

# B.TECH PROJECT

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Indian Institute of Technology Jodhpur

Under Supervision of Professor Gaurav Harit



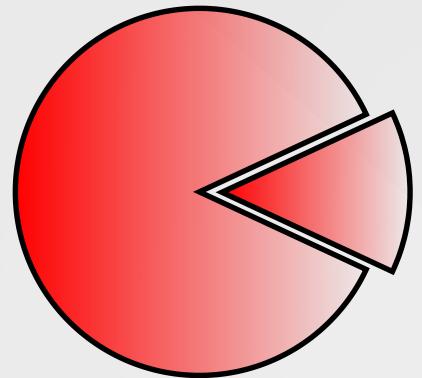
॥ त्वं ज्ञानमयो विज्ञानमयोऽसि ॥

# INDIAN SIGN LANGUAGE RECOGNITION USING MULTILAYER CNN



- **Problem:** Classification of isolated gesture images into 33 classes (0-9 digits, A-Z alphabets excluding V, H, J)
- **Importance in Sign Language:** Fingerspelling recognition aids in spelling names, places, or unknown signs in sign language.
- **Significance:** Enhancing accuracy is crucial for effective communication and accessibility in sign language interpretation.

# MOTIVATION



## 6.3 % INDIANS

6.3% of India's population  
Significant **Auditory**  
Impairment according to  
WHO estimates



<https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.sounderic.com%2Fpost%2Findian-sign-language&psig=AOvVaw3ylMb1CBXlg2WHDUvOCkuw&ust=1704635197335000&source=images&cd=vfe&opi=89978449&ved=0CBMQjRxqFwoTCNCJx6PzyIMDFQAAAAAdAAAAABD>

## EDUCATIONAL CHALLENGE

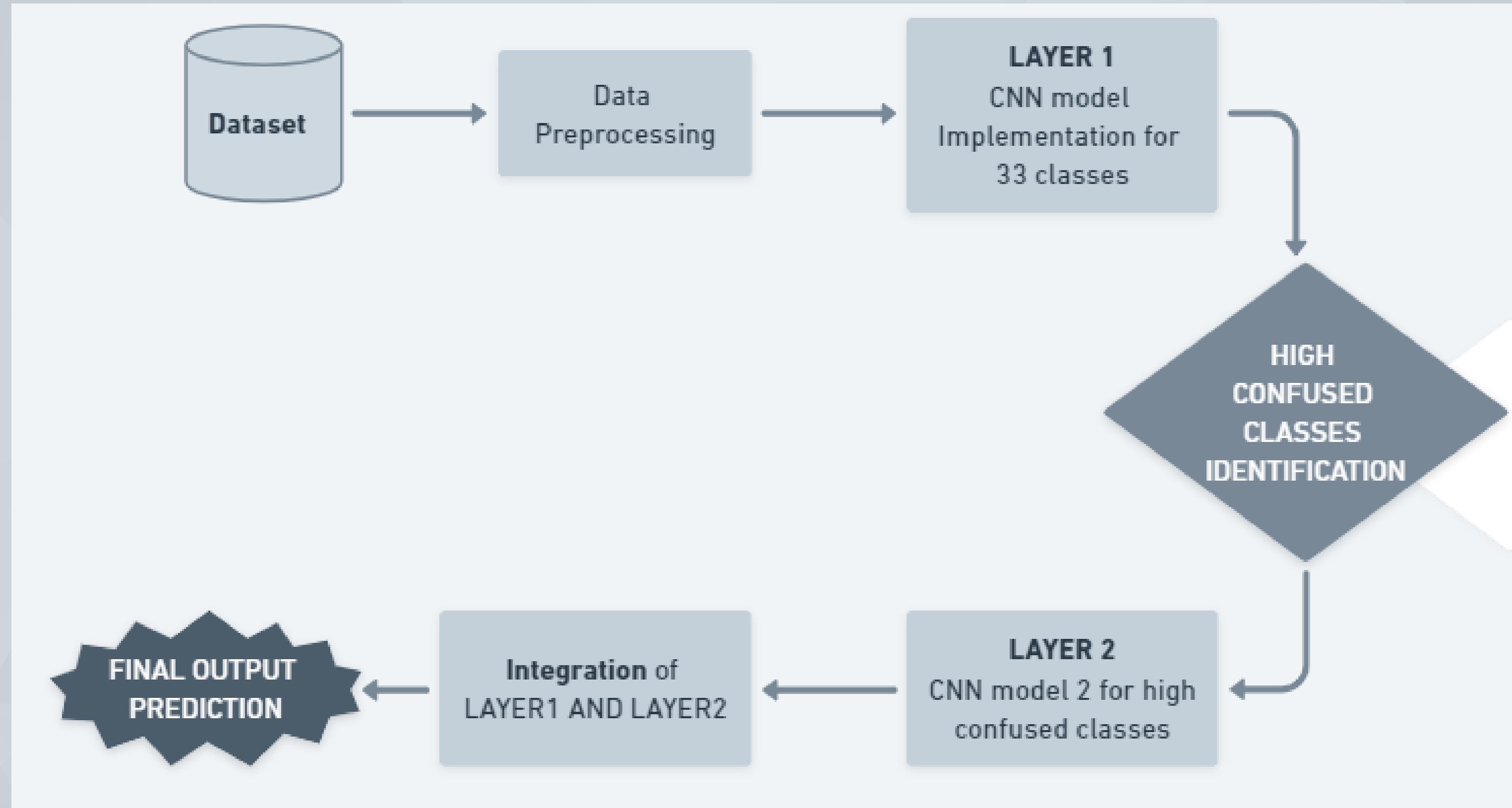
Only **3 Deaf Schools** are  
available per **1 million**  
people in India



