

Sign Language Recognition

Roqaya – Mennatullah – David – Youssef

01

**Goal: Automate
recognition of Arabic Sign
Language (ArSL) using deep
learning for accessibility.**

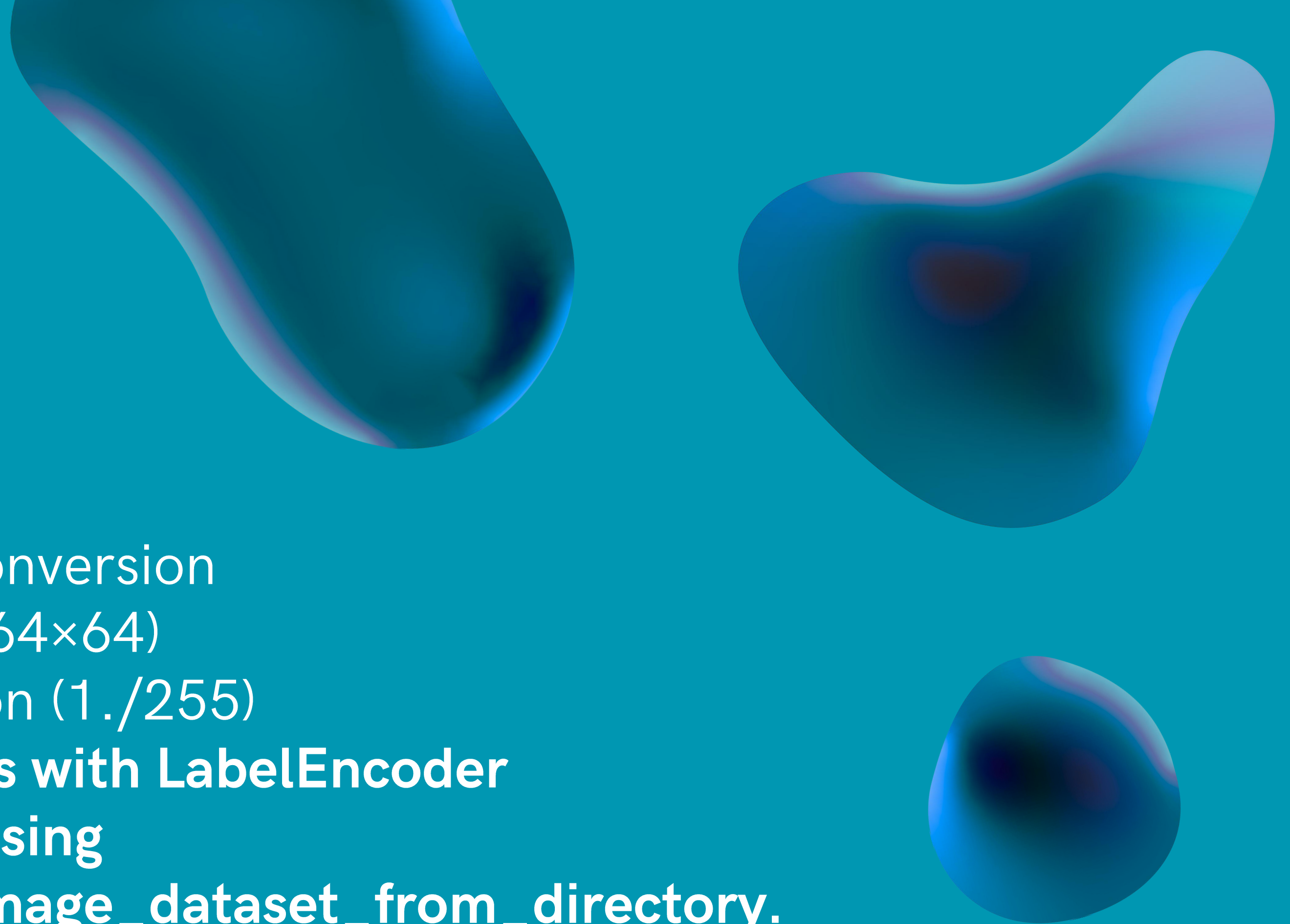


Dataset

- **ArSL Dataset (54K Images, 32 Classes)**
- **Grayscale Images, size standardized to 64×64 pixels.**
- **Labels: Arabic letters (ain, ba, jeem, etc.)**
- **Training/Testing split: 80% training, 20% testing.**

02

- **Methodology**
- **Pre-processing**
 - Grayscale conversion
 - Resizing to (64×64)
 - Normalization (1./255)
- **Encoding labels with LabelEncoder**
- **Data pipeline using**
`tf.keras.utils.image_dataset_from_directory.`



Models Used

- **Model 1: Fully Connected Neural Network (Baseline)**
 - Flatten → Dense(128) → Dense(64) → Dense(32, softmax)
- **Model 2: Convolutional Neural Network (CNN)**
 - Conv2D (32, 64, 128 filters) + MaxPooling2D
 - Flatten → Dense(128, relu) → Dropout(0.5) → Dense(32, softmax)

Training & Results

- Epochs: 20/20
- CNN Model Performance:
- Accuracy: 97.15%
- Loss decreased steadily (from 1.7711 \rightarrow 0.0847).
- Baseline Model: Lower performance compared to CNN.



Prediction Example

- **Input: Sample ArSL Image (64×64 grayscale).**
- **Model Output: Softmax → Highest probability = predicted class.**
- **Example: Predicted class → "jeem".**
- **Visualization with Matplotlib.**

Challenges

Data Issues: Class imbalance, noisy images.

Limited time

Technical Errors: Encountered dtype mismatch ("string to float cast error").

Future Work

- Expand dataset: more samples, real-time video signs.
- Use Transfer Learning (e.g., VGG16, ResNet, MobileNet).
- Apply Data Augmentation (rotation, flipping, zoom).
- Develop Real-time Detection System (webcam integration).
- Build a Mobile App for accessibility.
- Explore Transformer-based Vision Models (ViT).

Conclusion

- Achieved 97.15% accuracy on Arabic Sign Language recognition.
- CNN significantly outperformed simpler models.
- Project demonstrates real-world ML application for accessibility.

The background is a solid teal-blue color. It is decorated with several large, organic, wavy shapes in a darker blue shade, which appear to be floating or flowing around the central text. These shapes are located in the top-left, top-right, bottom-left, and bottom-right corners, leaving the center clear for the text.

Let's move to the model