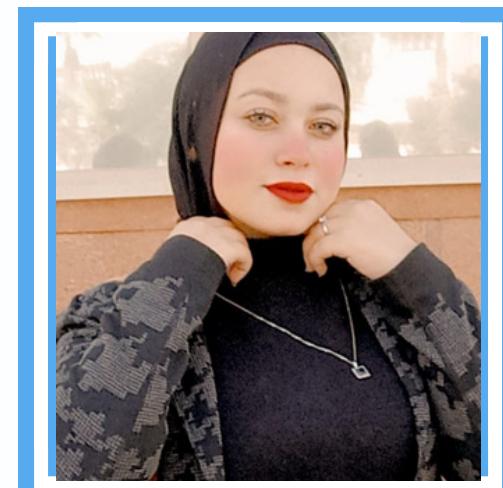


جامعة
كل من يحتاج أن يُسمع

Supervisor

Dr. Mary Monir

OUR TEAM



**Mohamed
Omar**

**Yasser
Mahmoud**

Rana Yasser

Manar Sabri

Dina Bakry

**Abdelrahman
Ali**

**Ahmed
Essam**



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01

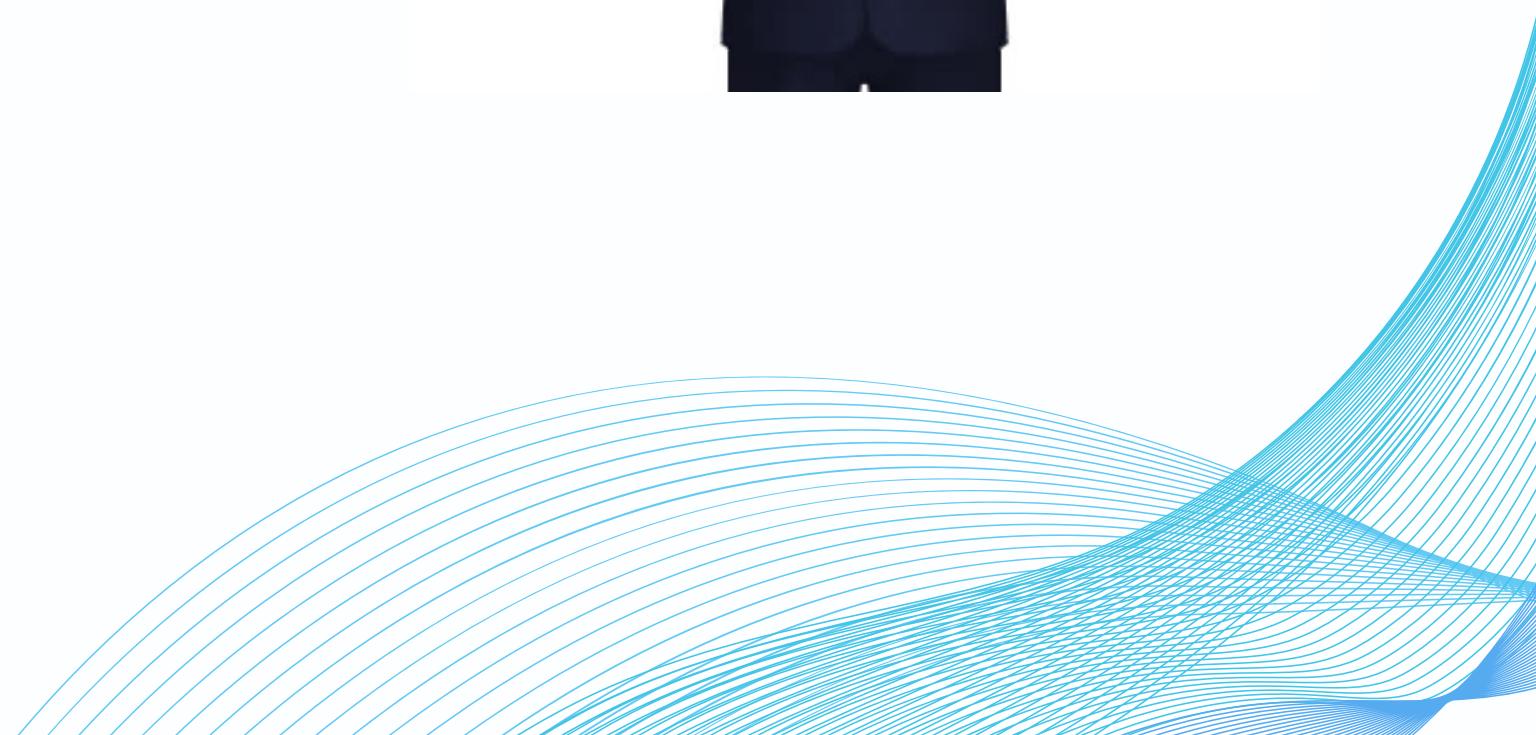
PROBLEM STATEMENT

PROBLEM STATEMENT

(THE LOST LANGUAGES OF THE ARAB DEAF COMMUNITY)

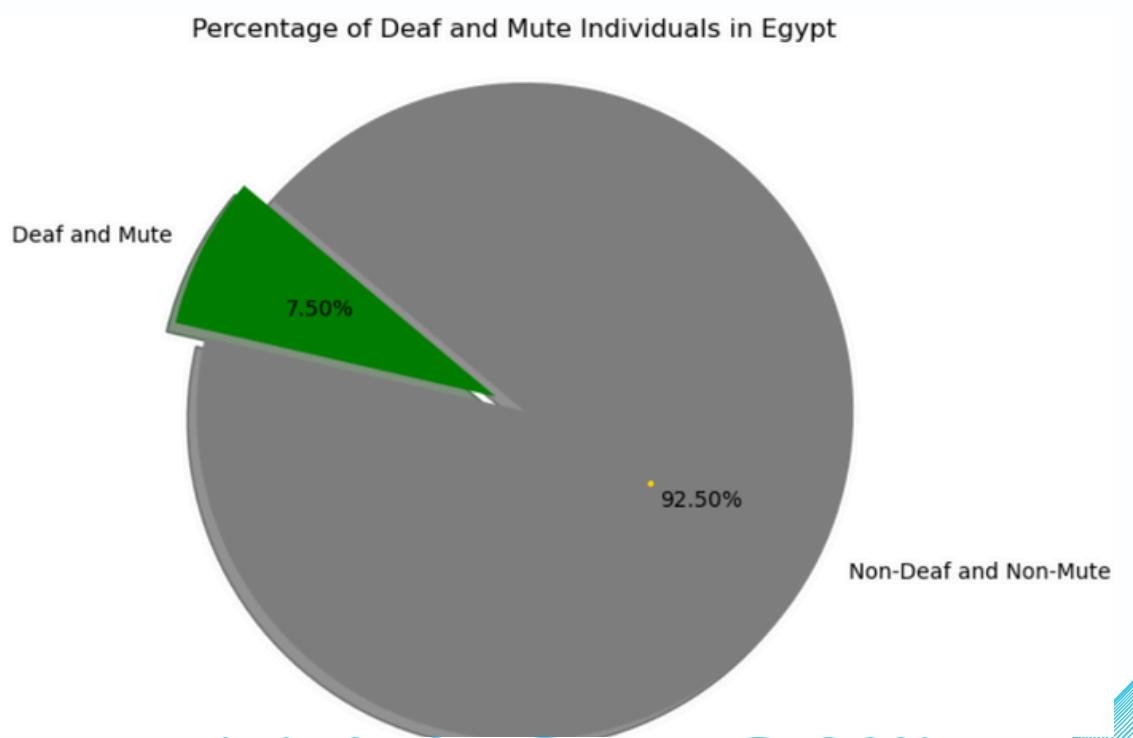
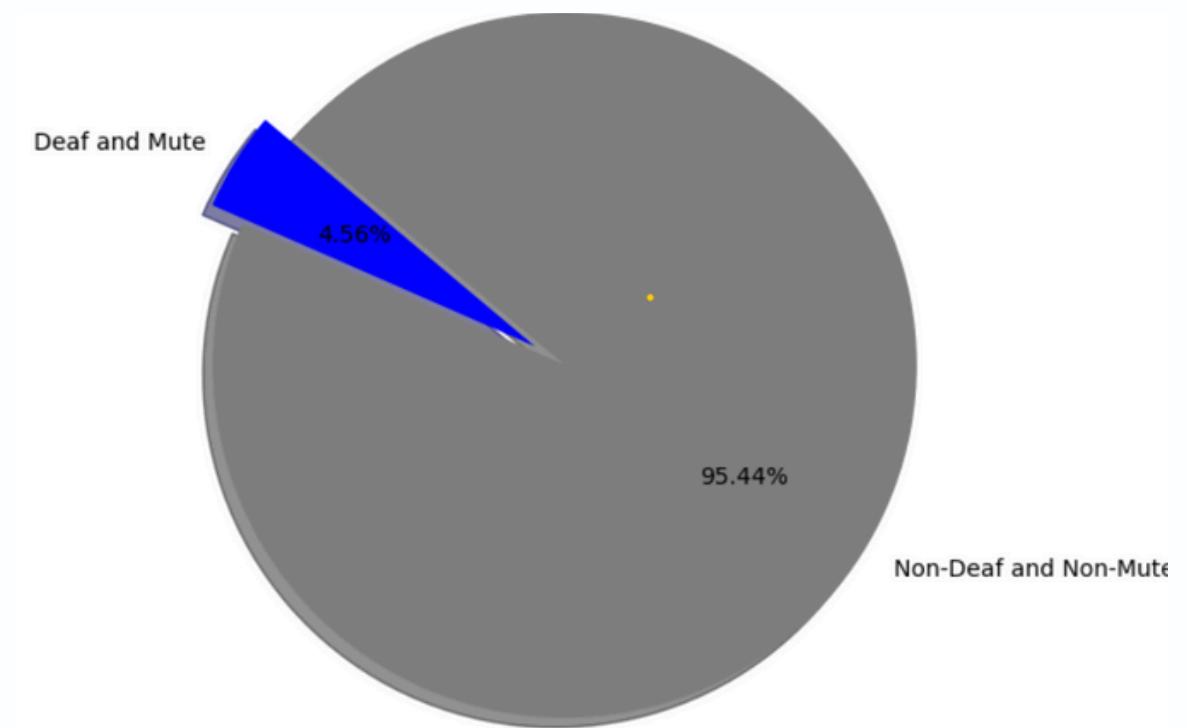
Despite recent advancements in sign language recognition, several significant challenges remain in developing robust and reliable systems for Arabic Sign Language Recognition (ArSLR). These challenges are particularly pronounced due to specific issues such as

- **Impact on the Deaf Community**
- **Lack of Publicly Available ArSL Datasets**
- **Lack of Awareness and Funding**



PROBLEM STATEMENT(CONT.)

- Deaf individuals face challenges including:
 - Communication barriers
 - Limited access to education
 - Employment discrimination
 - Social isolation
 - Difficulty accessing services
- They play a crucial role in society, representing a significant portion of the population.
- Statistics:
 - Worldwide: **4.56%** Deaf and Mute, **95.44%** Hearing
 - In Egypt: **7.50%** Deaf and Mute, **92.50%** Hearing

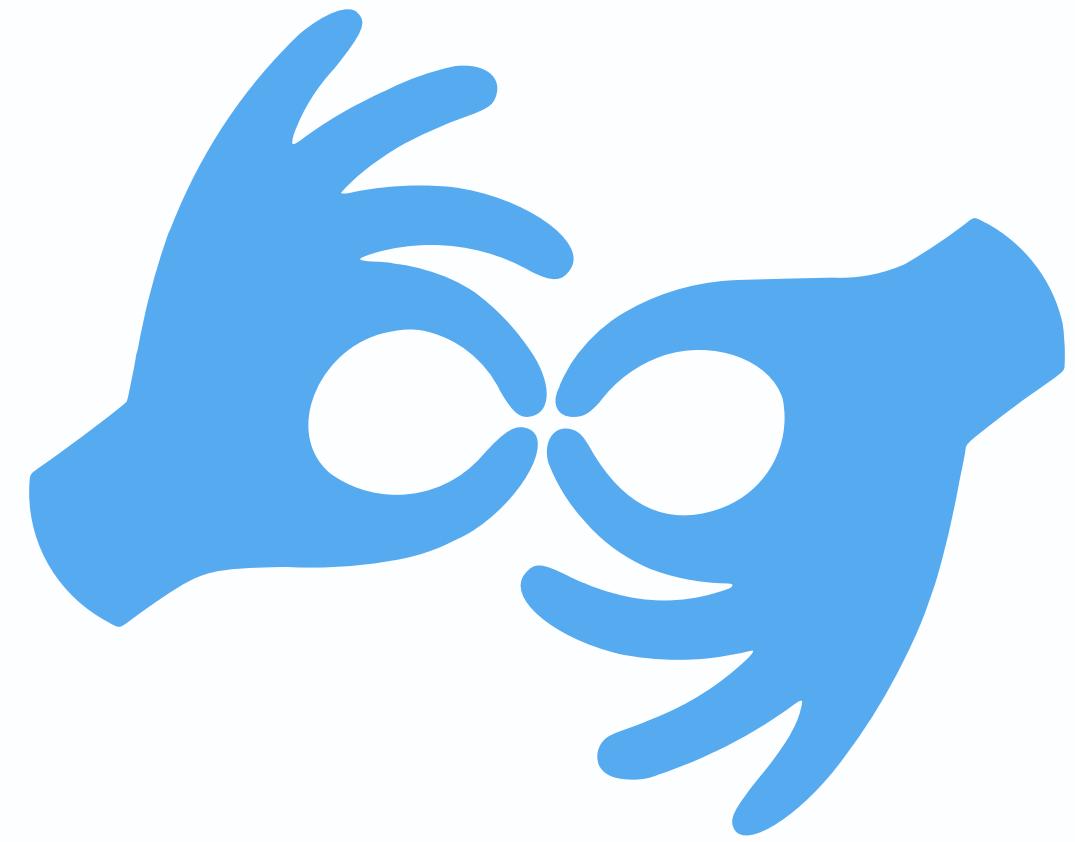


02

PROJECT DESCRIPTION

PROJECT DESCRIPTION

Esma3ny, an application that has been developed to support the hand-of-hearing, deaf and dumb communities to reduce and break down the gap between them and the rest of the community.



