ARABIC SIGN LANGUAGE HAND GESTURE RECOGNITION

A Real-Time AI Application for Enhanced Communication

INTRODUCTION & PROBLEM STATEMENT

Why Gesture Recognition?

- Gesture-based interfaces are a crucial part of modern human-computer interaction, with applications in gaming, touchless control, and assistive technology.
- This project aims to bridge the communication gap by developing a system to accurately recognize Arabic Sign Language hand gestures.
- Our goal is to create a lightweight, accurate, and real-time model that can be used for sign language interpretation from video streams or static images.

THE DATASET

OUR DATA: ARASL DATASET

- We used a publicly available Arabic Sign Language (ArASL) dataset containing 54,000 images.
- The dataset is comprised of images of hand gestures representing 32 different Arabic letters.

DATA PREPARATION & AUGMENTATION

Data Preparation

- All images were resized to a consistent 224x224 pixels and then normalized to standardize pixel values.

Data Augmentation

To make our model more robust and prevent overfitting, we used several techniques:

- Random rotations and horizontal flips
- Adjustments to brightness, contrast, and saturation
- Random affine transformations

MODEL ARCHITECTURE

- We used transfer learning with two powerful pre-trained CNNs: **MobileNetV2** and **EfficientNetB0**.
- The core of these models (the backbone) was kept frozen, and we trained a custom classifier head specifically for our 32 gesture classes.
- Our best results came from **EfficientNetB0**, which proved to be both accurate and efficient for our needs.
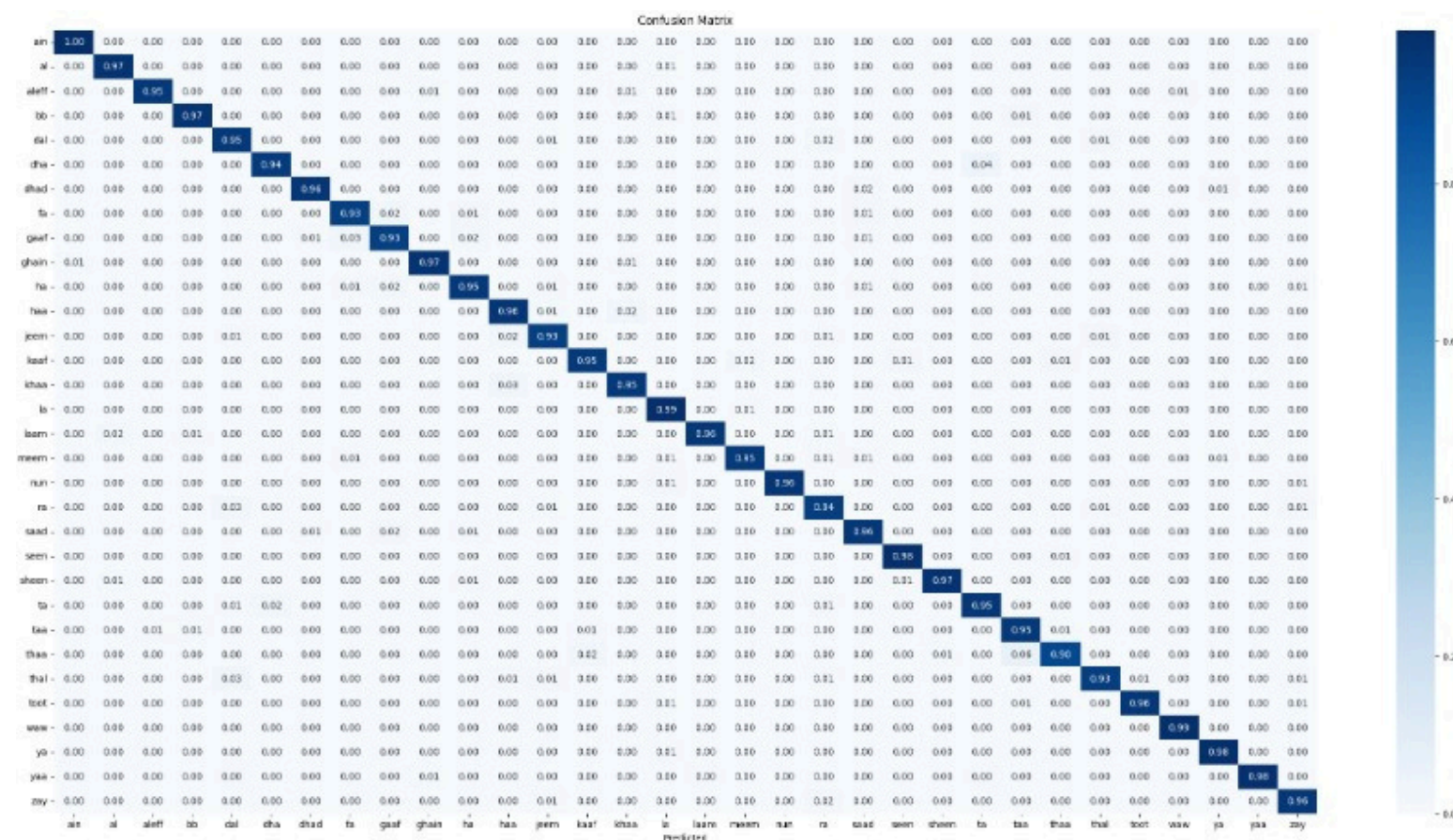
Transfer Learning
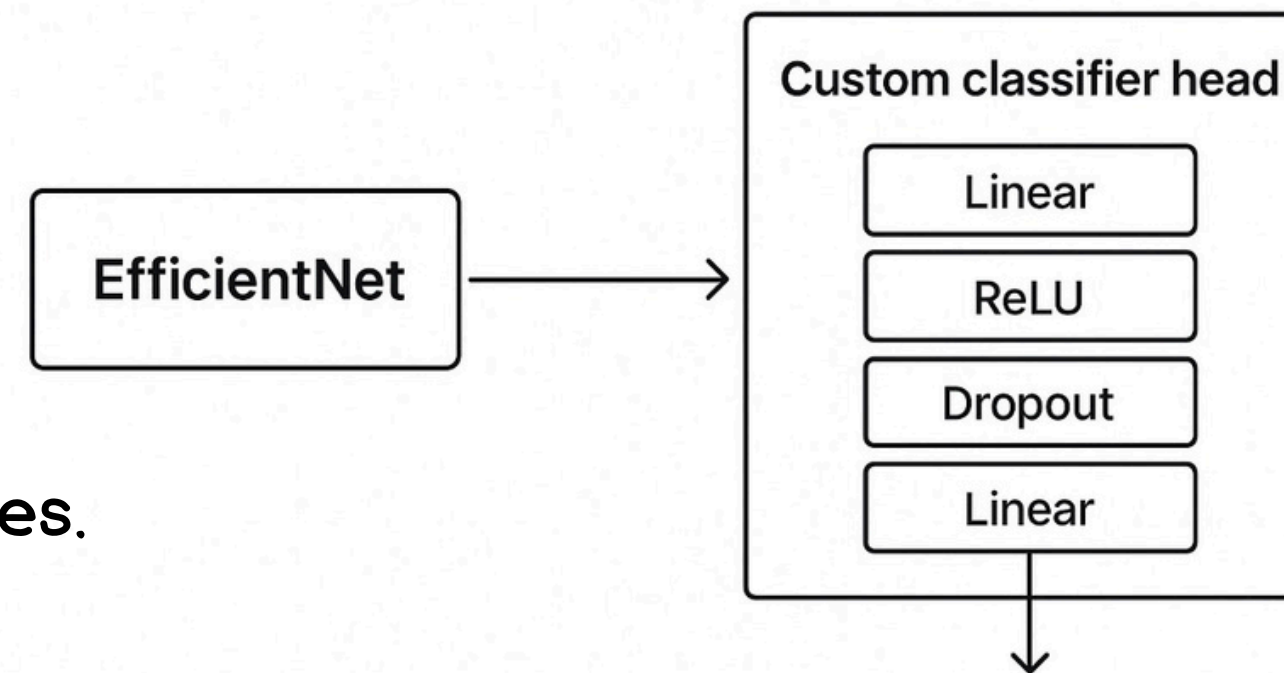
RESULTS AND EVALUATION

