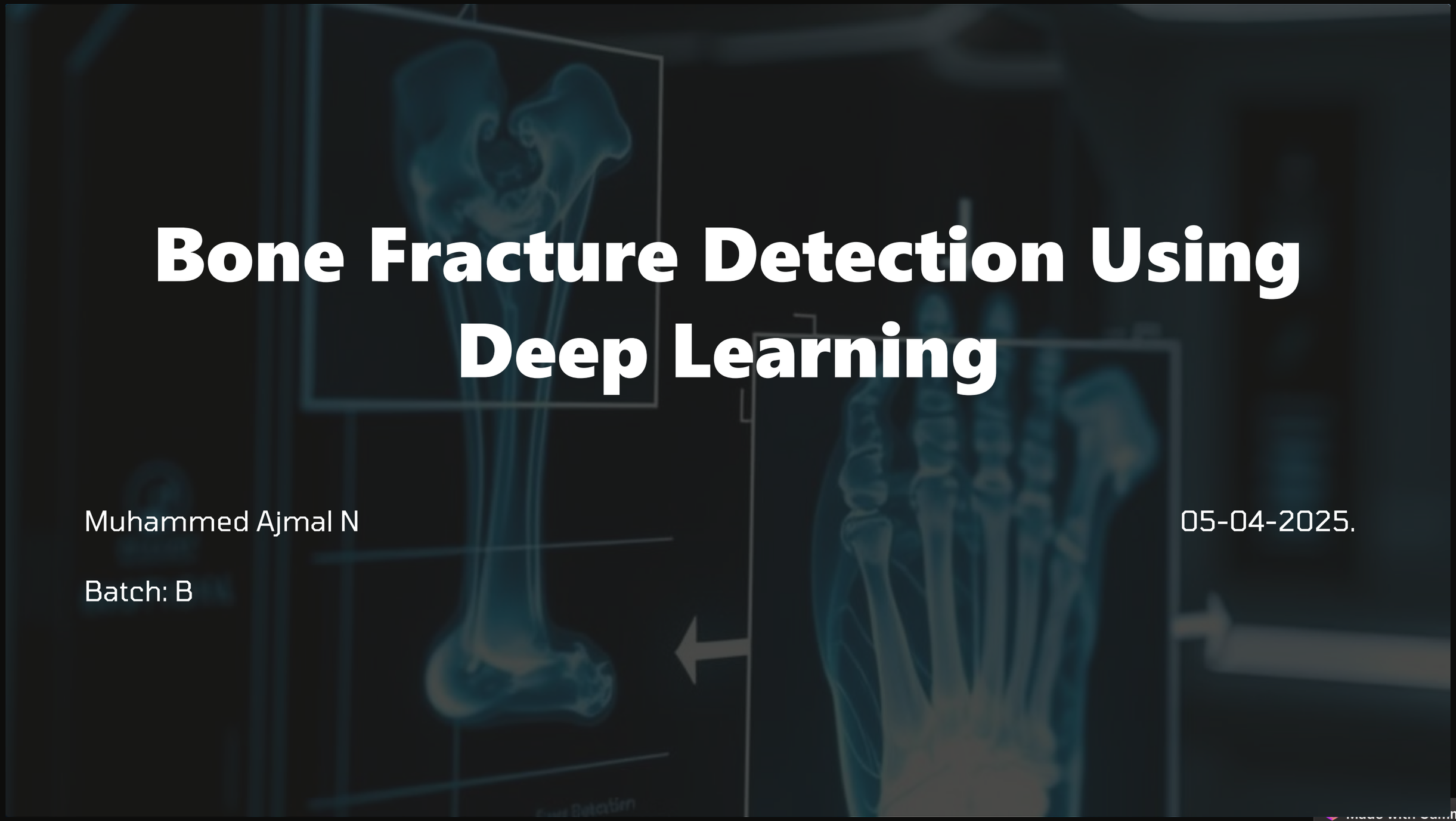
