ESM3NY

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Capstone Project: Sign Language Translation System

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Outline

- Introduction
- Understanding Arabic Sign Language
- System Workflow
- About The Data
- Modeling
- Applications and Impact
- Project TimeLine

Introduction

Introduction

Who are deaf and mute people ?

Deaf and mute individuals are those who experience both hearing and speech impairments

Global Prevalence of Hearing Loss:

- According to the World Health Organization (WHO), approximately 466 million individuals worldwide are affected by hearing loss, including 34 million children.
- The number of individuals affected by hearing loss is projected to exceed 900 million by 2050

Introduction

Challenges

The deaf and hard of hearing community faces communication challenges and limited availability of communication methods. Also, Seeking medical or security assistance without an interpreter presents a significant obstacle.

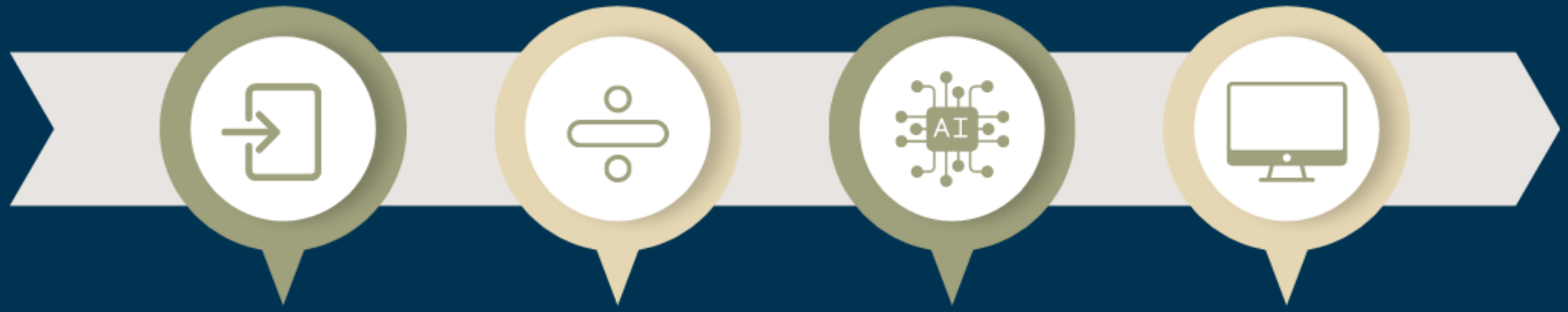
Understanding Arabic Sign Language

Arabic Sign Language (ArSL) is the primary method of communication used by the deaf community in Arabic speaking areas. It is a visual language that relies on hand movements, facial expressions, and body language to convey meaning. ArSL has its own distinct grammar and structure, which are separate from spoken Arabic. It is used for everyday conversation, education, and cultural expression within the Deaf community.

Understanding Arabic Sign Language

The biggest obstacle in such a system lies in the difficulty of representing the Arabic language through a fixed data set that lacks many simple and complex sentences and expressions. Also, the process requires attention to various details, such as facial expressions accompanying gestures and signals.

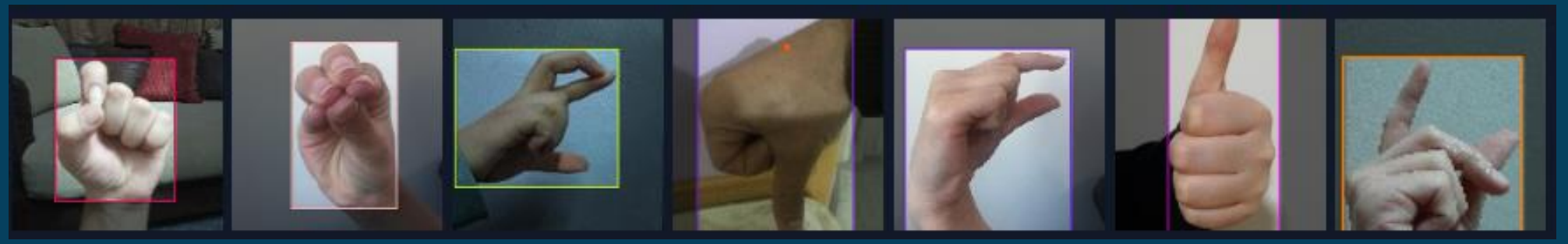
System Workflow



STAGE: 1	STAGE: 2	STAGE: 3	STAGE: 4
Input stream video from the webcam	Divide the video into frames	Entering each frame into the model	Display the translation on screen

About The Data

We faced challenges in finding data that represented the gestures and movements of Arabic sign language. However, we found a collected dataset that included Arabic alphabet signs