03

GOALS AND OBJECTIVES

GOALS AND OBJECTIVES

Our goals and objectives are:

- Make deaf people communicate with us
- Add as many words to make sure that communication make easily
- Make high accuracy as possible



04

FUNCTIONAL AND NON-FUNCTIONAL REQUIREMENTS

FUNCTIONAL AND NON-FUNCTIONAL REQUIREMENTS

Functional

- Login
- Record a Video
- Upload a Video
- Play the record
- Logout

Non -Functional

- Reliability
- Usability
- Accessibility
- Flexibility

05

PRIOR SOLUTIONS - RELATED WORK

PRIOR SOLUTIONS - RELATED WORK

| Paper | Year | Used Model | Accuracy | Challenges |
|----------------------------------------------------------------------------------------------------------------------------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Arabic Sign Language Recognition using Lightweight CNN-based Architecture [Link] | 2022 | lightweight EfficientNet CNN architecture | 94.30% | The document discusses challenges in Arabic Sign Language (ArSL) recognition. Some of the challenges include the similarity between some of the letters. For instance, the signs for the letters “seen” and “fa” are quite similar. Additionally, cultural variations in signing across the 22 Arab countries can cause difficulties. |
| Signer-Independent Arabic Sign Language Recognition System Using Deep Learning Model [Link] | 2023 | CNN-LSTM-SelfMLP architecture with MobileNetV2 and ResNet18 backbones, focusing on segmenting the face and hand regions to improve recognition. | The best model achieved 87.69% accuracy, with precision, recall, F1 score, and specificity all around 87-88%. | Although the model showed significant improvement, the complexity of the multi-stage processing might limit real-time applications and increase computational requirements |
| Classification Model Utilizing Facial Landmark Tracking [Link] | 2022 | Random Forest Classifier combined with Principal Component Analysis (PCA) on facial landmarks to classify ASL sentences. | 86.5% | The model relies heavily on facial landmarks and may struggle with sign language gestures that involve more complex hand and body movements beyond facial cues |
| A Real-Time Arabic Sign Language Alphabets (ArSLA) Recognition Model Using Deep Learning Architecture [Link] | 2022 | AlexNet architecture for recognizing Arabic sign language alphabets | 94.81% | The model's performance was mainly validated in a controlled environment, which might not fully represent real-world conditions with varying signers and backgrounds |
| Arabic Sign Language Recognition Using Convolutional Neural Network and MobileNet [Link] | 2020 | CNNs, specifically leveraging MobileNet for its efficiency and performance on mobile devices. | 94.86% | The model's real-time performance and robustness in diverse lighting conditions and backgrounds were not extensively evaluated |

06

DATASET DESCRIPTION

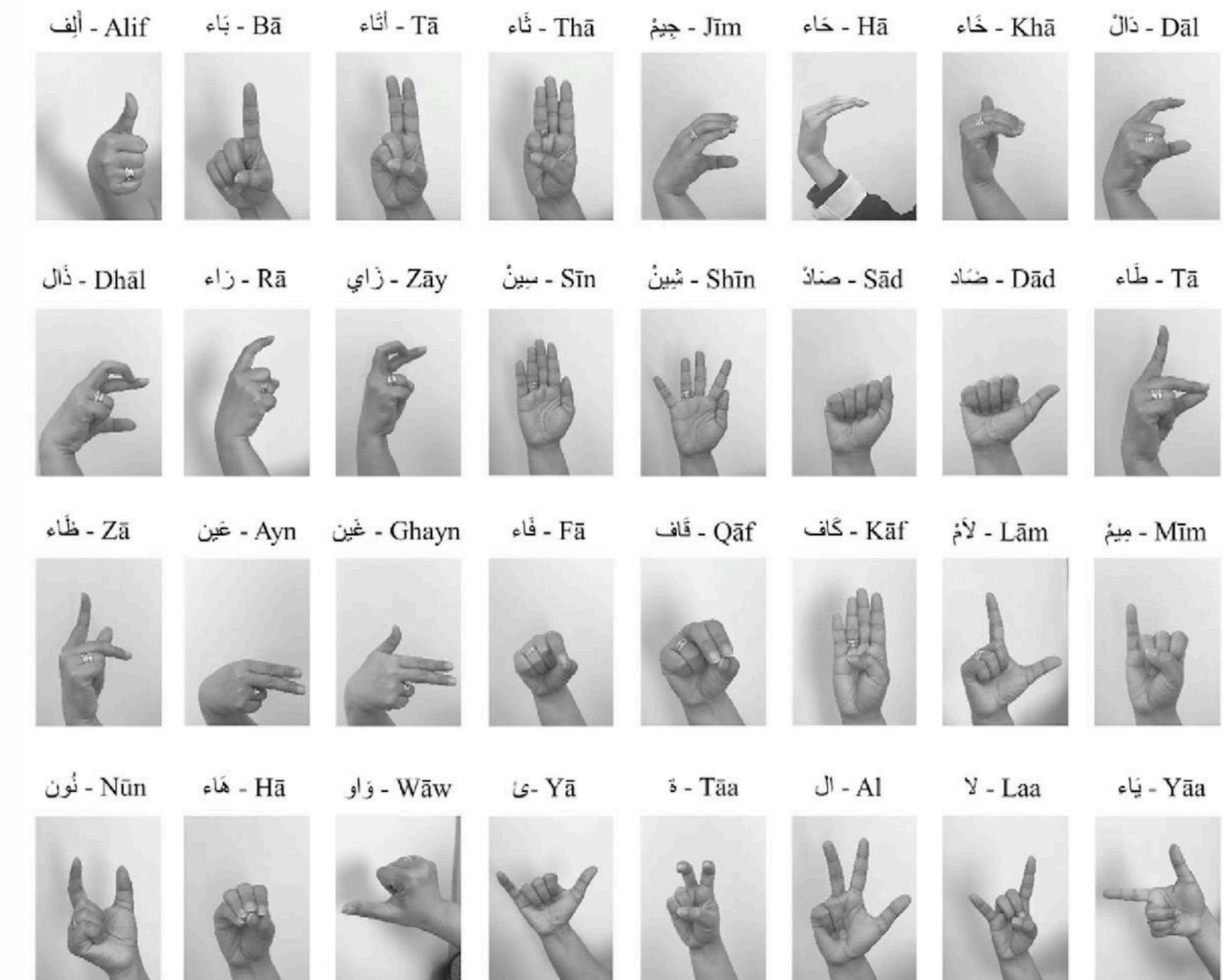
DATA SET DESCRIPTION

- **Letter Recognition**

- 55,000 images
- 28 classes (Arabic letters)
- Resolution: 224 x 224 pixels
- Purpose: Train models like VGG16 for letter-to-text conversion.

- **Word Recognition**

- Common Arabic sign words (e.g., "Father," "Mother," "Sister," "Egypt," "Brother," "How Are You," "I")
- NumPy arrays, 30 fps
- Purpose: Train models like Conv1D for sign-to-word conversion



07

PRE-PROCESSING AND MODELING

7.1

CASE ONE WORD BASED

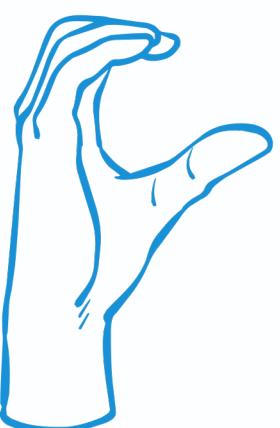
Case1 : Pre-Processing

1
Resizing The image to 224*224 to speed up the training process

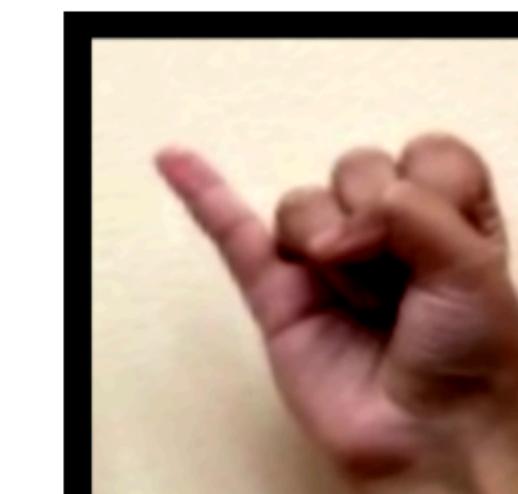
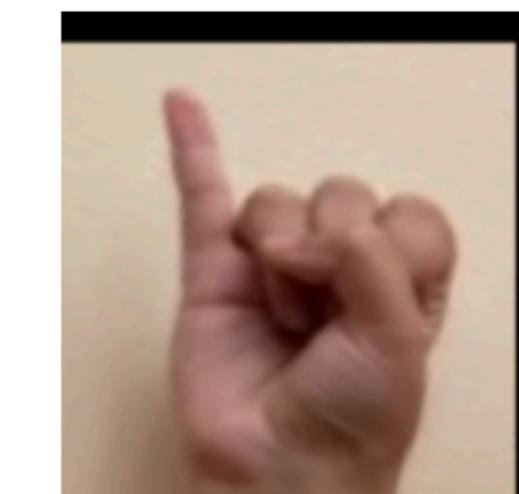
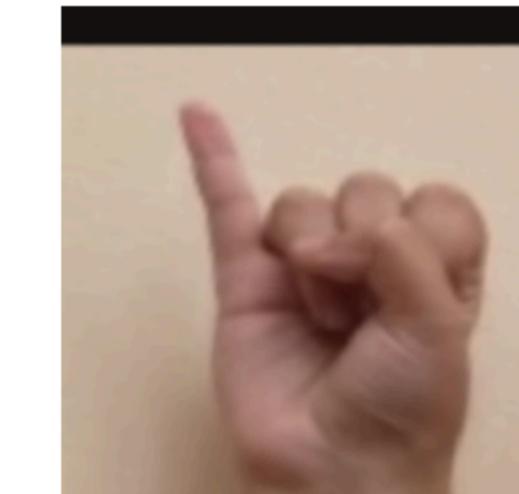
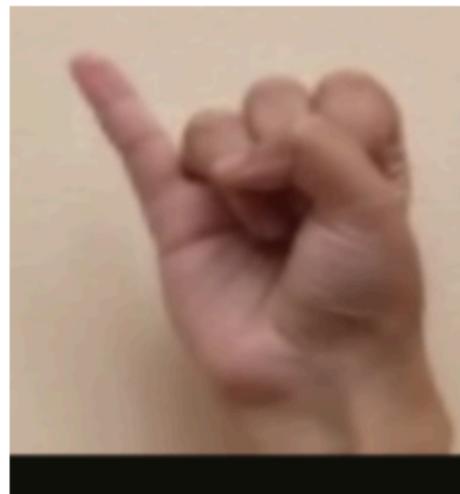
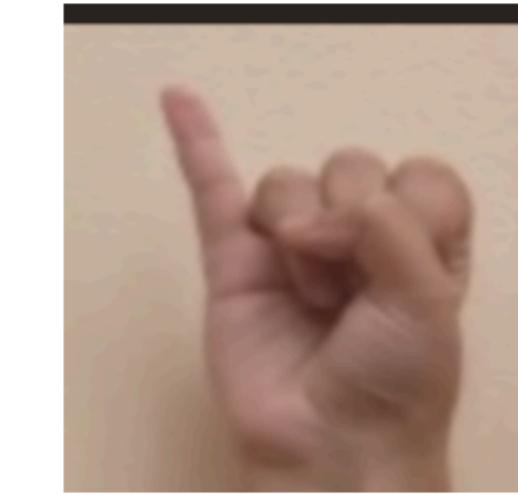
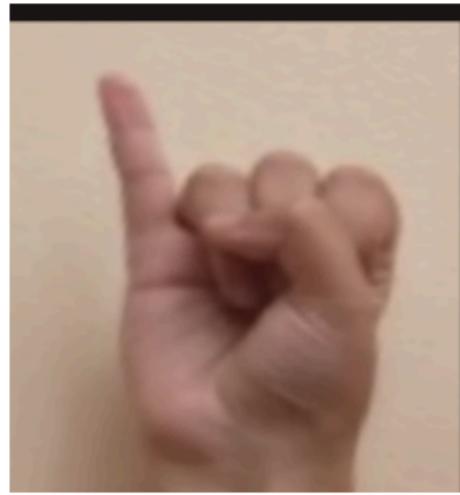
2
Custom Layer for Brightness and Contrast