## EMPLOYMENT DISPARITIES

Census data from 2011 revealed  
that merely 26.1% of deaf  
population were employed

# PROJECT WORKFLOW



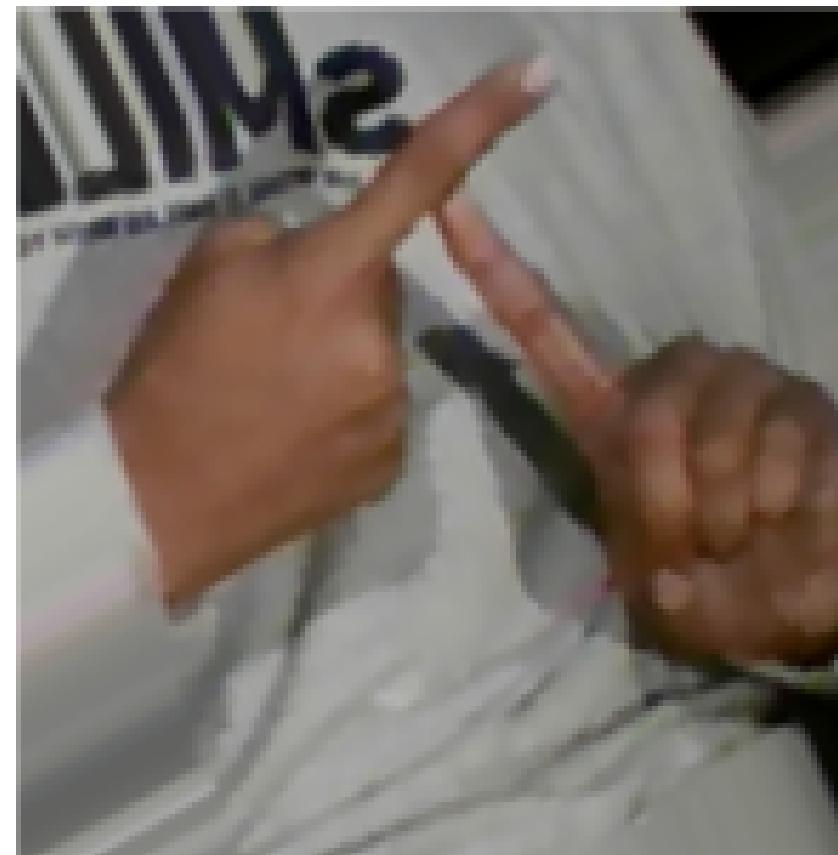
# **DATASET : SILATRA HANDPOSES DATASET(INDIAN FINGERSPELLING)**

