

Spectacle Frame Recommendation

BY DETECTION OF FACE SHAPE

Agenda

- Problem Statement
- Project Approach
- Data Exploration
- Modelling & Evaluation
 - CNN built from scratch
 - CNN with transfer learning (VGG-Face)
- Conclusions
- Next Steps

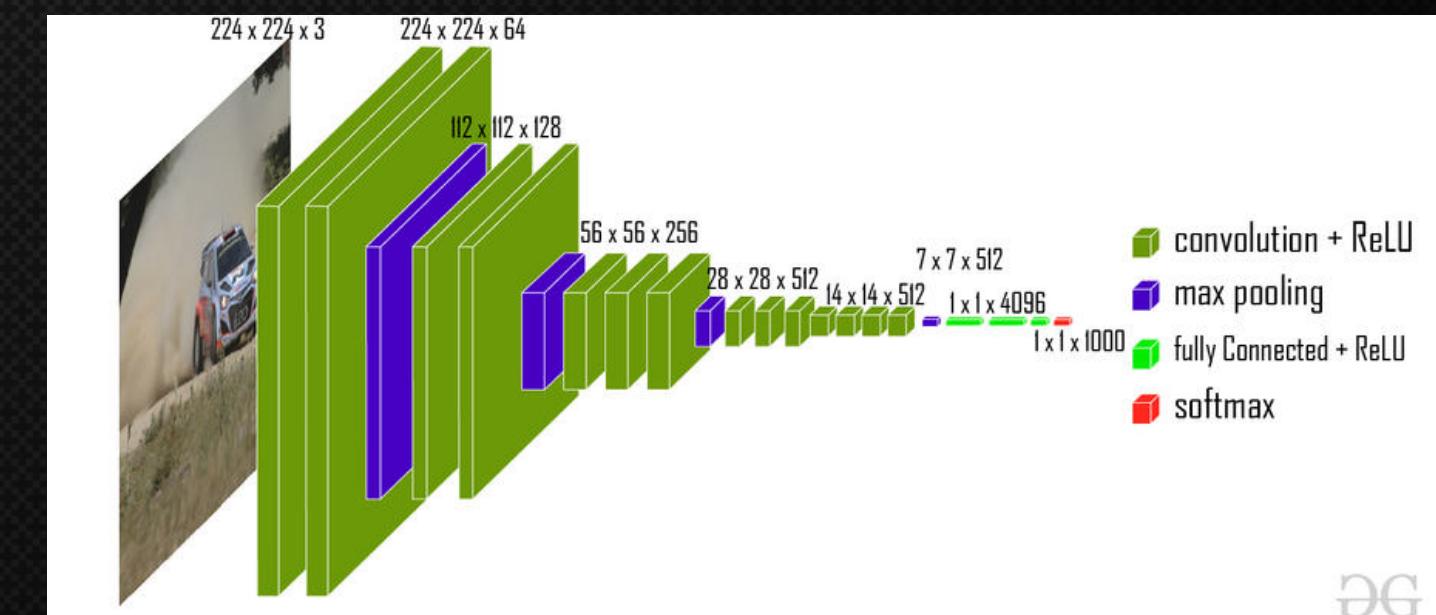
Problem Statement

This project aims to develop a system that can automatically classify human faces into five different shape categories, such as round, oval, square, oblong or heart-shaped.