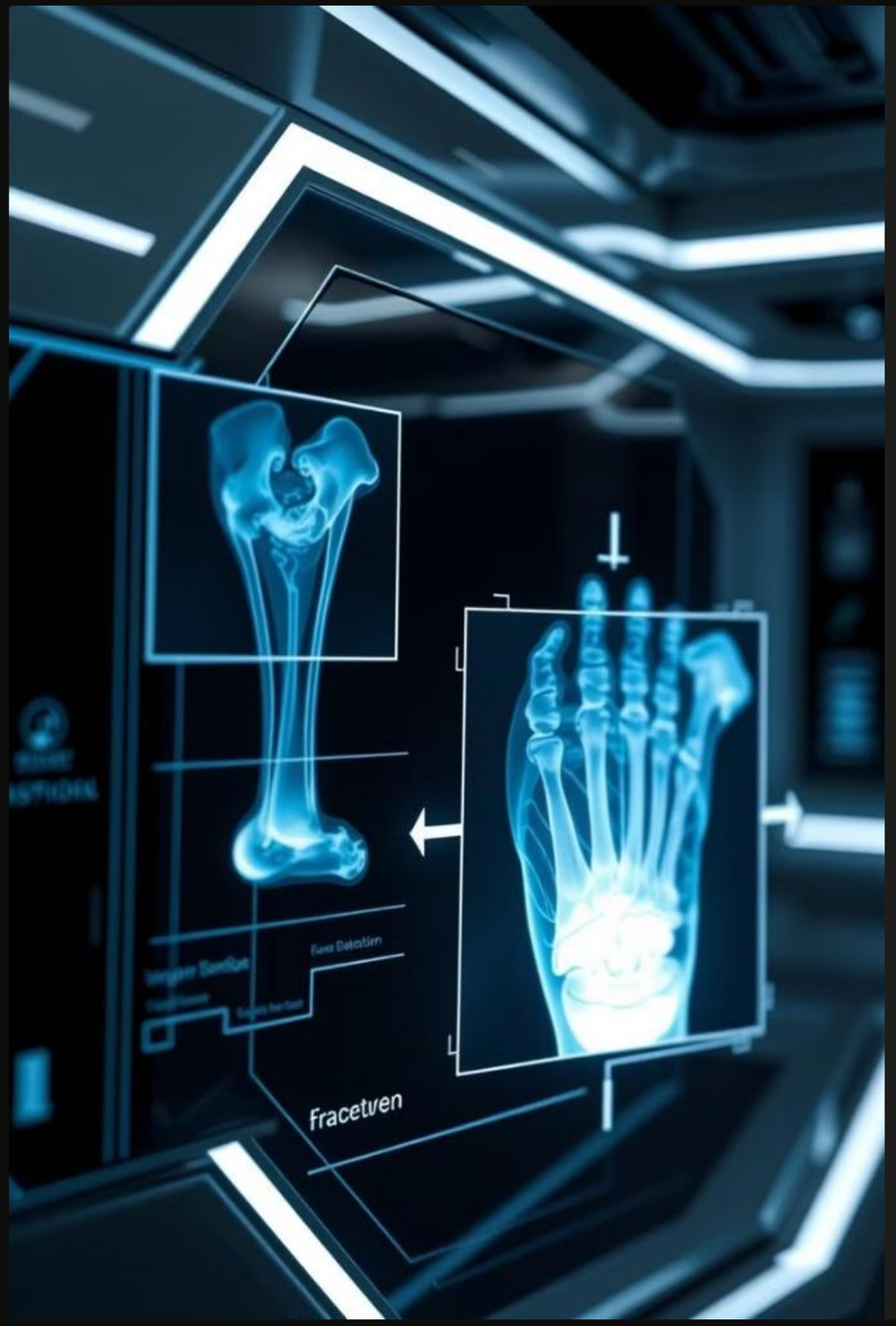