About The Data

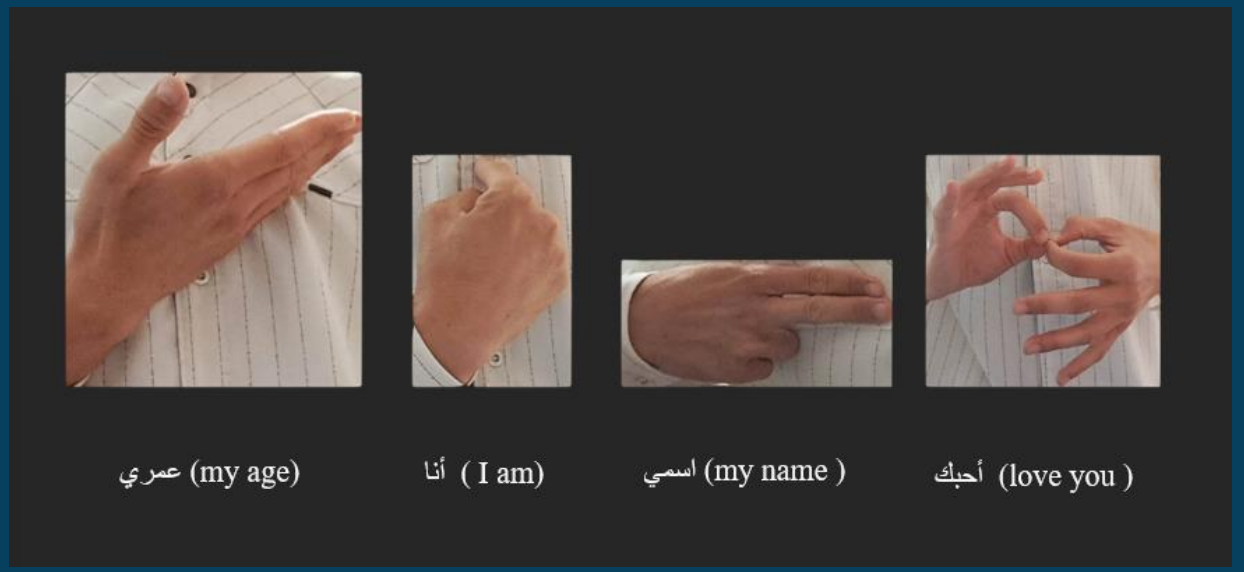
However, this set of data contained only signs of the Arabic alphabet only, but sign language is characterized by the presence of gestures and signs indicating complex sentences and expressions that must be considered during the process of building the translated system.

Therefore, a group of complex expressions were collected to form meaningful sentences, as more than 500 images of several people in several different places were collected.

About The Data

Roboflow Work:

- image annotation.
- Image augmentation
- After the augmentation process the dataset was increased to 1770 images after these operations.
- Total Number of images 9264.



Modeling

Where the YOLOv5 algorithm was used for training the model weights and torch.hub.load was used to access the model in Inference.

The YOLO (You Only Look Once) algorithm is a real-time object detection system that aims to localize and classify objects in images.

```
model_name = 'best_final_2.onnx'
model = torch.hub.load('ultralytics/yolov5', 'custom', path=model_name)

model.conf = 0.7
model.max_det = 1
```