3
Custom Layer for Augmentation

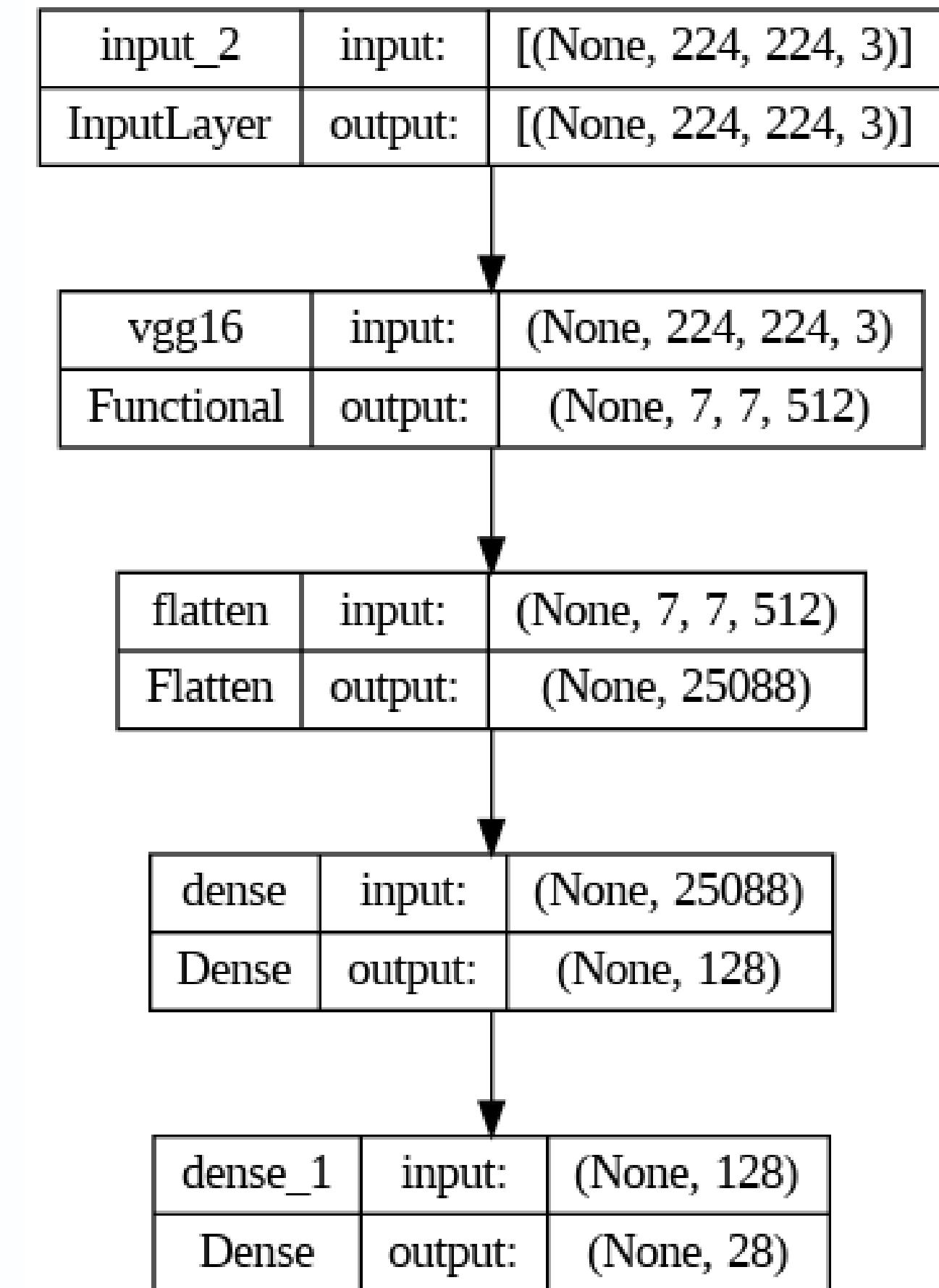
4
Labeling the data , Dividing it to Train, Validate, Test.



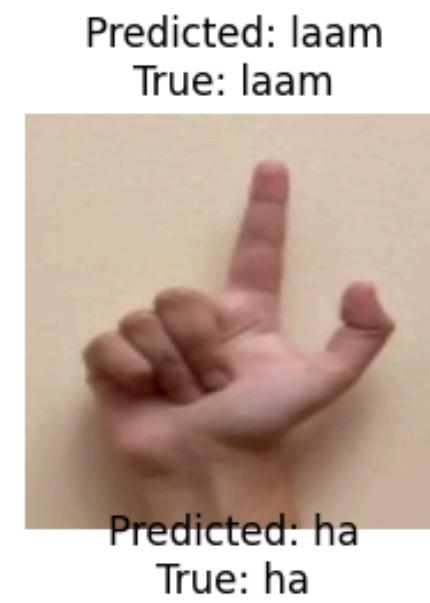
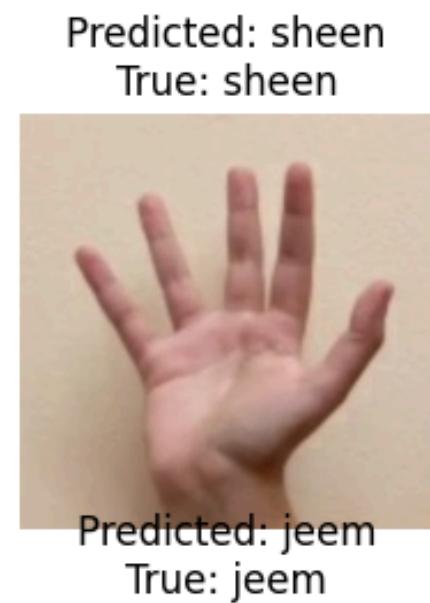
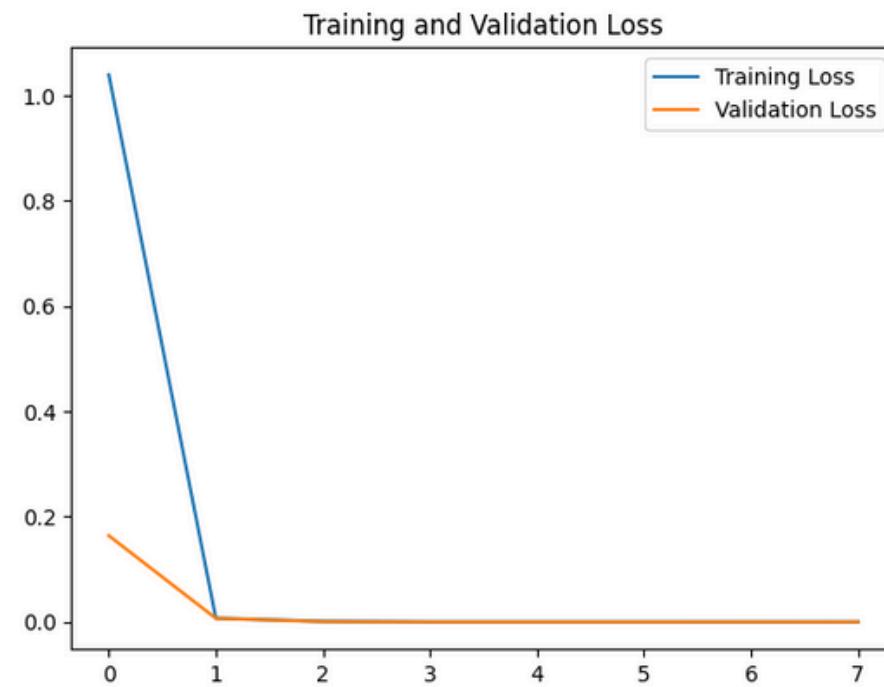
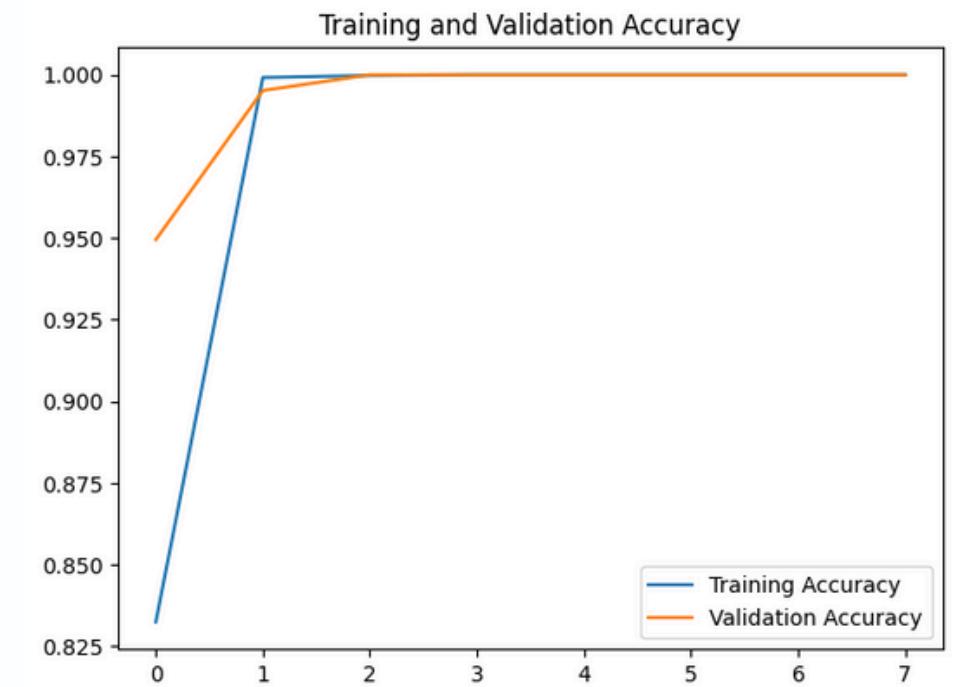
The Output of Augmentation Layer for Same Image



VGG16 Model Architecture for Letter Recognition



98% Accuracy After 20 Epoch



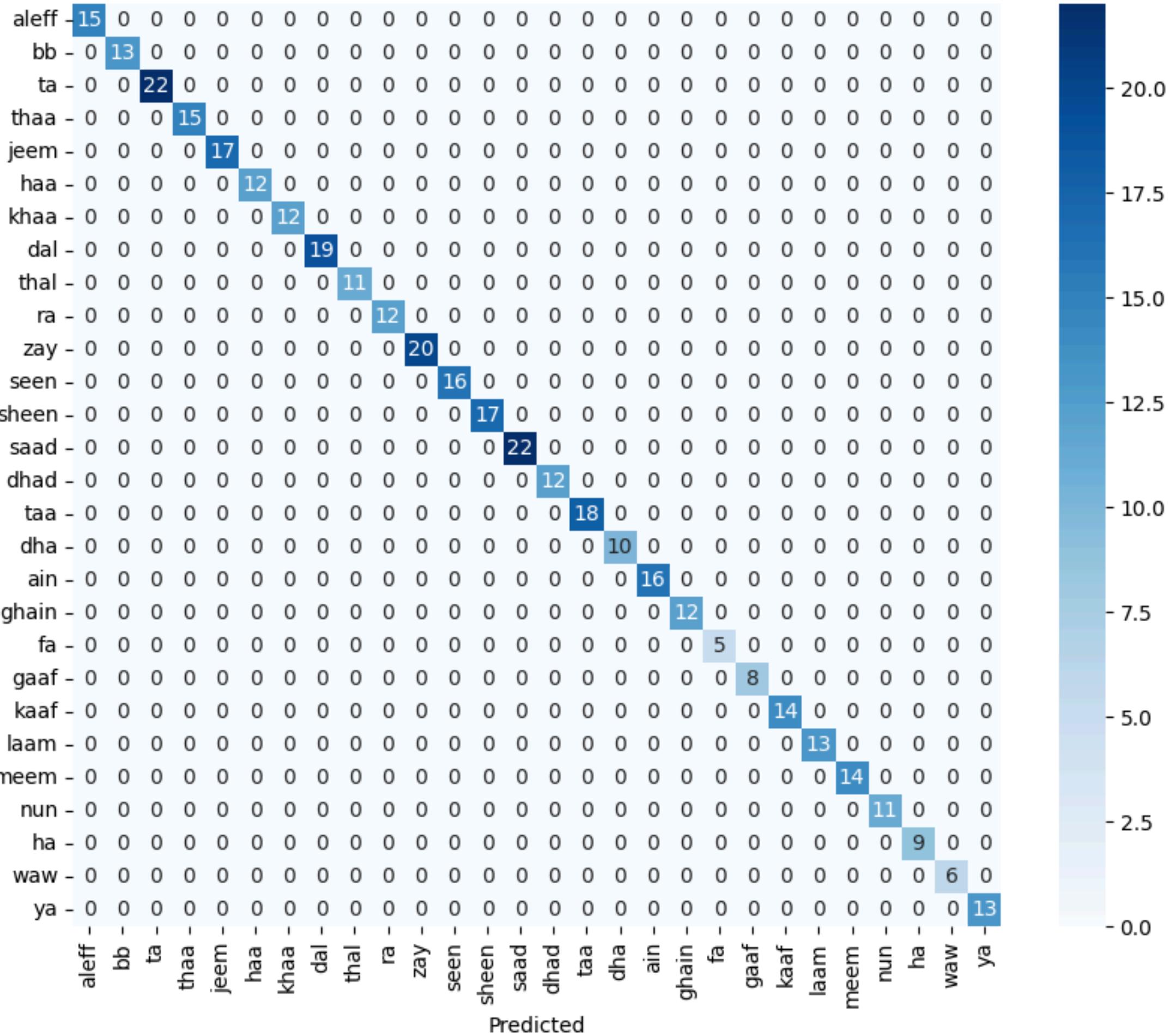
A Deep Dive into the Classification Report of the VGG16 Model

| | | | | |
|--------------|------|------|------|-----|
| ha | 1.00 | 1.00 | 1.00 | 10 |
| waw | 1.00 | 1.00 | 1.00 | 10 |
| ya | 1.00 | 1.00 | 1.00 | 17 |
| accuracy | | | 1.00 | 384 |
| macro avg | 1.00 | 1.00 | 1.00 | 384 |
| weighted avg | 1.00 | 1.00 | 1.00 | 384 |

| | precision | recall | f1-score | support |
|-------|-----------|--------|----------|---------|
| aleff | 1.00 | 1.00 | 1.00 | 14 |
| bb | 1.00 | 1.00 | 1.00 | 14 |
| ta | 1.00 | 1.00 | 1.00 | 19 |
| thaa | 1.00 | 1.00 | 1.00 | 18 |
| jeem | 1.00 | 1.00 | 1.00 | 15 |
| haa | 1.00 | 1.00 | 1.00 | 12 |
| khaa | 1.00 | 1.00 | 1.00 | 15 |
| dal | 1.00 | 1.00 | 1.00 | 18 |
| thal | 1.00 | 1.00 | 1.00 | 12 |
| ra | 1.00 | 1.00 | 1.00 | 14 |
| zay | 1.00 | 1.00 | 1.00 | 16 |
| seen | 1.00 | 1.00 | 1.00 | 16 |
| sheen | 1.00 | 1.00 | 1.00 | 17 |
| saad | 1.00 | 1.00 | 1.00 | 19 |
| dhad | 1.00 | 1.00 | 1.00 | 14 |
| taa | 1.00 | 1.00 | 1.00 | 12 |
| dha | 1.00 | 1.00 | 1.00 | 13 |
| ain | 1.00 | 1.00 | 1.00 | 10 |
| ghain | 1.00 | 1.00 | 1.00 | 13 |
| fa | 1.00 | 1.00 | 1.00 | 10 |
| gaaf | 1.00 | 1.00 | 1.00 | 9 |
| kaaf | 1.00 | 1.00 | 1.00 | 11 |
| laam | 1.00 | 1.00 | 1.00 | 11 |
| meem | 1.00 | 1.00 | 1.00 | 17 |
| nun | 1.00 | 1.00 | 1.00 | 8 |