comprises 33 classes (0-9, A-Z excluding V, H, J) with approximately 10K images

Digit/Letter: b



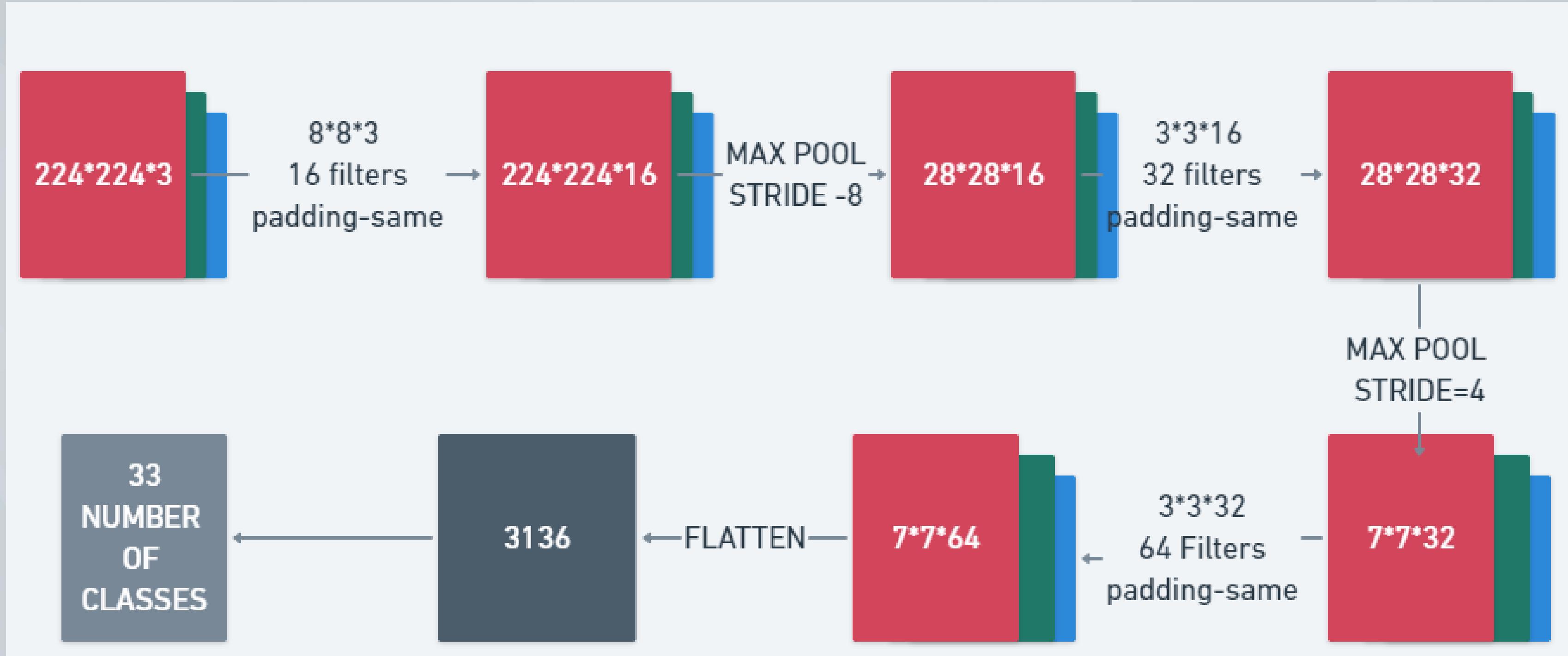
Digit/Letter: t



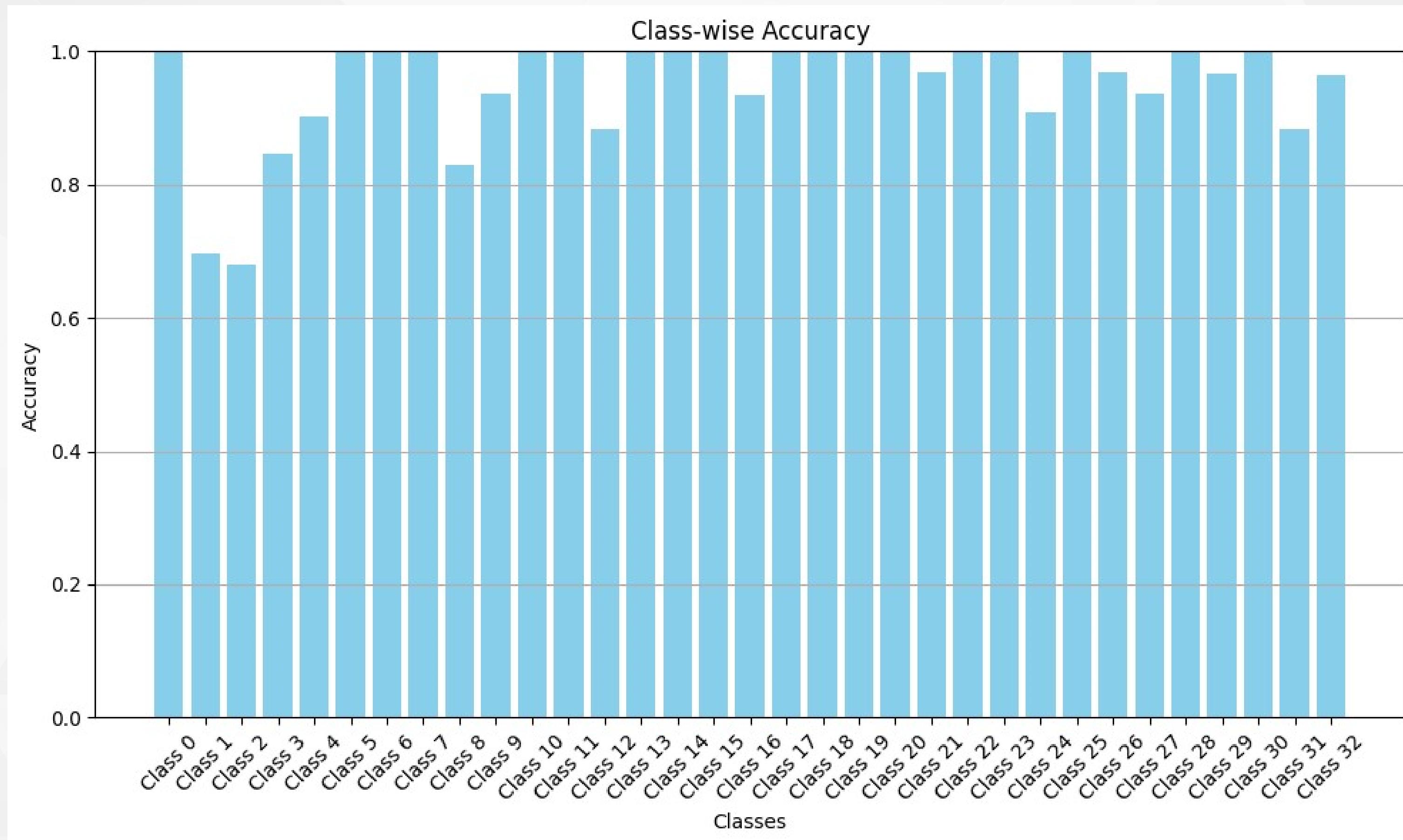
Digit/Letter: p



# LAYER 1: CNN



# OVERALL TEST (UNSEEN DATA) ACCURACY: 94.97%



# IDENTIFICATION OF HIGH CONFUSION CLASSES

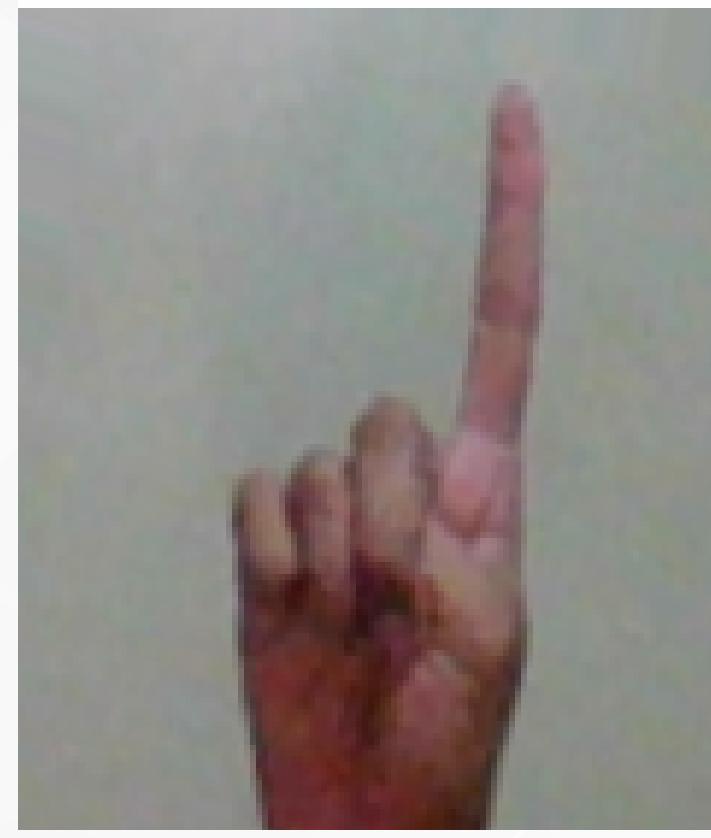