Bone Fracture Detection Using Deep Learning

Muhammed Ajmal N

Batch: B

05-04-2025.



Problem Statement

- **Bone fractures are a common medical condition.**

Manual Detection Time-consuming, prone to error.

Misdiagnosis can lead to delayed treatments and complications.

AI-assisted detection can provide quicker and more accurate results.

Assists radiologists in high-workload environments.

CNNs (Convolutional Neural Networks) can effectively classify X-ray images as fractured or not.

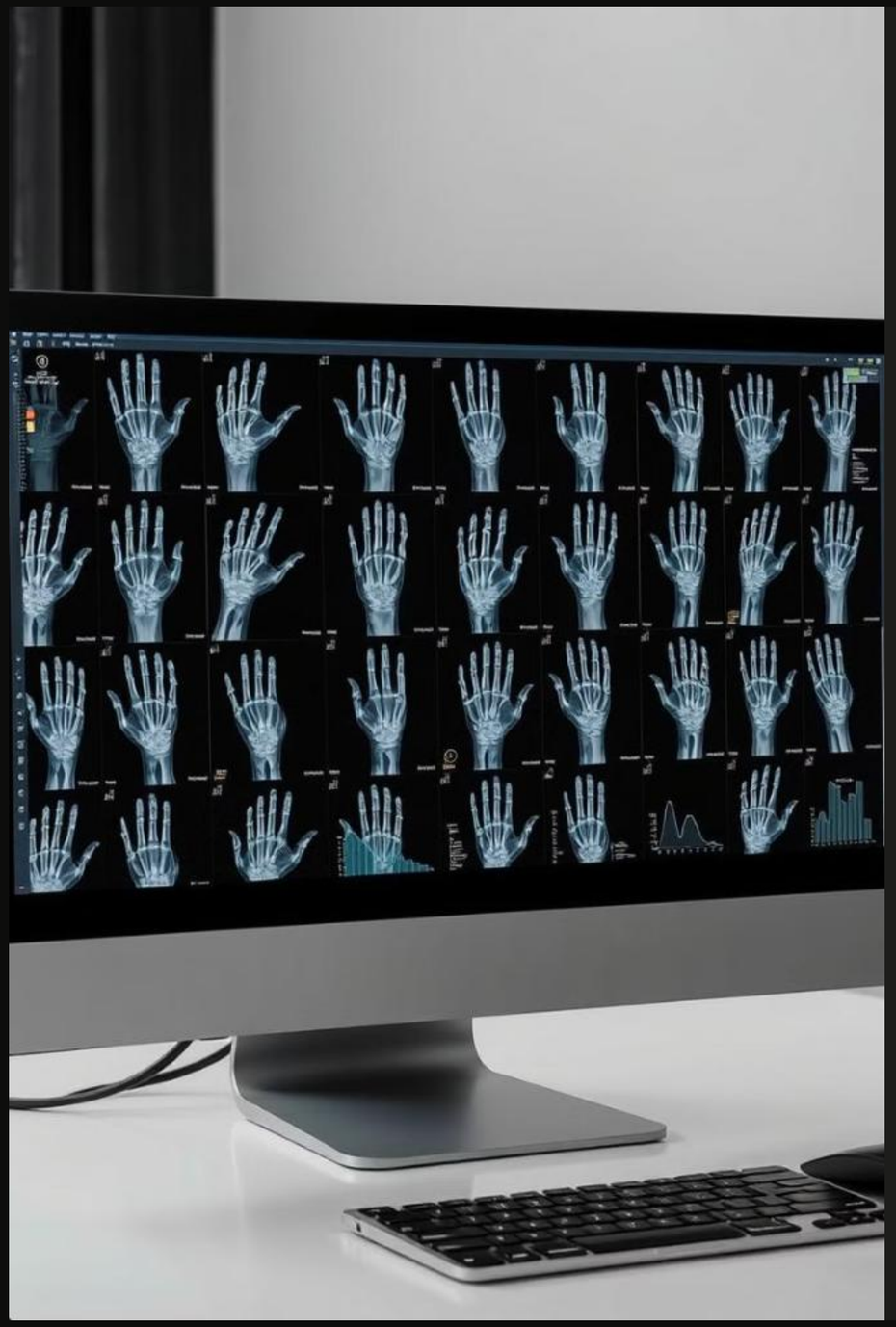
Objectives

Goal:

Build a binary image classification model to predict if an X-ray image shows a fractured or non-fractured bone.