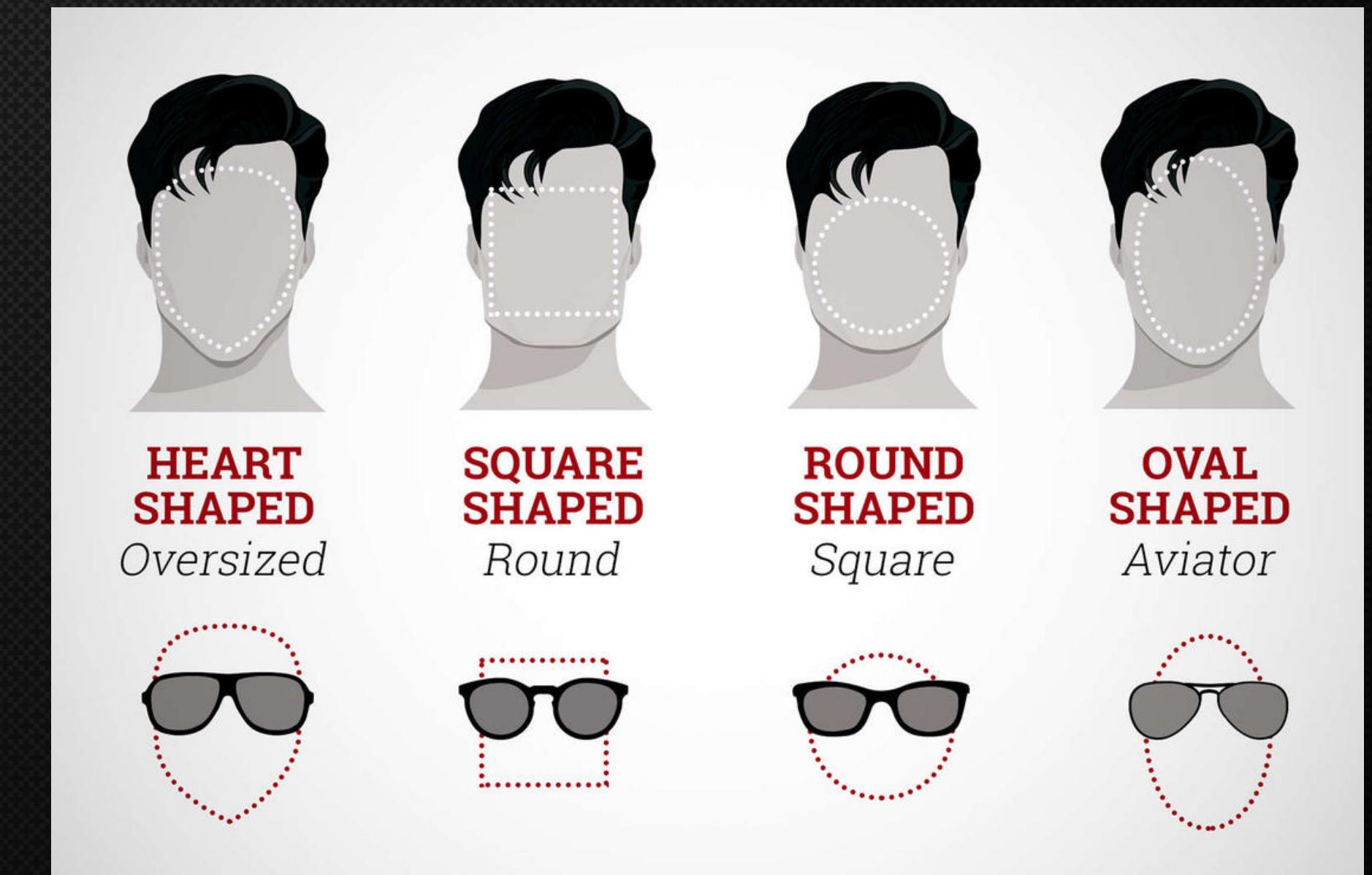
Problem Statement

The system will take as input a collection of facial images in .jpeg format and use deep learning techniques to extract and analyze facial features, allowing it to accurately classify each image according to its corresponding face shape category. The project will involve building a CNN-based model to train and test the face shape classification system and implementing various performance evaluation metrics to assess the model's effectiveness.



