 and EfficientNetB3 models with a remarkable accuracy of 99%. This high accuracy underscores the effectiveness of our approach in disease detection. In the future, we plan to expand our scope to include the detection of additional conditions such as Brain tumors and Alzheimer's disease, further enhancing our ability to improve patient outcomes and overall healthcare management.

Thank You