Aim:

- Develop an automated system for detecting bone fractures from X-ray
- Deployment as a user-friendly web app for real-world use.
- Improve processing time
- Enhance diagnostic accuracy by reducing human errors in identifying fractures.



Dataset

Source:

From Kaggle by Madushani Rodrigo: [Bone-Fracture-Multi-Region-X-Ray-Data]

Training	Validation	Test
9,246 images.	828 images.	506 images

Size
10,580 samples.

Data Type: Image dataset

Features: image of fractured bone's x-rays

Not image of non fractured bone's x-rays

Challenges: Variability in X-ray image quality

Methodology

1. Import required Libraries :
   - Import necessary libraries for deep learning and image processing.
   - tensorflow, os, keras, matplotlib
2. Data Collection & Preprocessing :
   - Load Train,Test & validation image dataset.
   - Image resizing, normalization (rescale 1./255), augmentation (rotation, flip)
3. Data Visualization:
   - Visualize x-ray images of both Fractured and Not-fractured.
4. Model Selection:
   - CNN-based architecture for image classification, with Conv2D, MaxPooling layers, flatten layer, Dense layers.
5. Training :
   - Fit the model using the training and validation sets.
   - 30 epochs with Adam optimizer and binary cross-entropy loss.
6. Evaluation:
   - Accuracy and loss on test data.
7. Deployment:
   - Streamlit-based web application.

Model Implementation

Algorithm:

Convolutional Neural Network (CNN)

- 3 **Conv2D** layers with increasing filters (32→ 64→128)
- **MaxPooling** to reduce dimensions.
- Flatten, Dense, Dropout layers
- Sigmoid Activation in Output Layer

Why CNN?

Effective for image feature extraction.

Suitable for binary classification.

Training Process:

- Train-test-validation split via generators
- Hyperparameter tuning (epochs, batch size, learning rate)