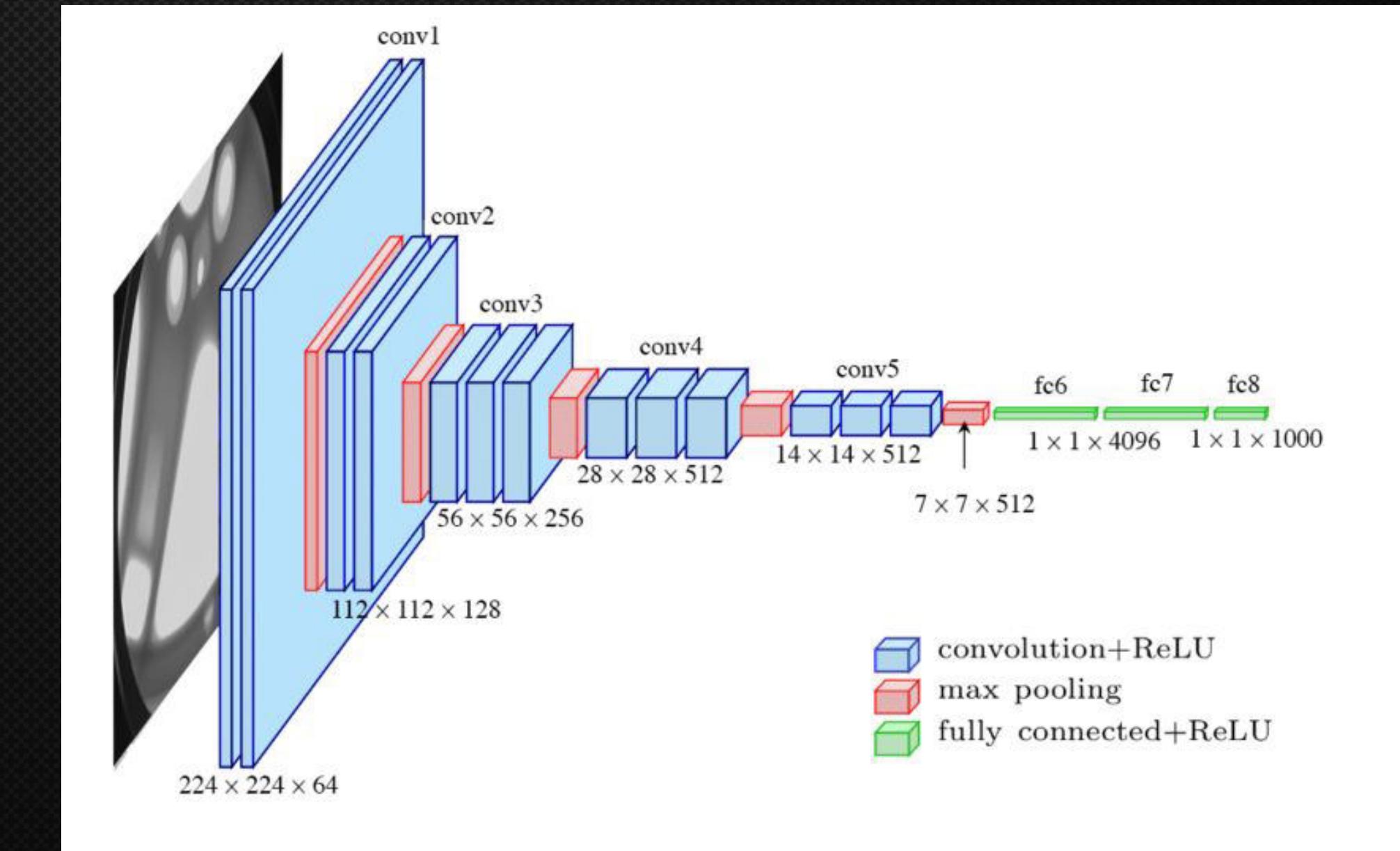
Problem Statement

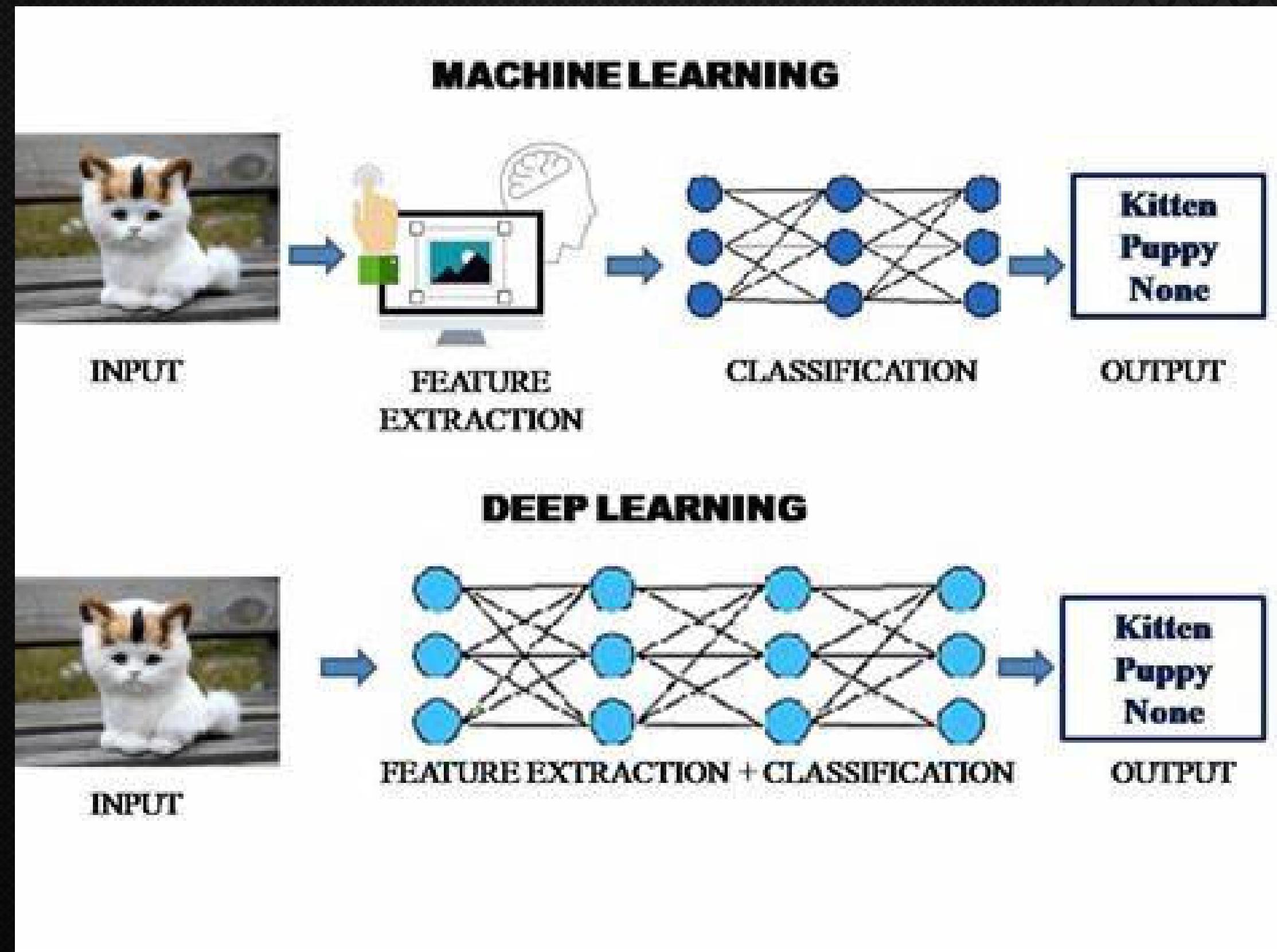
The final design will then recommend **spectacles frame** according to the **face shape**. For example, a square frame looks suitable for a round face shape.



Project Approach

Deep Learning with Convolutional Neural Network (CNN)