the Confusion Matrix of the VGG16 Model

Confusion Matrix



7.2

CASE TWO LETTER BASED

Case2 : Pre-Processing

Keypoints using MP
Holistic

1

2

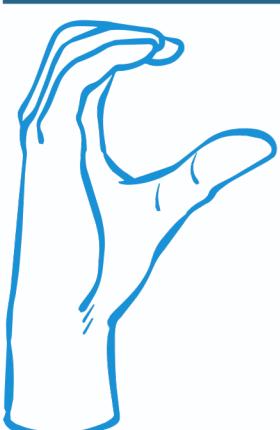
Extract Keypoint
Values

3

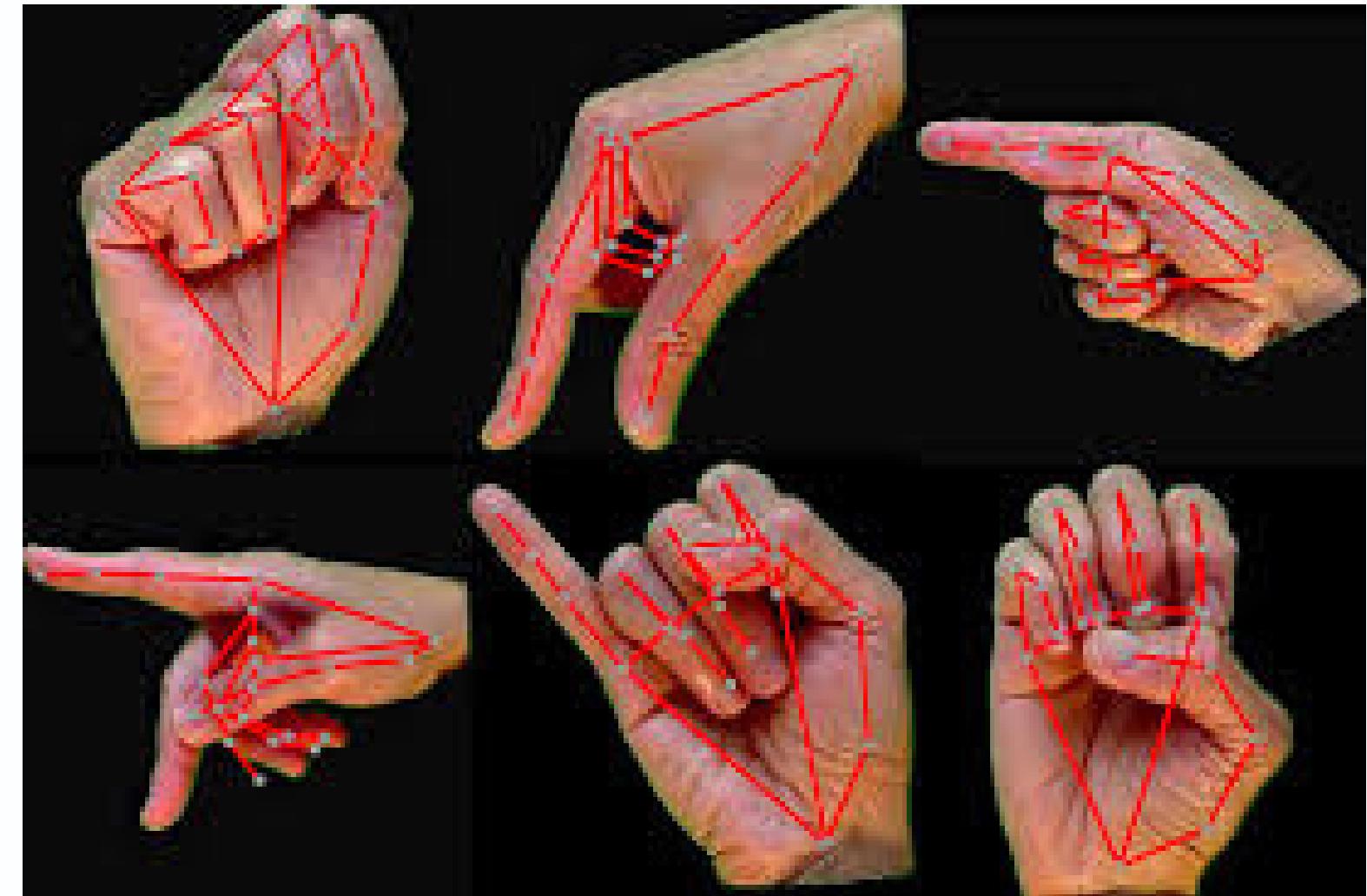
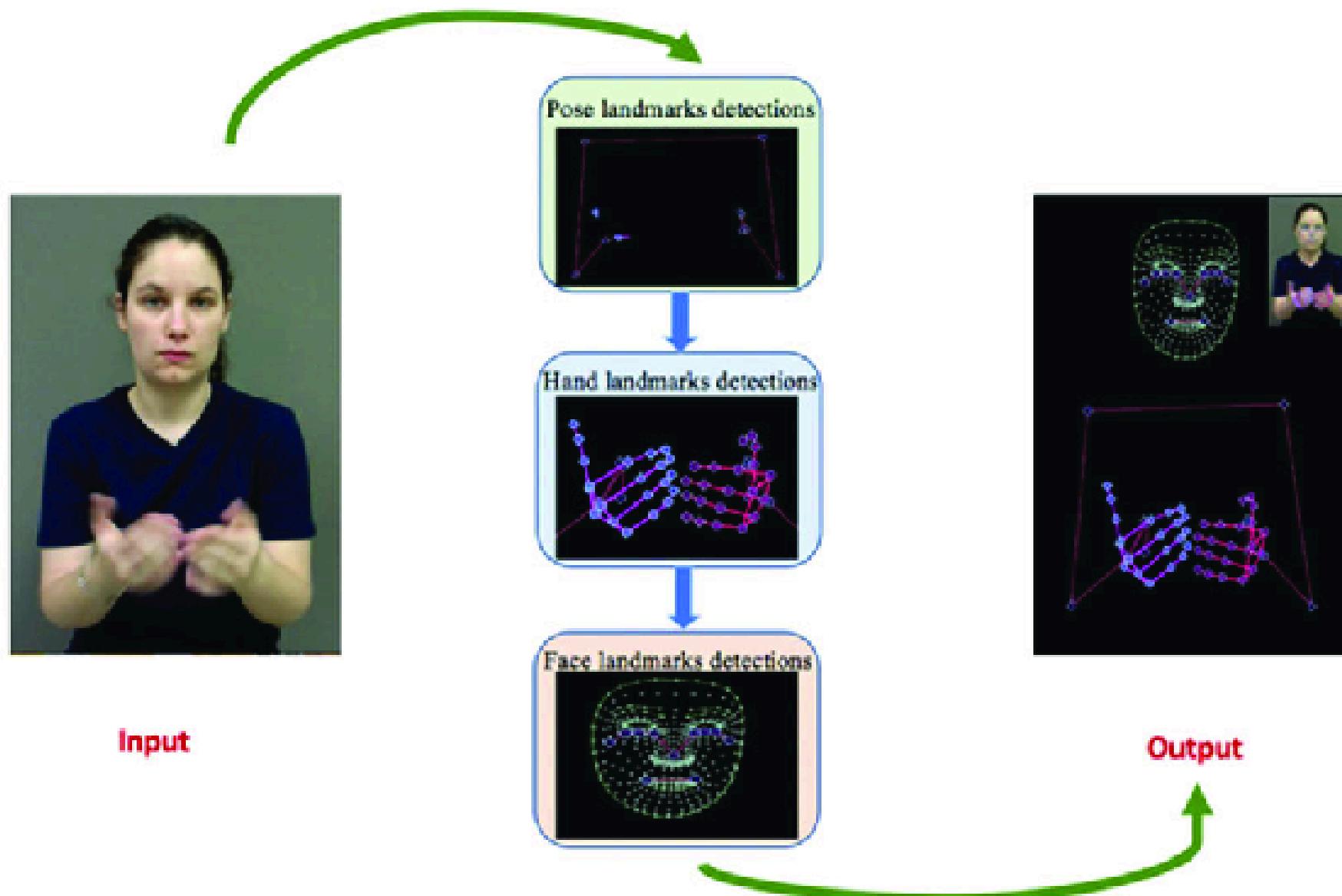
4