## Confusion Matrix

# HIGH CONFUSION CLASSES

Digit/Letter: 8



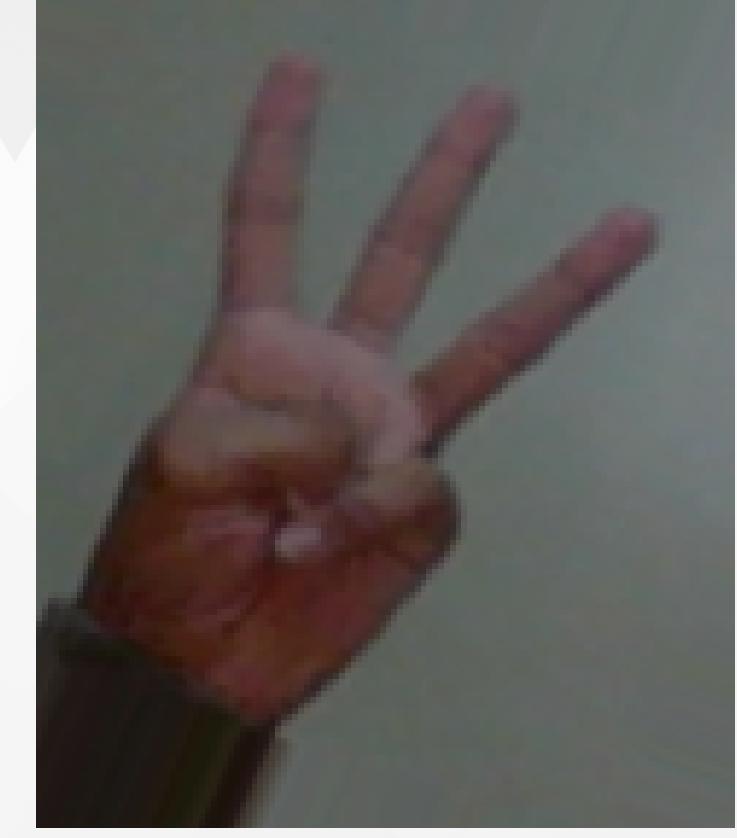
Digit/Letter: 1



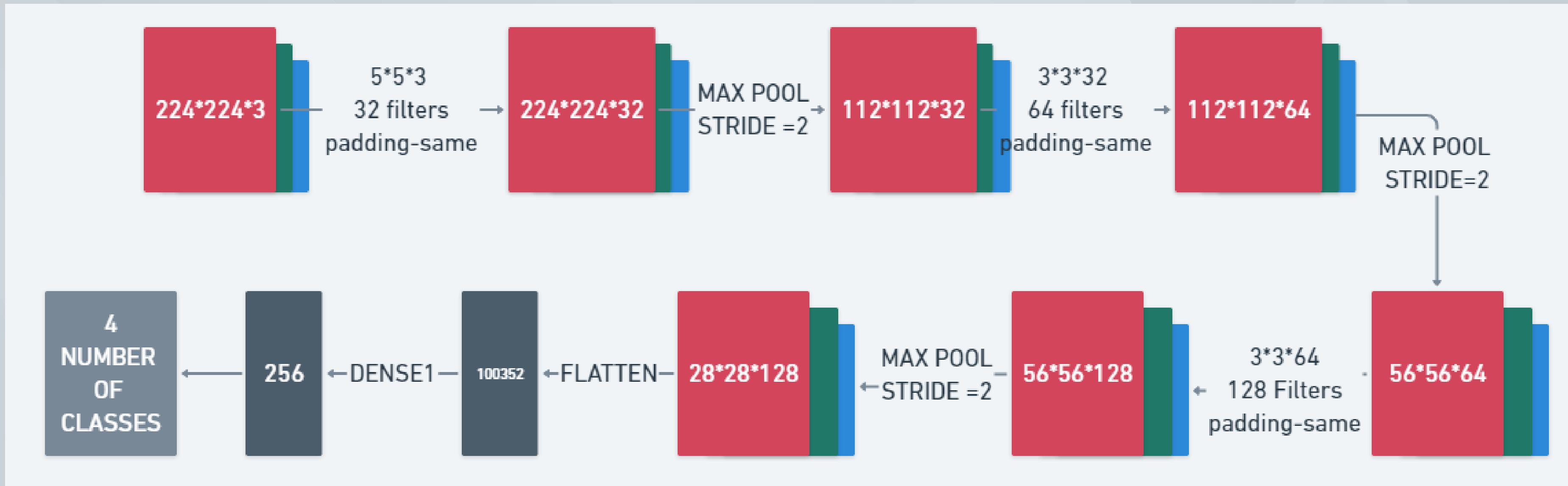
Digit/Letter: 2



Digit/Letter: 3



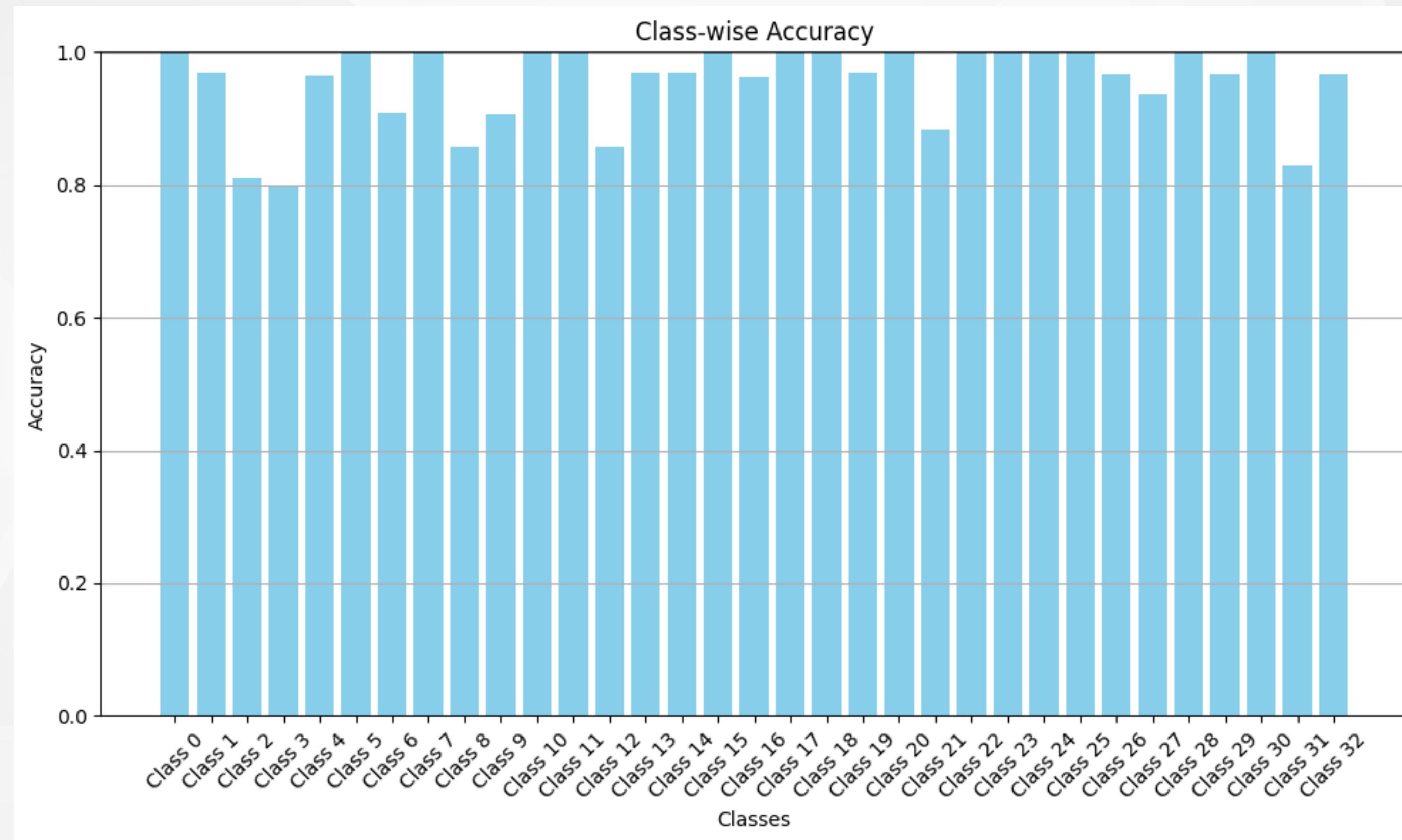
## LAYER 2: CNN



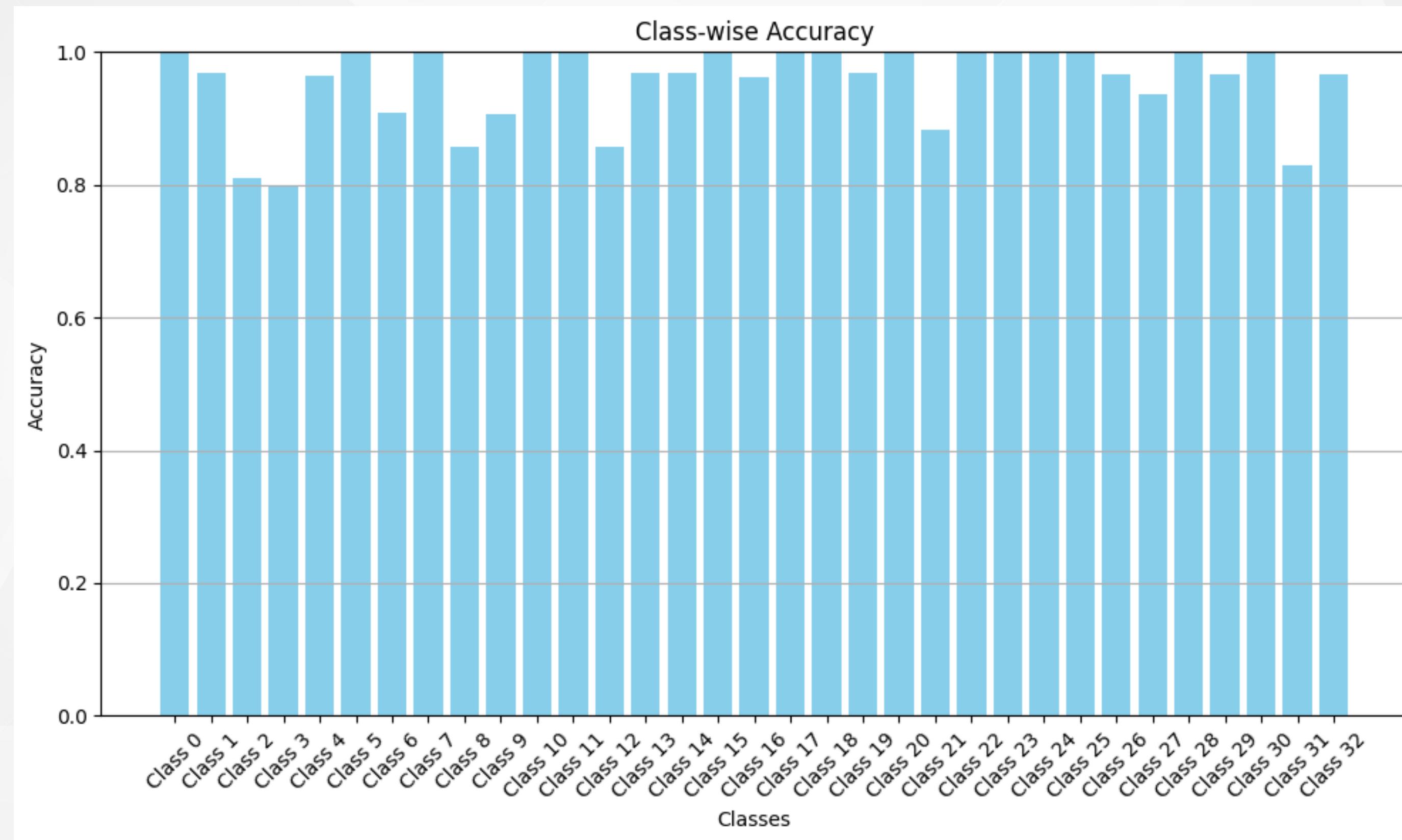