Project Stages

1

**Data
Exploration &
Preprocessing**

2

**Modelling &
Evaluation**

CNN built from scratch

3

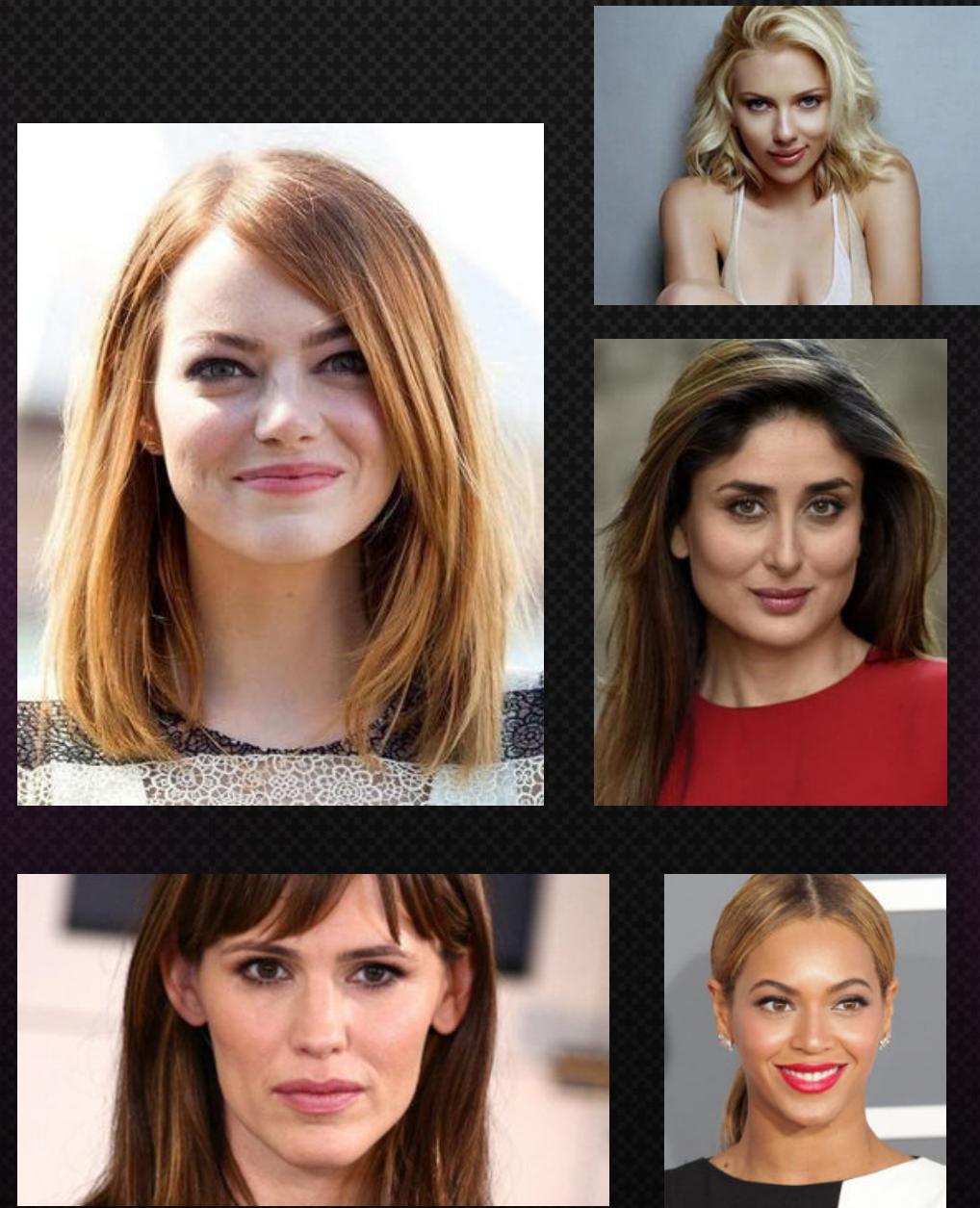
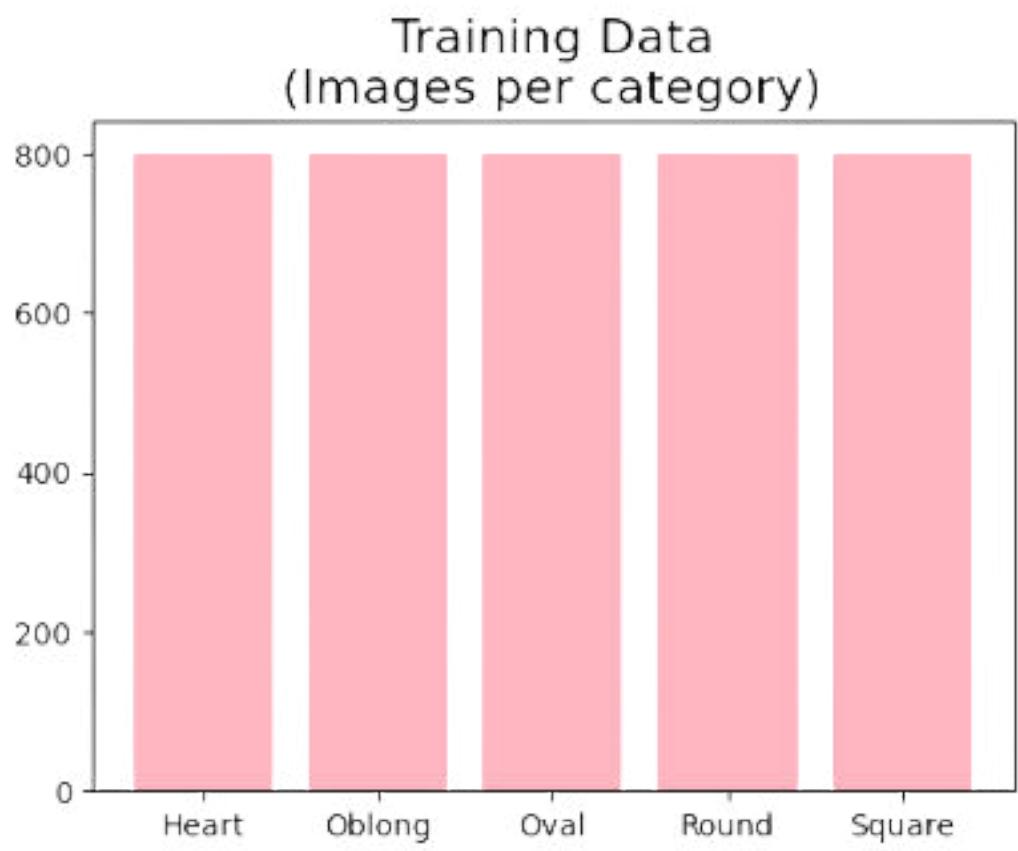
**Modelling &
Evaluation**