Preprocess Data and
Create Labels and
Features

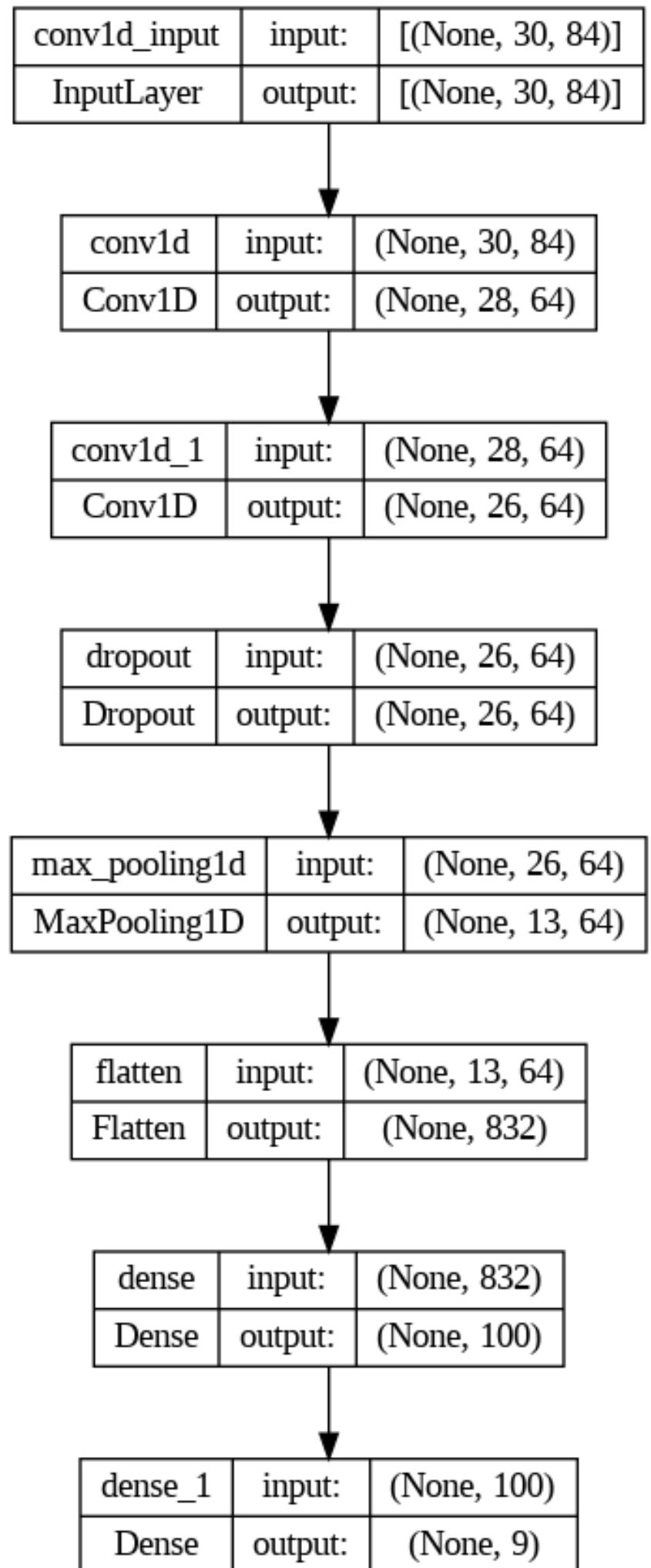
Data
Augmentation



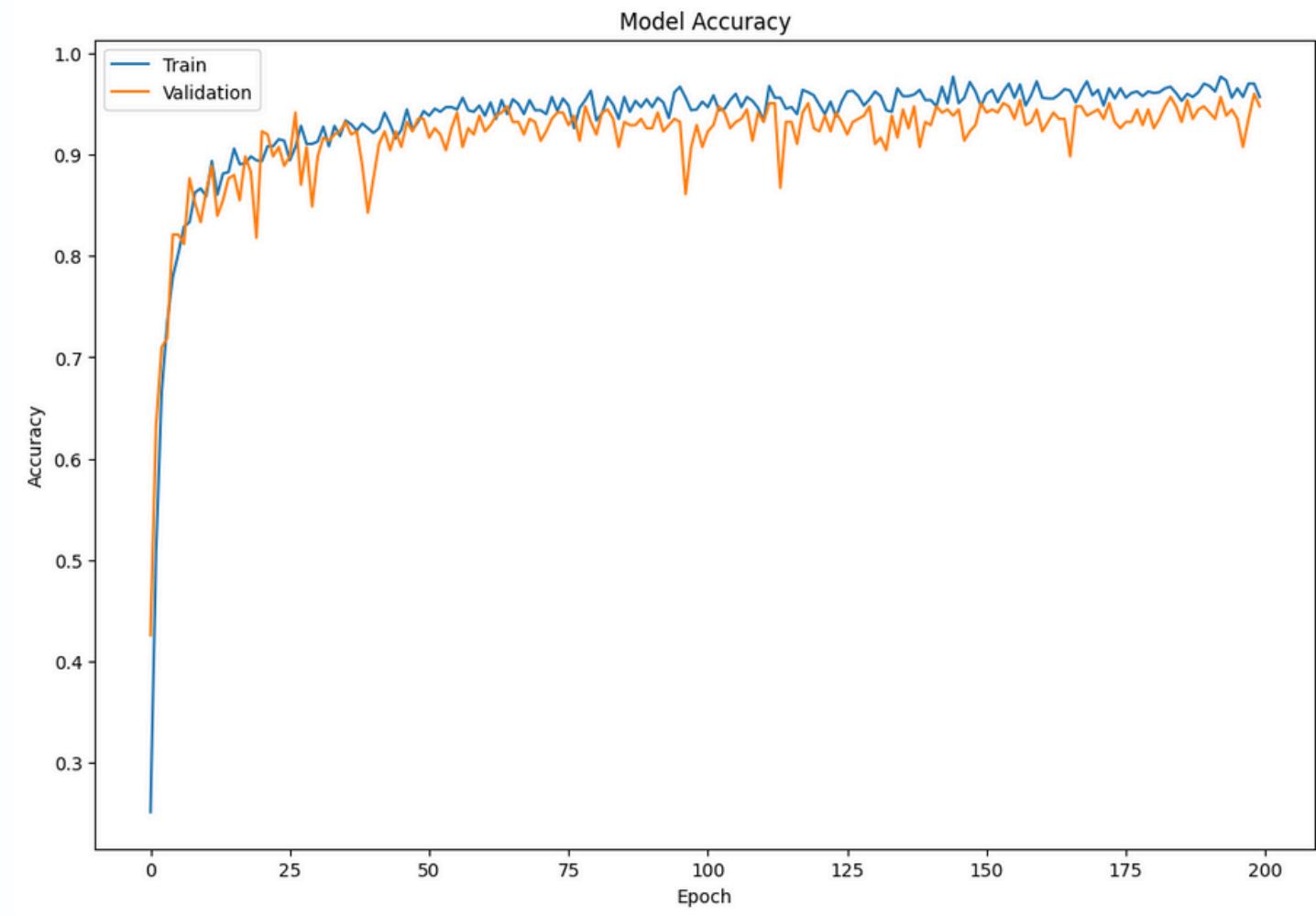
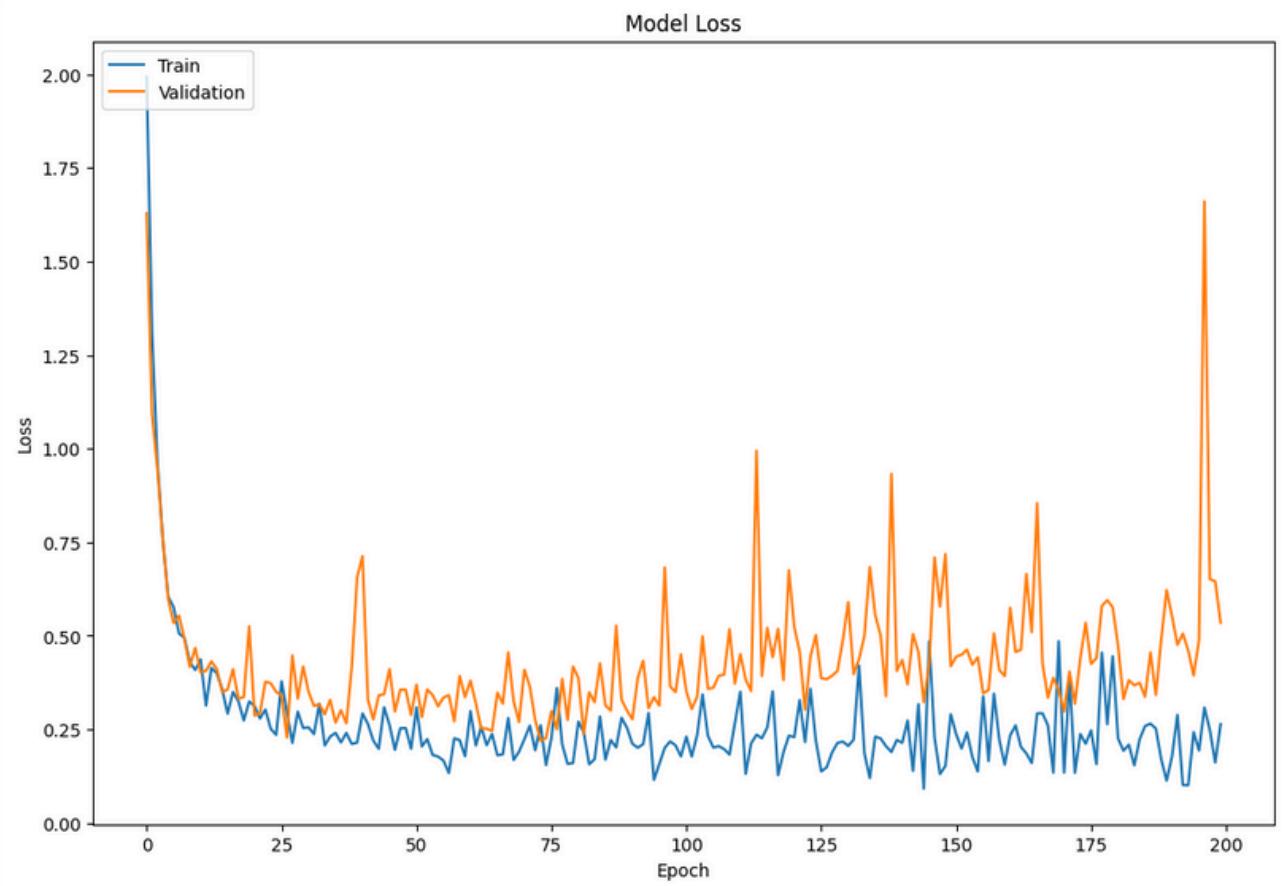
Detection & Extraction Landmarks



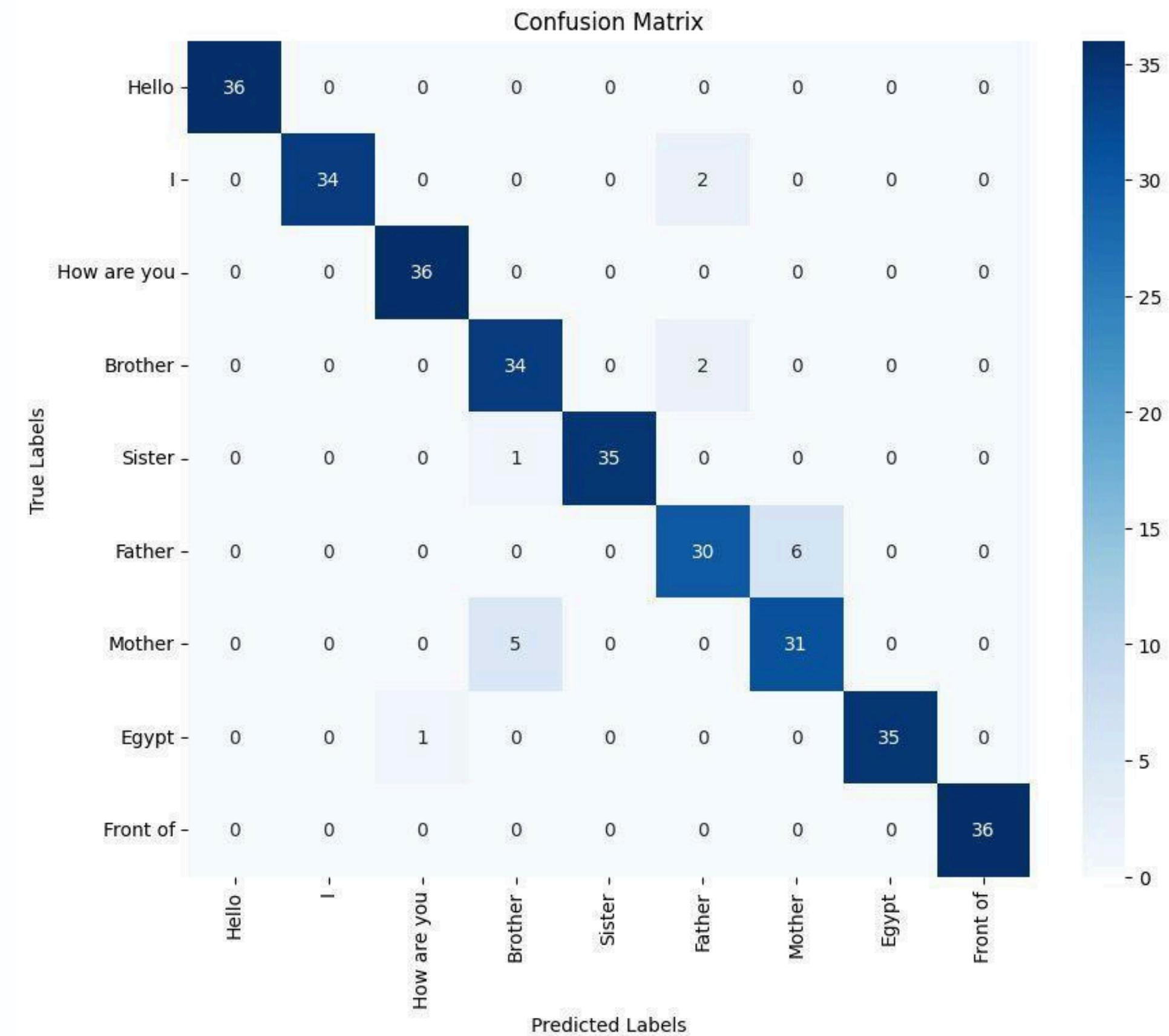
Conv1D Model Architecture for Word Recognition



**95% Accuracy
After 200 Epoch**



A Deep Dive into the Confusion Matrix of the Conv1D Model



The Confusion Matrix of the Conv1D Model

| | precision | recall | f1-score | support |
|--------------|-----------|--------|----------|---------|
| Hello | 1.00 | 1.00 | 1.00 | 36 |
| I | 1.00 | 0.94 | 0.97 | 36 |
| How are you | 0.97 | 1.00 | 0.99 | 36 |
| Brother | 0.85 | 0.94 | 0.89 | 36 |
| Sister | 1.00 | 0.97 | 0.99 | 36 |
| Father | 0.88 | 0.83 | 0.86 | 36 |
| Mother | 0.84 | 0.86 | 0.85 | 36 |
| Egypt | 1.00 | 0.97 | 0.99 | 36 |
| Front of | 1.00 | 1.00 | 1.00 | 36 |
| accuracy | | | 0.95 | 324 |
| macro avg | 0.95 | 0.95 | 0.95 | 324 |
| weighted avg | 0.95 | 0.95 | 0.95 | 324 |

08

THE PROPOSED FRAMEWORK

PROPOSED FRAMEWORK



Flask



Firebase



Flutter

Flask

We used it to deploy our model and
link between ML and Flutter



Flask

Flask(cont)

Flask designed to make getting started quick and easy, with the ability to scale up to complex applications.



Flask

Flask(cont)

Advantages

Is used in this scenario because it offers several advantages that make it suitable for developing the application to upload and process files.

- 1) Simplicity and flexibility**
- 2) Ease of Handling HTTP Request**
- 3) Strong Community and Documentation**
- 4) Development and Debugging Tools**

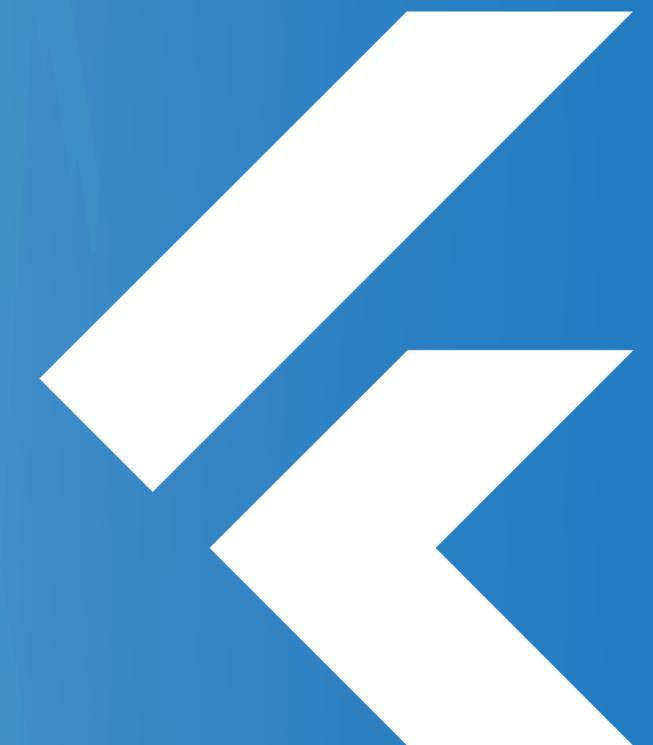
Firebase

firebase is back-end as a service, so
we used firebase in authentication
process



Flutter

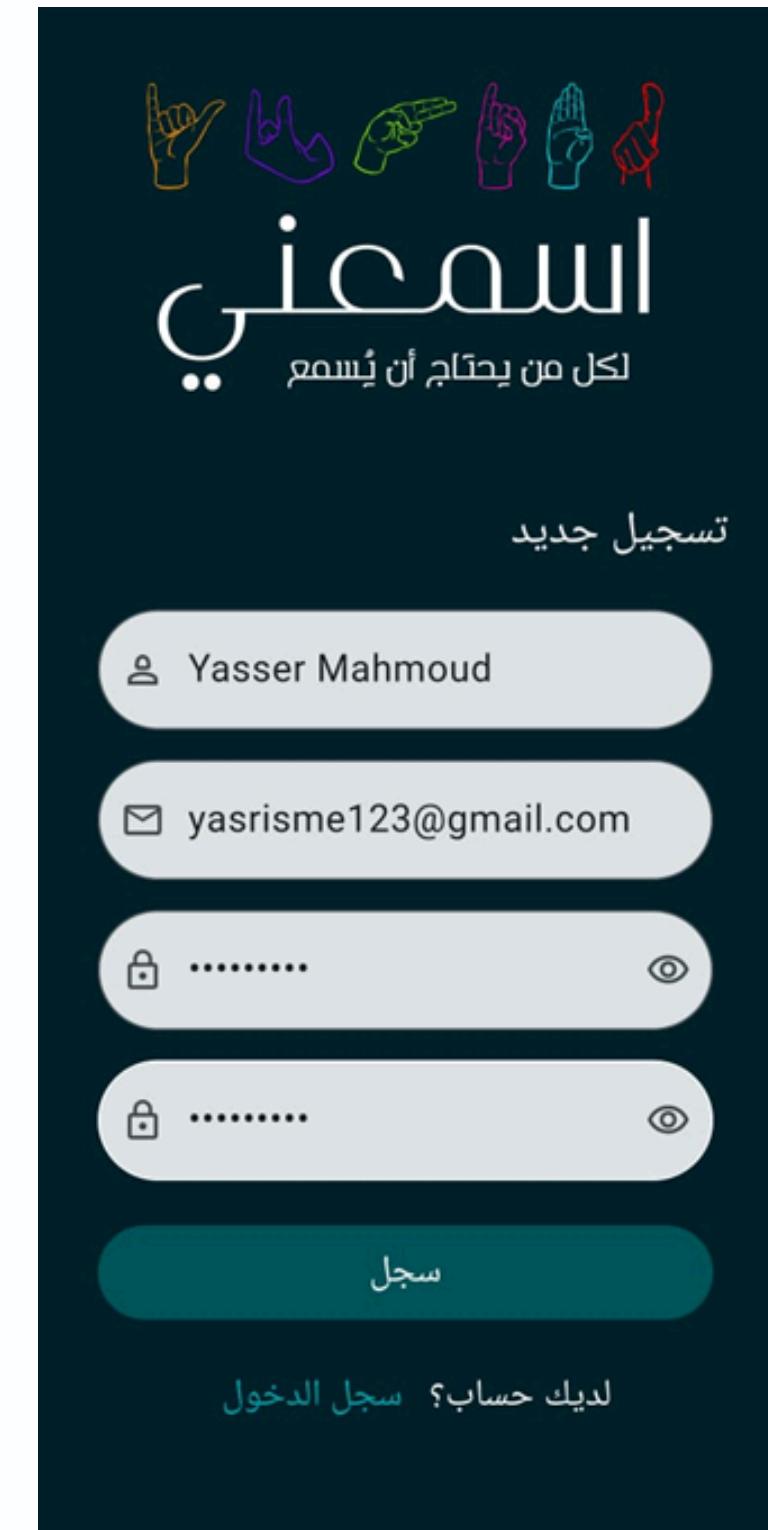
Flutter is cross platform mobile framework that we used to make the front end of the project