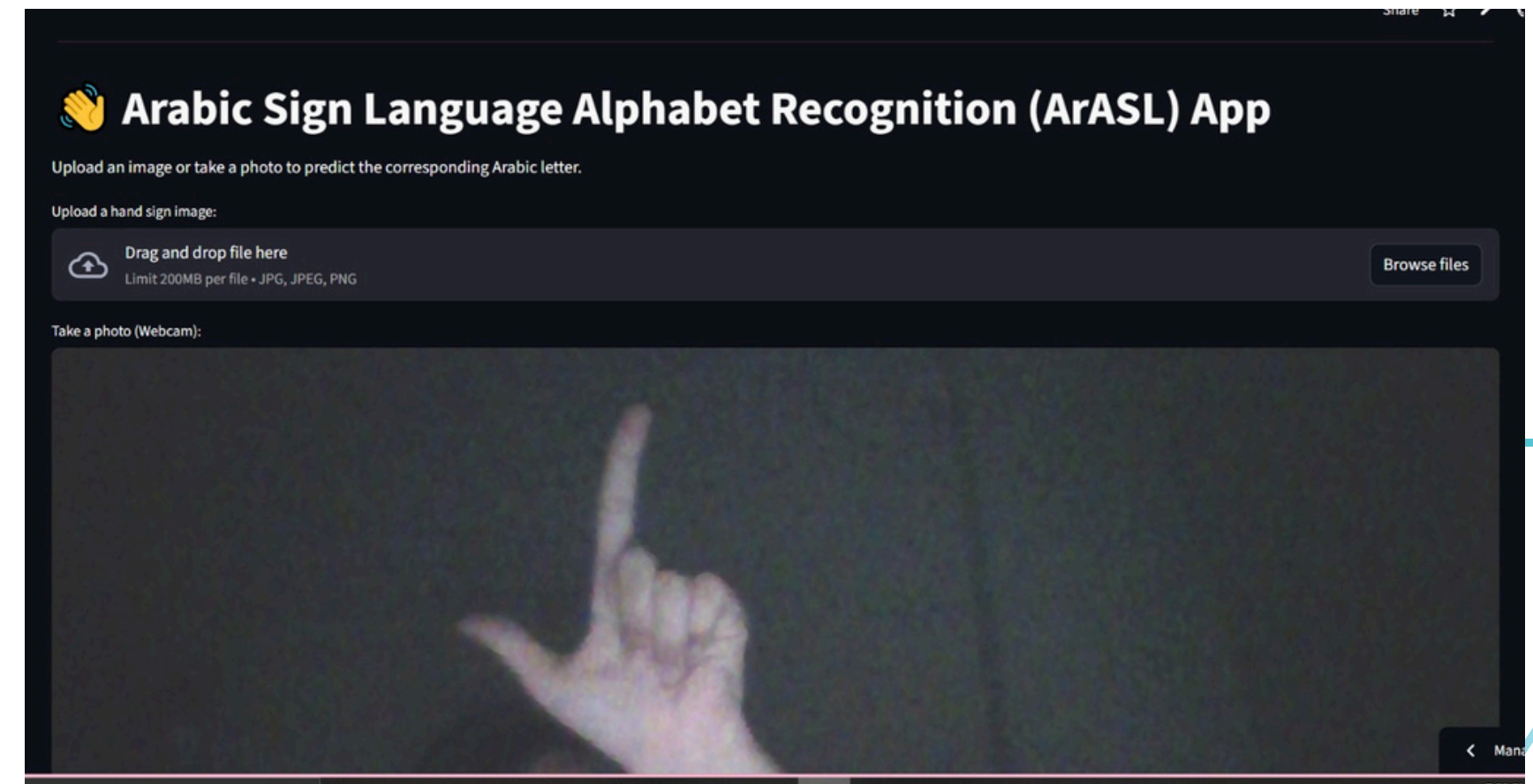**The EfficientNetB0 model achieved a final validation accuracy of 95.73%**

Key Metrics

- Accuracy: 95.73%
- Precision, Recall, F1-score: Our model performed well across all classes, indicating high-quality predictions.

LIVE DEMONSTRATION

- This is the most engaging part! Explain that you'll show the live Streamlit app.
- The app uses MediaPipe Hands to detect and crop the hand in the video stream.
- The cropped image is then sent to our trained EfficientNetB0 model for real-time prediction.

👋 **Arabic Sign Language Alphabet Recognition (ArASL) App**

Upload an image or take a photo to predict the corresponding Arabic letter.

Upload a hand sign image:

Drag and drop file here
Limit 200MB per file • JPG, JPEG, PNG

Browse files

Take a photo (Webcam):

CALL TO ACTION: "LET ME WALK YOU THROUGH A LIVE DEMONSTRATION."

DEPLOYMENT & FINAL THOUGHTS

FROM MODEL TO APPLICATION

- The model is deployed via a user-friendly web interface built with Streamlit.
- The application includes a debug mode to visualize the hand bounding box, landmarks, and the top-3 predictions.
- The project successfully demonstrates the feasibility of real-time Arabic Sign Language recognition using computer vision.

Future Work: handling dynamic gestures or optimizing the model for mobile devices

GTC

THANK YOU