# **INTEGRATION OF LAYER 1 AND LAYER 2**

## Combined Confusion Matrix

# FINAL RESULT(LAYE 1+2) OVERALL TEST ACCURACY: 96.97%



# FINAL RESULT(LAYE 1+2) OVERALL TEST ACCURACY: 96.97%



# CHALLENGES FACED

- Limited Availability of Indian Sign Language Dataset
- Model Training with Insufficient Data
- Hyperparameter Optimization Challenges
- Hardware or Computational Constraints

# **SOFTWARE/LIBRARY REQUIREMENT**

- **Python 3.10.5**
- **tensorflow 2.15.0**
- **Keras**
- **NumPy**
- **Matplotlib**
- **OpenCV**

# LIMITATIONS OF PROPOSED MODEL

- Limited Generalization to Diverse Gestures
- Dependency on Static Gestures

# CONCLUSION

- Developed a real-time vision-based Indian Sign Language recognition system focusing on ASL alphabets.
- Achieved an impressive accuracy rate of 96.97% on the dataset, showcasing the model's effectiveness.
- Implemented a two-layered algorithmic approach, enhancing prediction accuracy by verifying and predicting symbols with closer similarities.
- Significantly improved predictive capabilities, ensuring robustness and precision in sign language recognition.
- Contributions extend to assistive technology for the Deaf and Mute community, empowering individuals with accessible communication tools

## FUTURE SCOPE

- Multi-frame Gesture Recognition Expansion
- Continuous Sign Language Dataset Recognition
- Sign Language Translation Exploration

# THANK YOU

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