Flutter(cont)

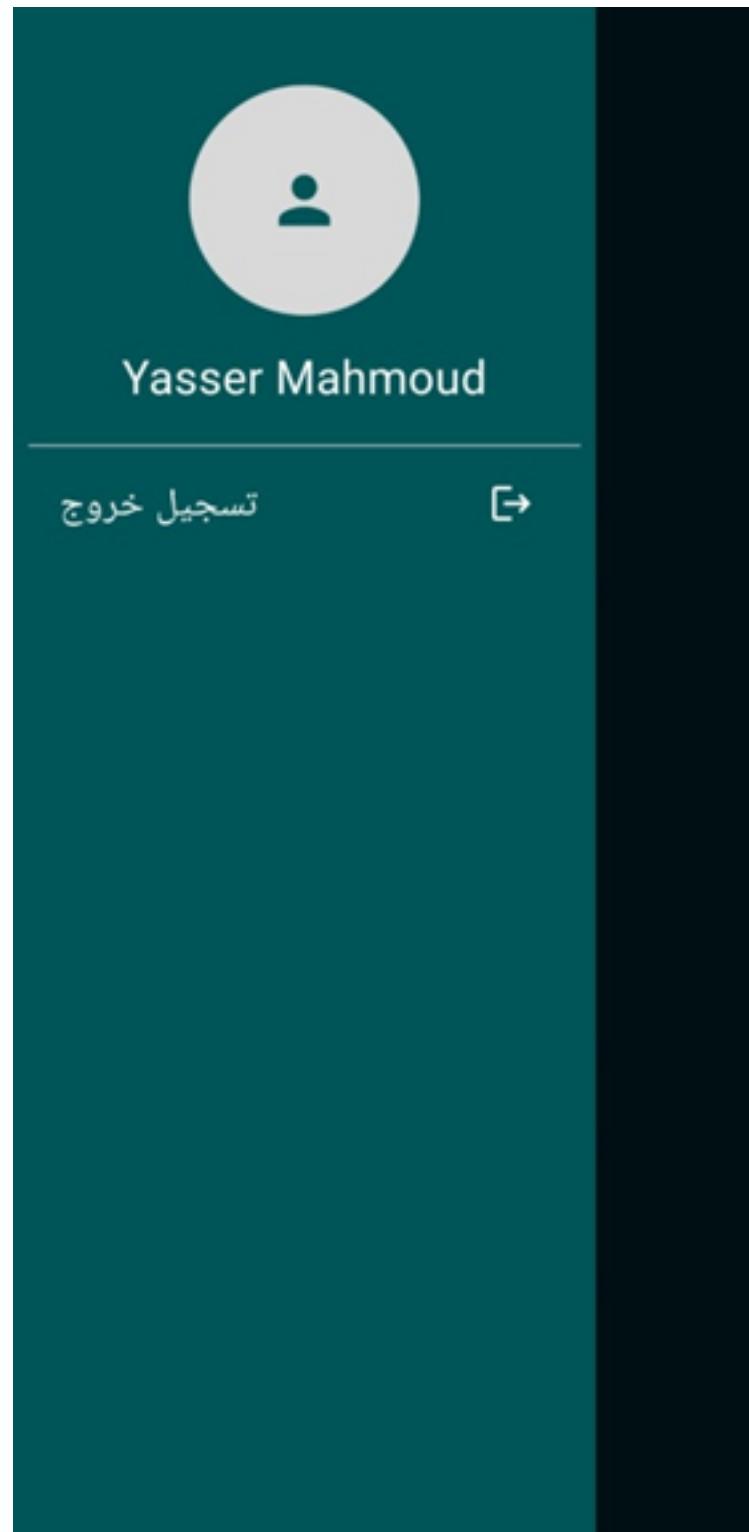


login page

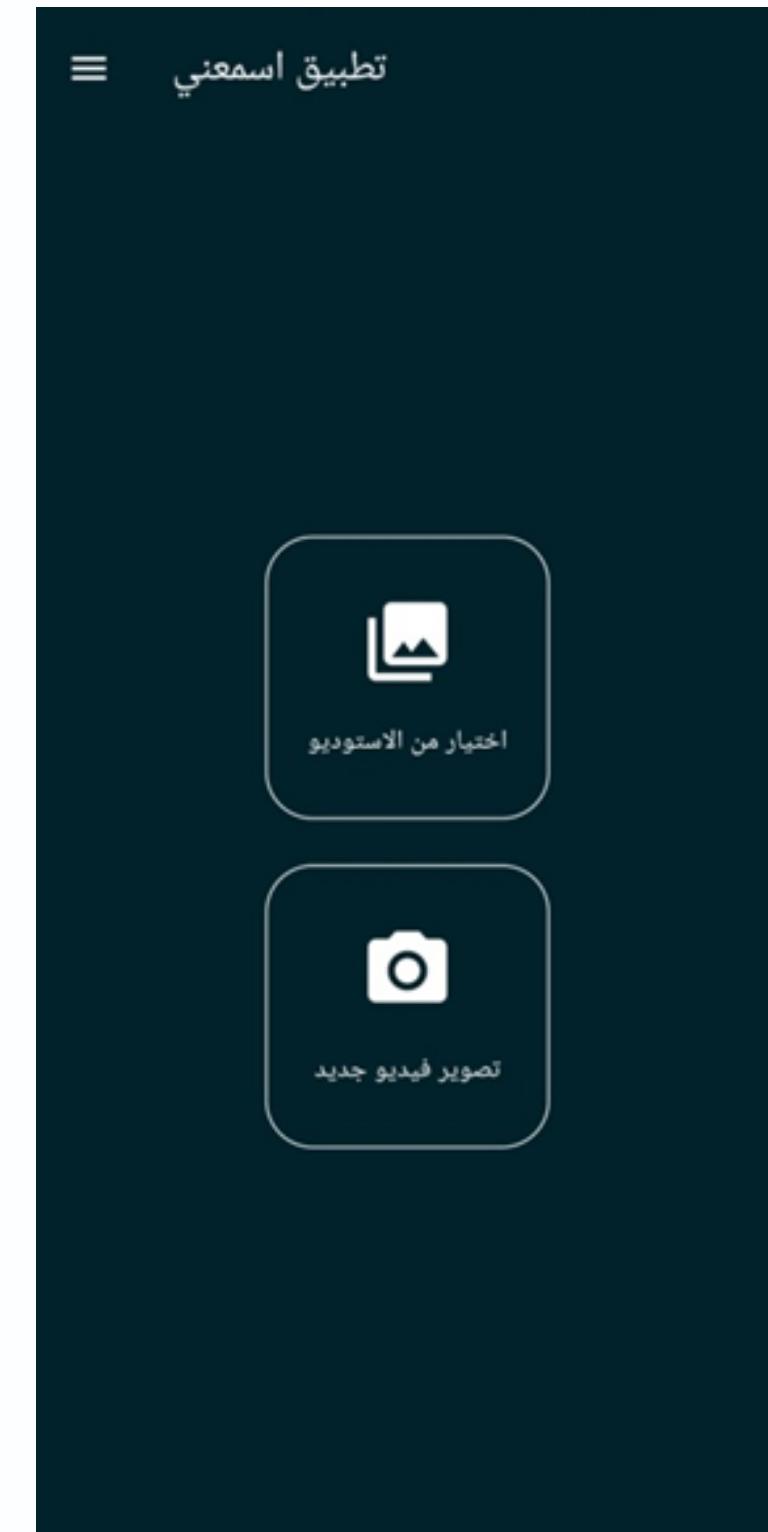


signup Page

Flutter(cont)