Modeling

```
!python /content/drive/MyDrive/AIO_Project/yolov5/train.py --data /content/drive/MyDrive/AIO_Project/yolov5/data/custom.yaml --epochs 20 --weights /content/drive/MyDrive/AIO_Project/yolov5s.pt --img 640
```

```
      Epoch    GPU_mem   box_loss   obj_loss   cls_loss  Instances       Size
      13/19      4.31G     0.0268    0.01086    0.03091          2        640: 100% 411/411 [03:31<00:00,  1.94it/s]
                 Class     Images  Instances          P          R      mAP50   mAP50-95: 100% 44/44 [00:18<00:00,  2.33it/s]
                   all       1397       1397      0.848      0.895      0.924      0.732

      Epoch    GPU_mem   box_loss   obj_loss   cls_loss  Instances       Size
      14/19      4.31G    0.02673    0.01088    0.02979          3        640: 100% 411/411 [03:33<00:00,  1.92it/s]
                 Class     Images  Instances          P          R      mAP50   mAP50-95: 100% 44/44 [00:18<00:00,  2.40it/s]
                   all       1397       1397      0.888       0.87      0.935       0.75

      Epoch    GPU_mem   box_loss   obj_loss   cls_loss  Instances       Size
      15/19      4.31G    0.02627    0.01057    0.02946          4        640: 100% 411/411 [03:31<00:00,  1.94it/s]
                 Class     Images  Instances          P          R      mAP50   mAP50-95: 100% 44/44 [00:18<00:00,  2.38it/s]
                   all       1397       1397       0.88      0.923      0.948      0.769

      Epoch    GPU_mem   box_loss   obj_loss   cls_loss  Instances       Size
      16/19      4.31G    0.02516     0.0105    0.02838          1        640: 100% 411/411 [03:31<00:00,  1.94it/s]
                 Class     Images  Instances          P          R      mAP50   mAP50-95: 100% 44/44 [00:21<00:00,  2.02it/s]
                   all       1397       1397      0.898      0.915      0.953      0.777

      Epoch    GPU_mem   box_loss   obj_loss   cls_loss  Instances       Size
      17/19      4.31G    0.02436    0.01034    0.02686          1        640: 100% 411/411 [03:27<00:00,  1.98it/s]
                 Class     Images  Instances          P          R      mAP50   mAP50-95: 100% 44/44 [00:18<00:00,  2.38it/s]
                   all       1397       1397      0.922      0.925      0.966      0.801

      Epoch    GPU_mem   box_loss   obj_loss   cls_loss  Instances       Size
      18/19      4.31G    0.02269    0.01005    0.02524          2        640: 100% 411/411 [03:26<00:00,  1.99it/s]
                 Class     Images  Instances          P          R      mAP50   mAP50-95: 100% 44/44 [00:19<00:00,  2.21it/s]
                   all       1397       1397      0.915      0.936       0.97      0.808

      Epoch    GPU_mem   box_loss   obj_loss   cls_loss  Instances       Size
      19/19      4.31G    0.02213       0.01    0.02463          1        640: 100% 411/411 [03:29<00:00,  1.96it/s]
                 Class     Images  Instances          P          R      mAP50   mAP50-95: 100% 44/44 [00:19<00:00,  2.28it/s]
                   all       1397       1397      0.933      0.949      0.976      0.816
```

Applications and Impact

Shows and presentation

In hospitals and security centers

Government departments

Education

Project TimeLine

PHASE ONE

Project Conception and Initiation and Planning

PHASE TWO

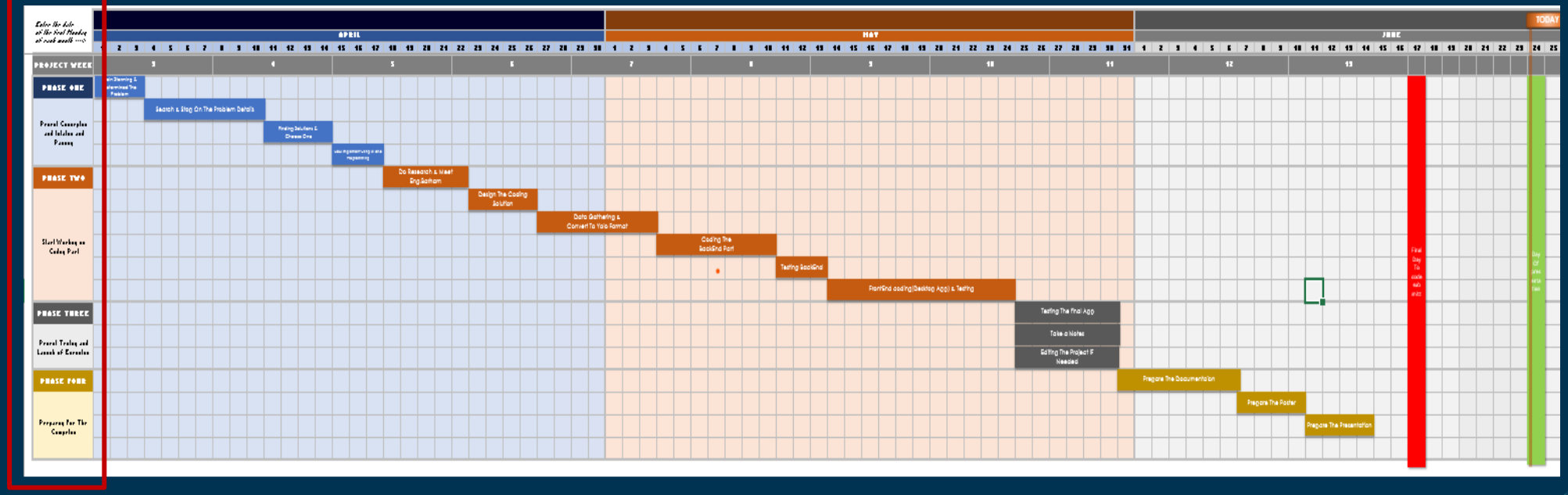
Start Working on Coding Part

PHASE THREE

Project Testing and Launch of Execution

PHASE FOUR

Preparing For The Competion



Thank You