Evaluation & Results

99%

Test Accuracy

0.03

Test Loss

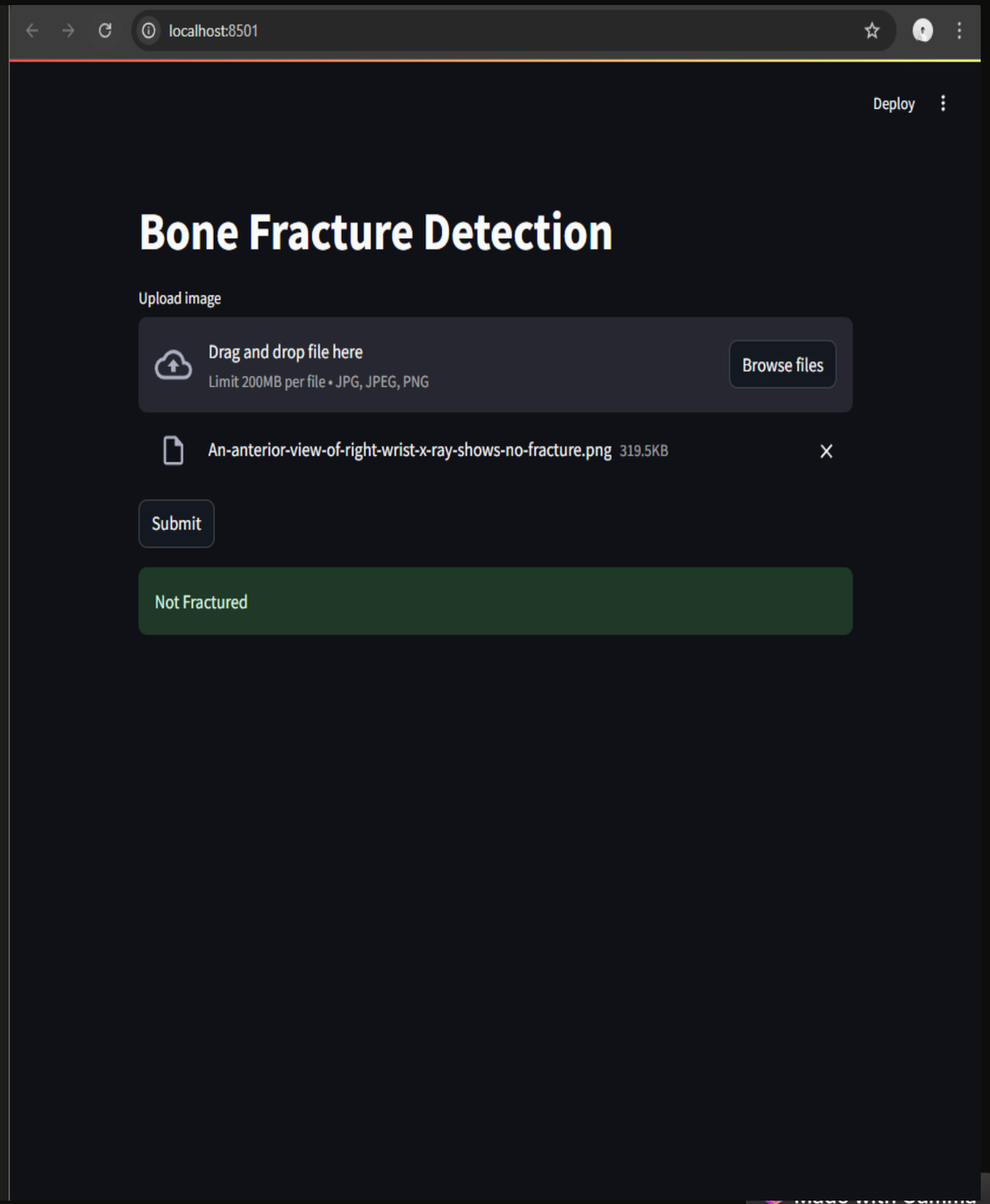
Deployment

Method

Web application using Streamlit.

Technologies

Python, TensorFlow/Keras, Streamlit.



Challenges & Limitations

- Limited Dataset size
- Overfitting issues
- Long Training time

Limitations:

Model depends on dataset quality

Key Takeaways:

- AI can aid in medical diagnostics
- CNNs are effective in X-ray image classification

Future Enhancements:

- Train with larger and more diverse datasets
- Improve model interpretability with heatmaps (Grad-CAM)
- Improve model with advanced architectures (e.g., ResNet, transfer learning)
- Add real-time prediction and integration with medical systems.
- Integration with 3D Imaging: Extending the model to work with CT scans and MRI for more comprehensive fracture analysis.
- Multi-Disease Diagnosis: Expanding the system to detect other bone-related issues such as osteoporosis or joint dislocations.

Conclusion

This project successfully developed a CNN-based model to detect bone fractures from X-ray images,

Offering a quick and accurate AI-assisted diagnosis. Deployed using Streamlit.

It provides an accessible tool for medical professionals.

While effective, it faces challenges. This project demonstrates how AI can support faster, more reliable medical diagnostics, and ultimately enhance patient care

References

Dataset Source

Dataset obtained from Kaggle by Madushani Rodrigo.

Bone-Fracture-Multi-Region-X-Ray-data

Medium Article

Deep learning for X-ray bone fracture detection overview.

Deep Learning for X-ray Bone Fracture Detection

Kaggle Notebook

Bone fracture detection using CNN notebook by Mahmoud Ali.

CNN Implementation Kaggle Notebook

Core Libraries

TensorFlow and Keras were used for model creation.

The OS library was used for file management.

THANK YOU

Thank you for your time and attention. I hope that you found this presentation informative and insightful.

I am excited about the potential of AI in medical diagnostics and believe that this project can contribute to better patient care.