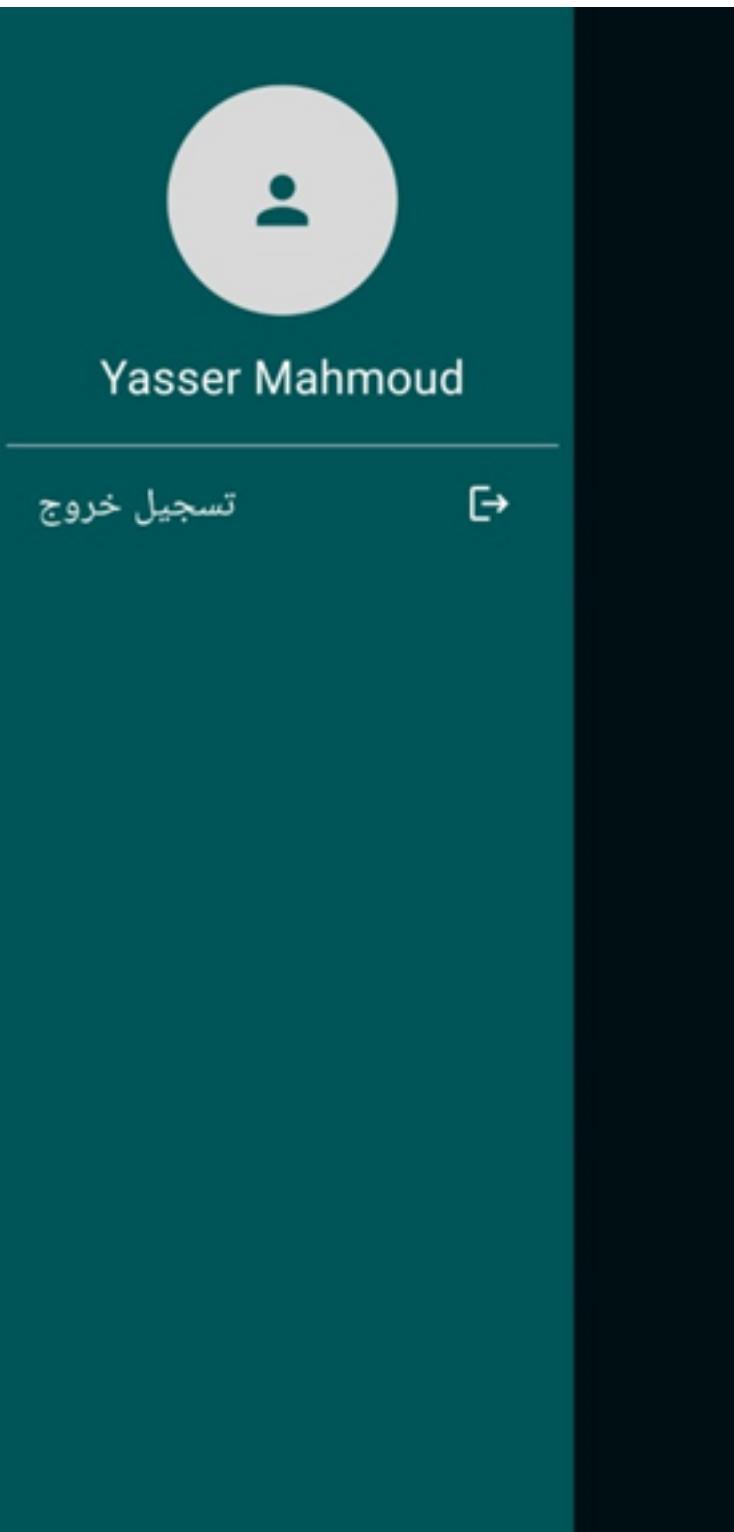


account slider

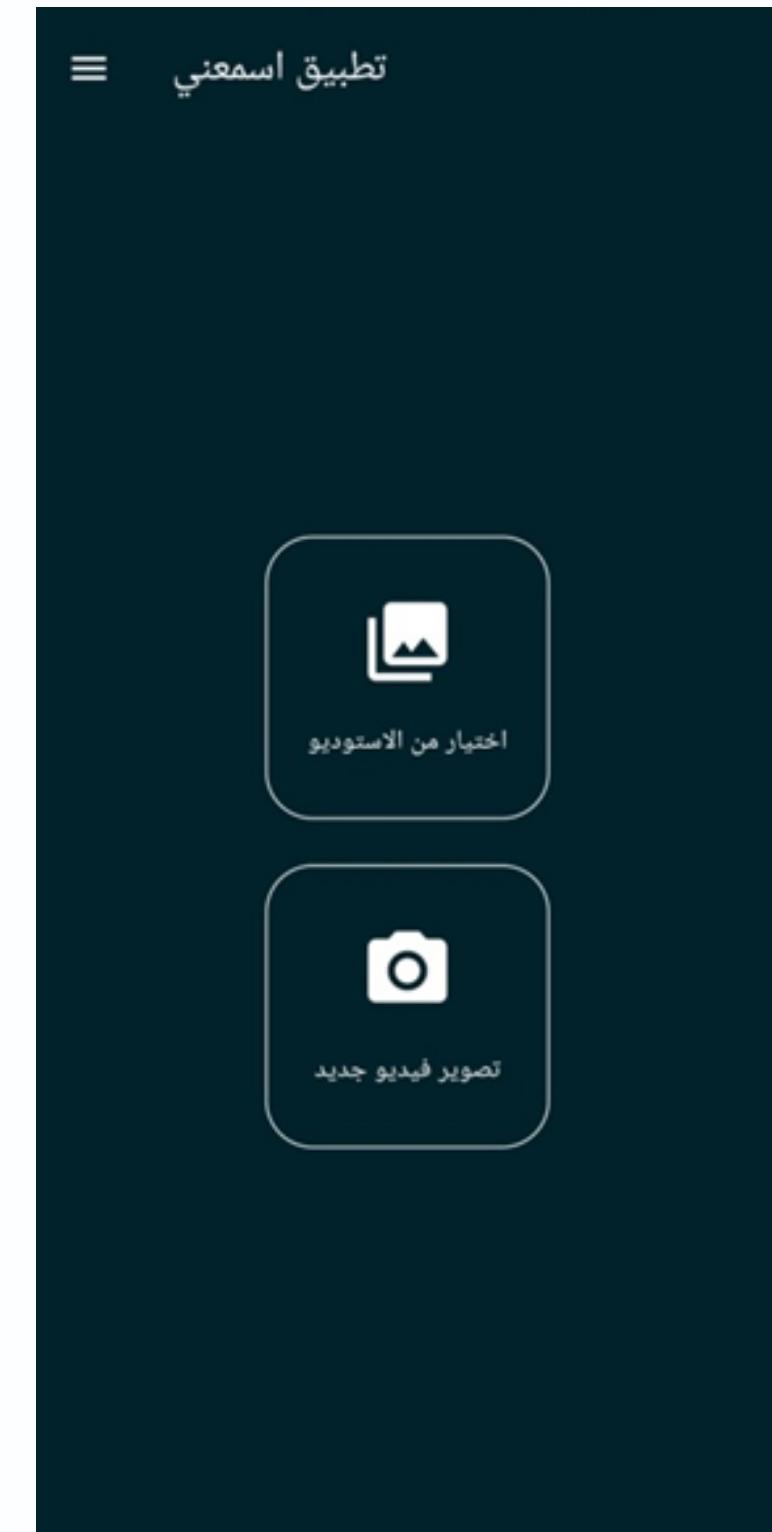


home page

Flutter(cont)

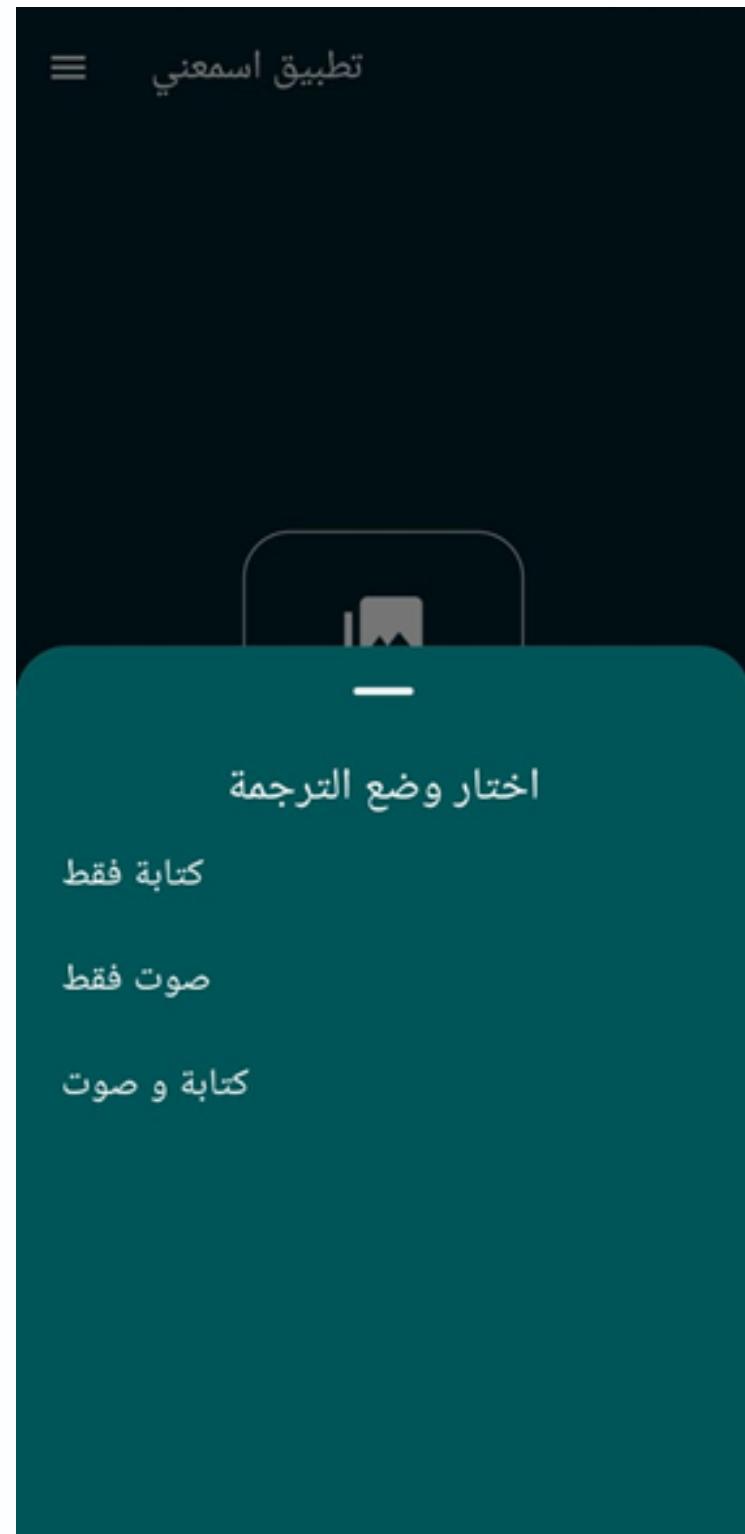


account slider

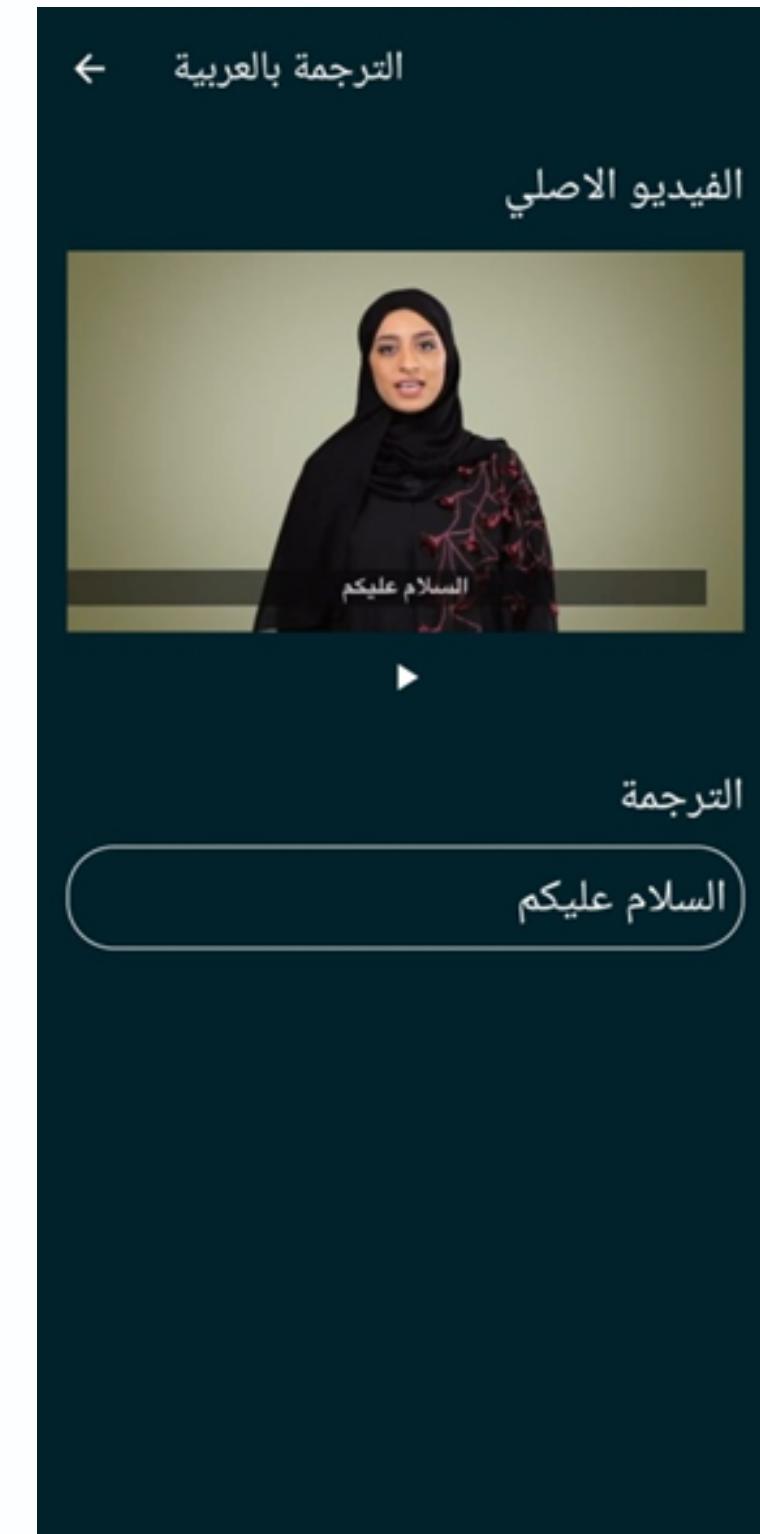


home page

Flutter(cont)

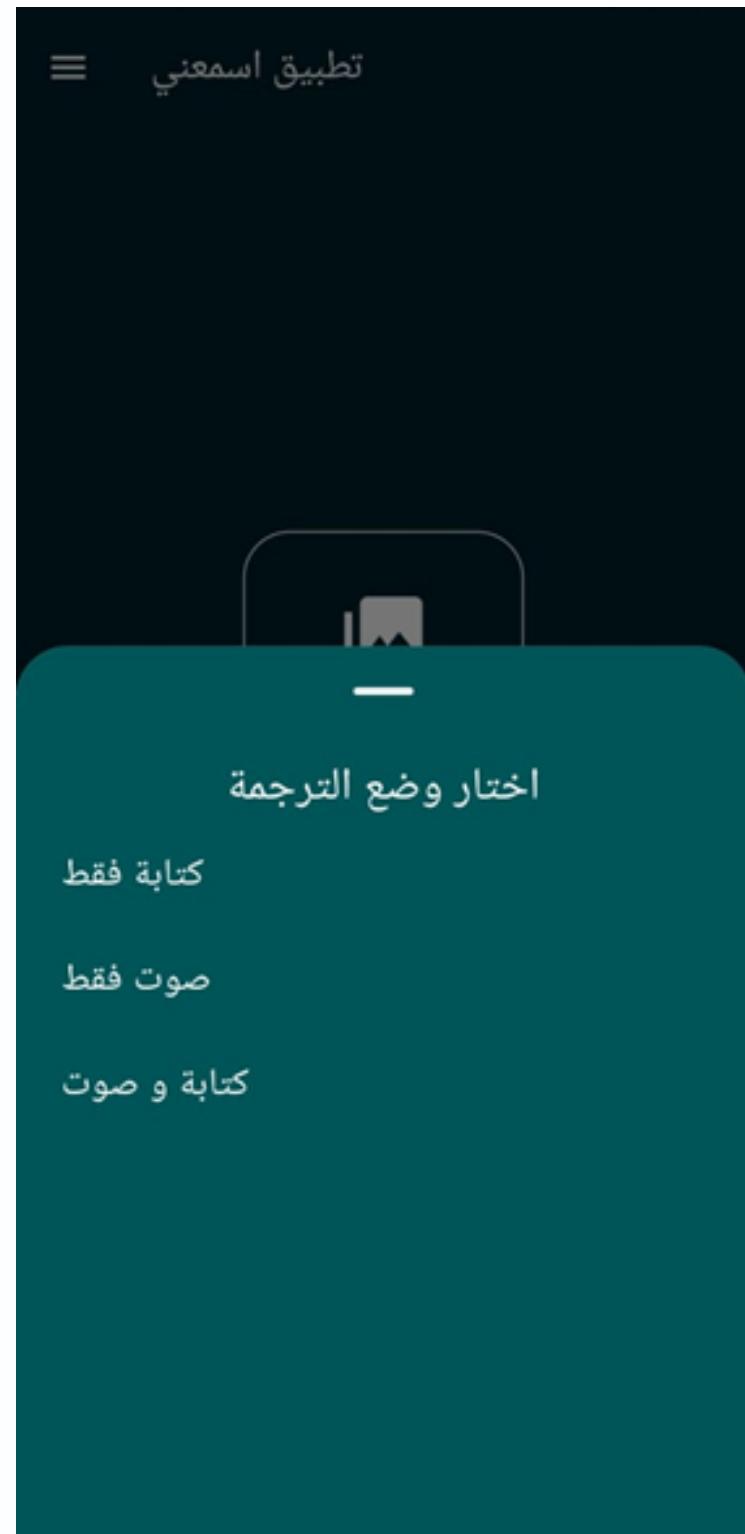


choose format
bottom sheet

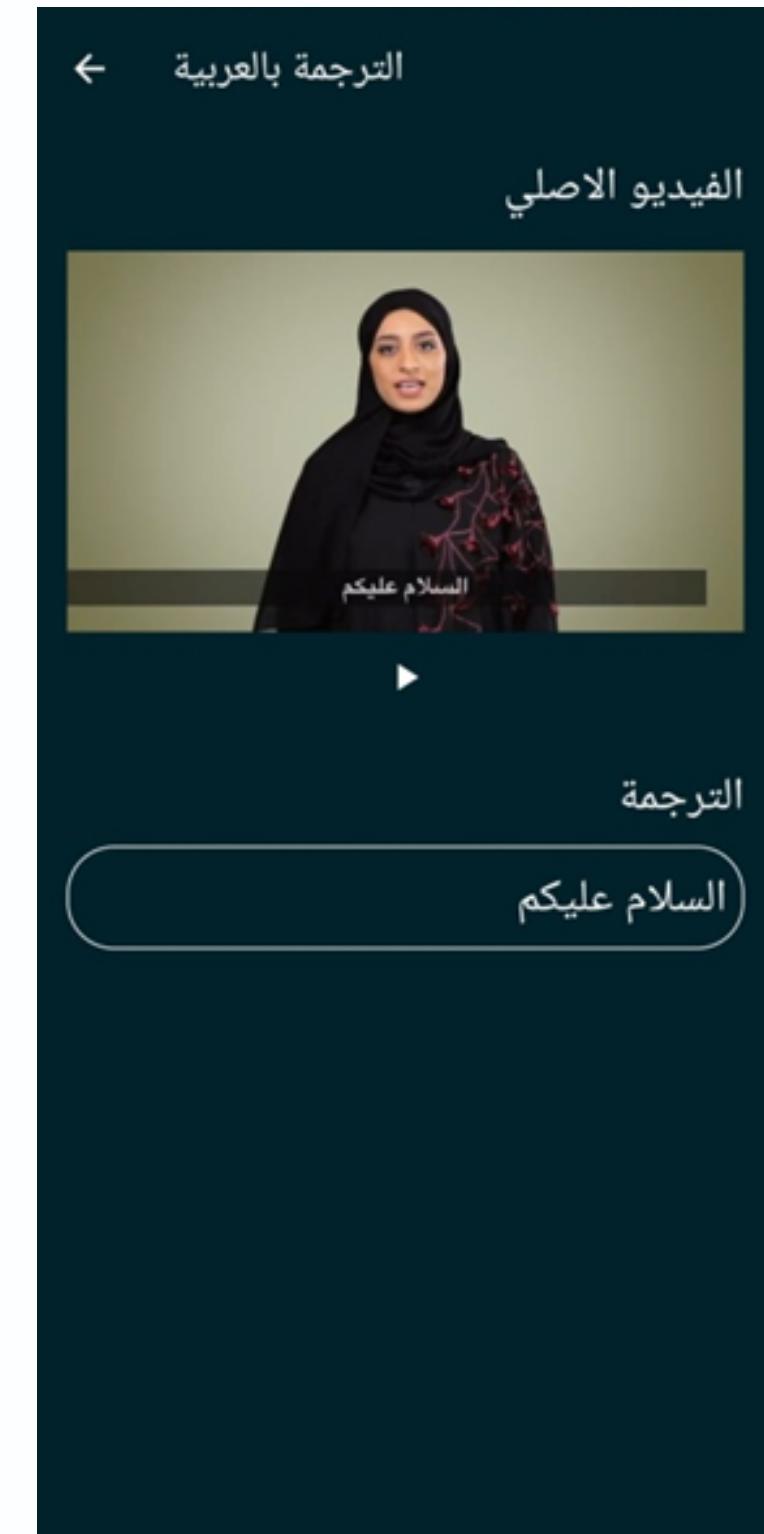


Text result page

Flutter(cont)

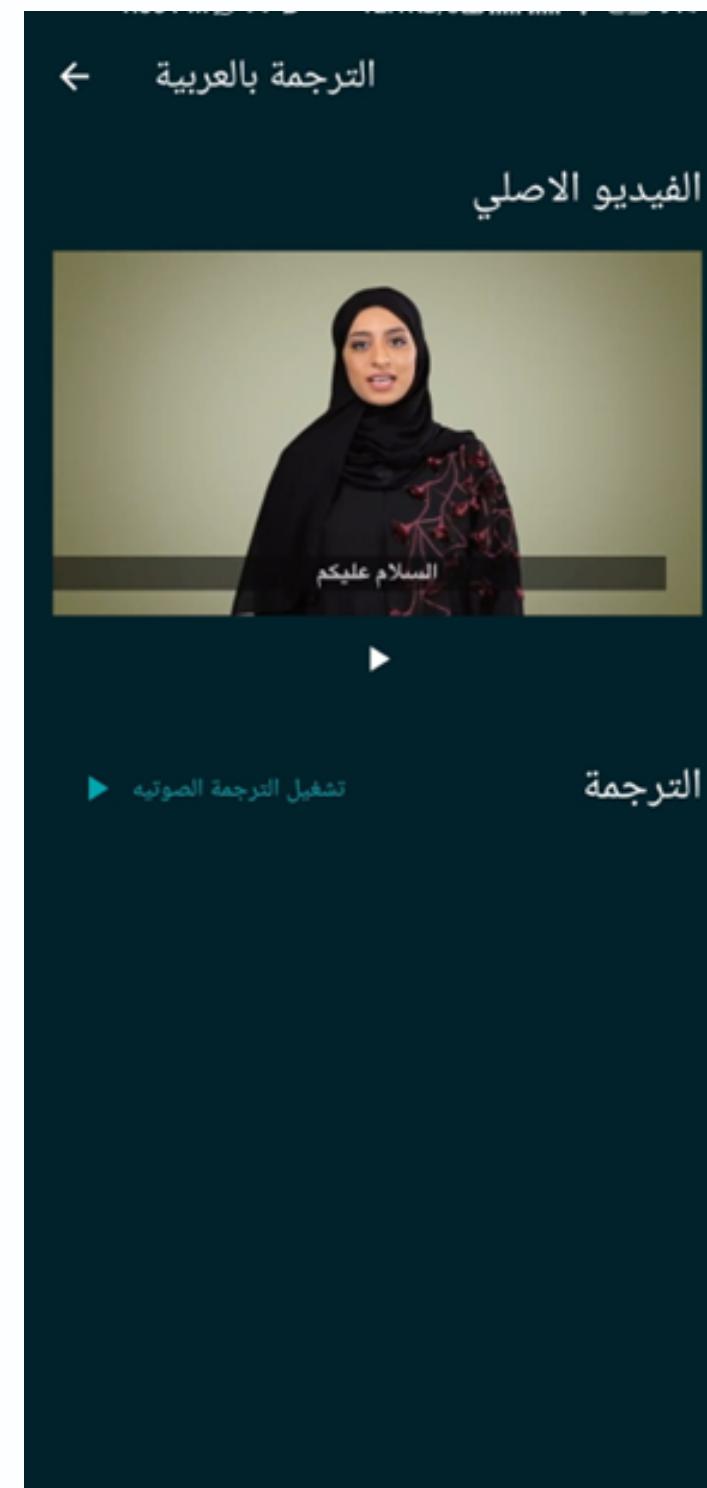


choose format
bottom sheet

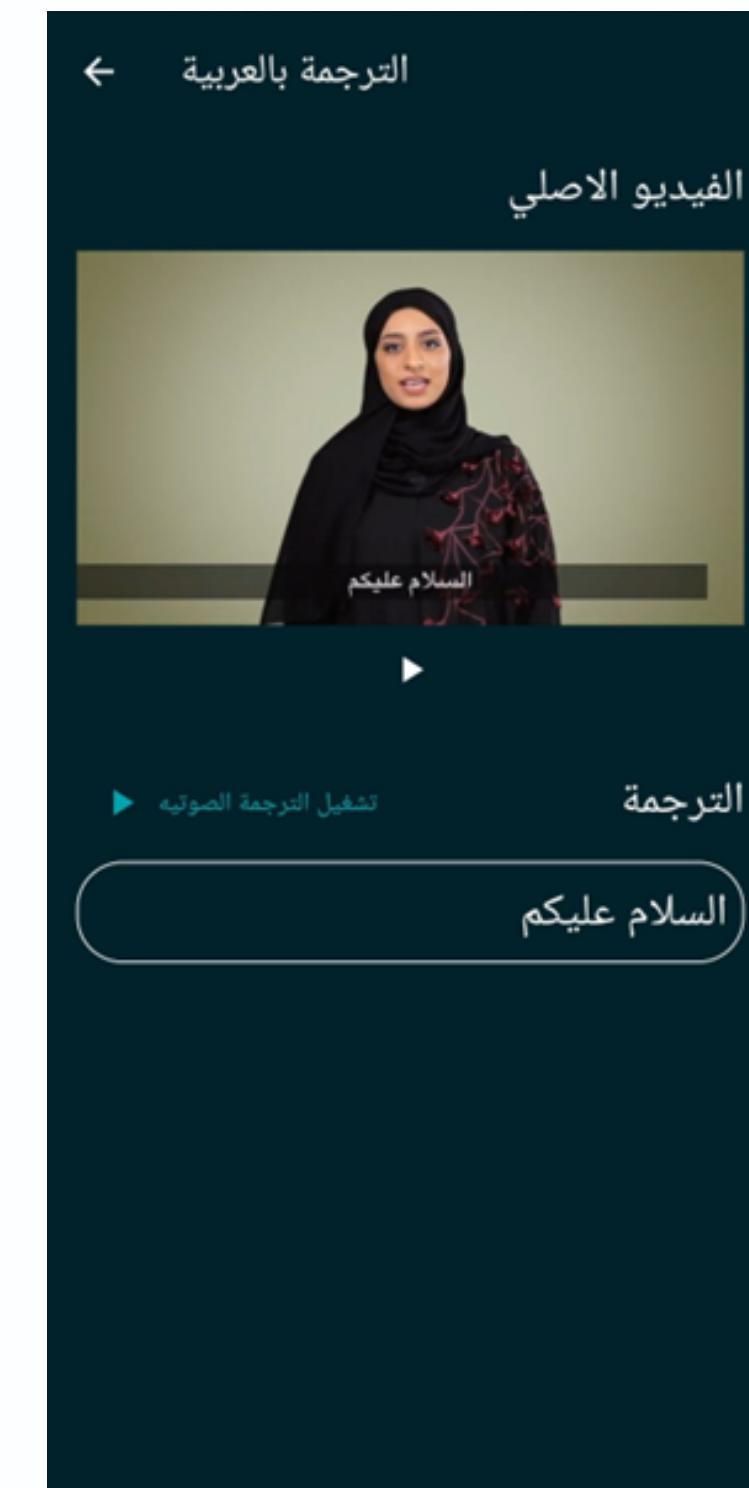


Text result page

Flutter(cont)



audio result page



audio and text
result page

09

FUTURE WORK

Future work

we aim to expand by having

- professional sign language interpreter for the dataset formation**
- high quality cameras to create the dataset**
- servers to host the model**
- explanation to include other languages**

10

BUSSINESS VISION

Business vision

we can make the project profitable by

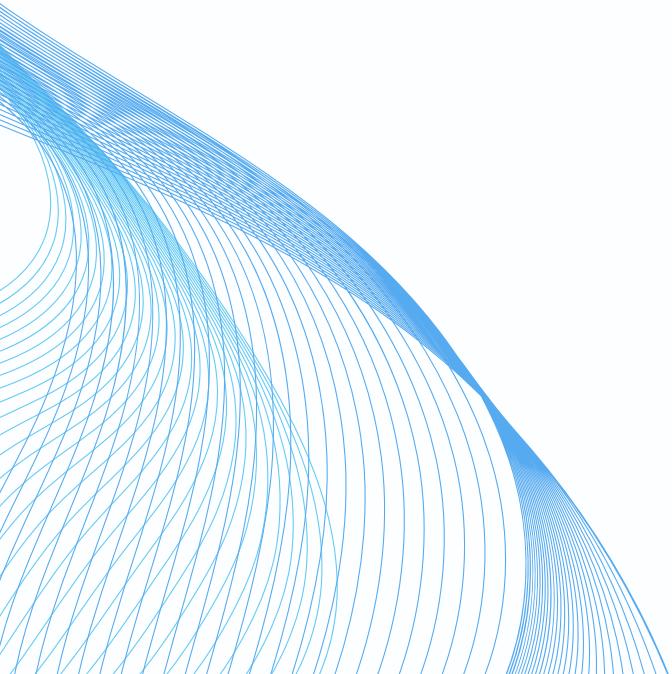
- make deals with factories that employs deaf people
- make deals with educational entities
- make deals with accessibility organizations

10

CONCLUSION

Conclusion

Esma3ny presents a promising solution for breaking down communication barriers and empowering the deaf and hard-of-hearing community. Its innovative approach combining accurate ArSL recognition, Text-to-Speech conversion, and a user-friendly mobile app holds significant potential for fostering inclusivity and social interaction.



12

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- [6] Z. Alsaadi, E. Alshamani, M. Alrehaili, A. A. D. Alrashdi, S. Albelwi, and A. O. Elfaki, "A real time Arabic Sign Language Alphabets (ARSLA) recognition model using deep learning architecture," *Computers*, vol. 11, no. 5, p. 78, May 2022, doi: 10.3390/computers11050078.
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- [8] Flutter documentation: <https://docs.flutter.dev/>
- [9] Why to use flutter: <https://www.freecodecamp.org/news/why-you-should-use-flutter/>
- [10] Flask documentation: <https://flask.palletsprojects.com/en/3.0.x/>
- [11] Online document., "VGG 16-Based Arabic Sign Language Letters Classification Model" online
- [12] Dataset Reference: <https://www.kaggle.com/datasets/ashrakatsaeed/all-data>
- [13] Arabic Alphabets Dataset: <https://colab.research.google.com/drive/1Ezldvuzmeb6DaguMPGi7N765QbuGP8TY?usp=sharing>
- [14] Arabic Words Dataset: https://colab.research.google.com/drive/1iLjUuw6QmC_X8NvsO5IMmZ5MTf2IHb8p?usp=sharing

THANK YOU