CNN with transfer
learning (VGG-Face)

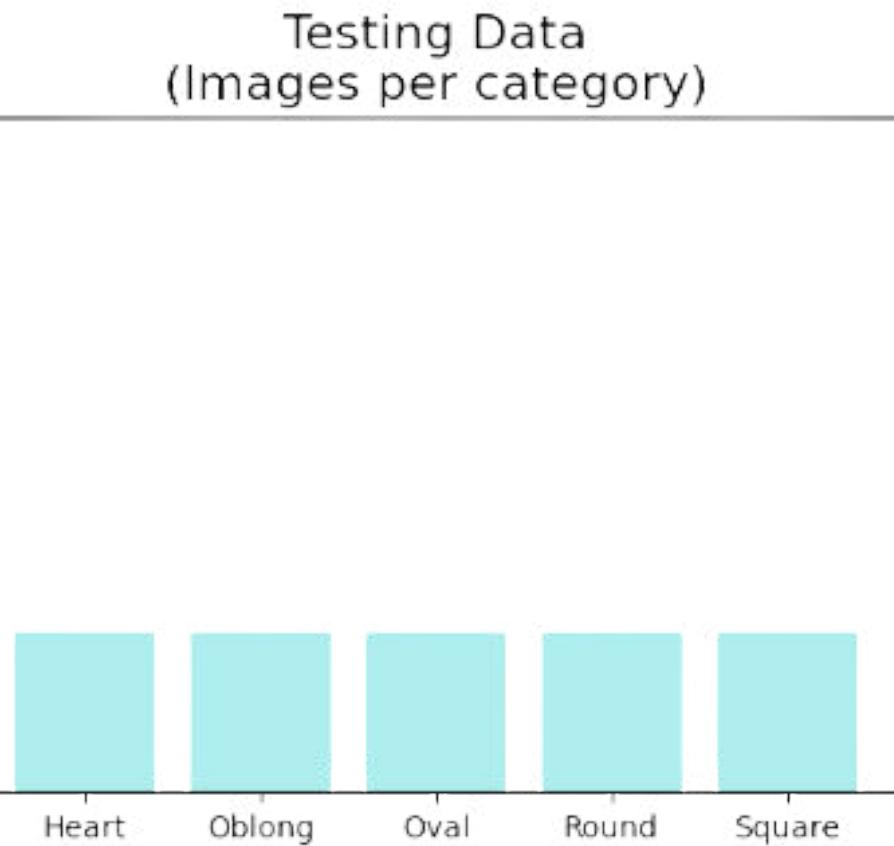
Kaggle Face Shape Dataset

Data Exploratory Analysis

Training Data
4000 images
(800 per class)



Testing Data
1000 images
(200 per class)



Images are mostly taken as portraits (aspect ratio < 1)



Portrait



Square = 1



Landscape

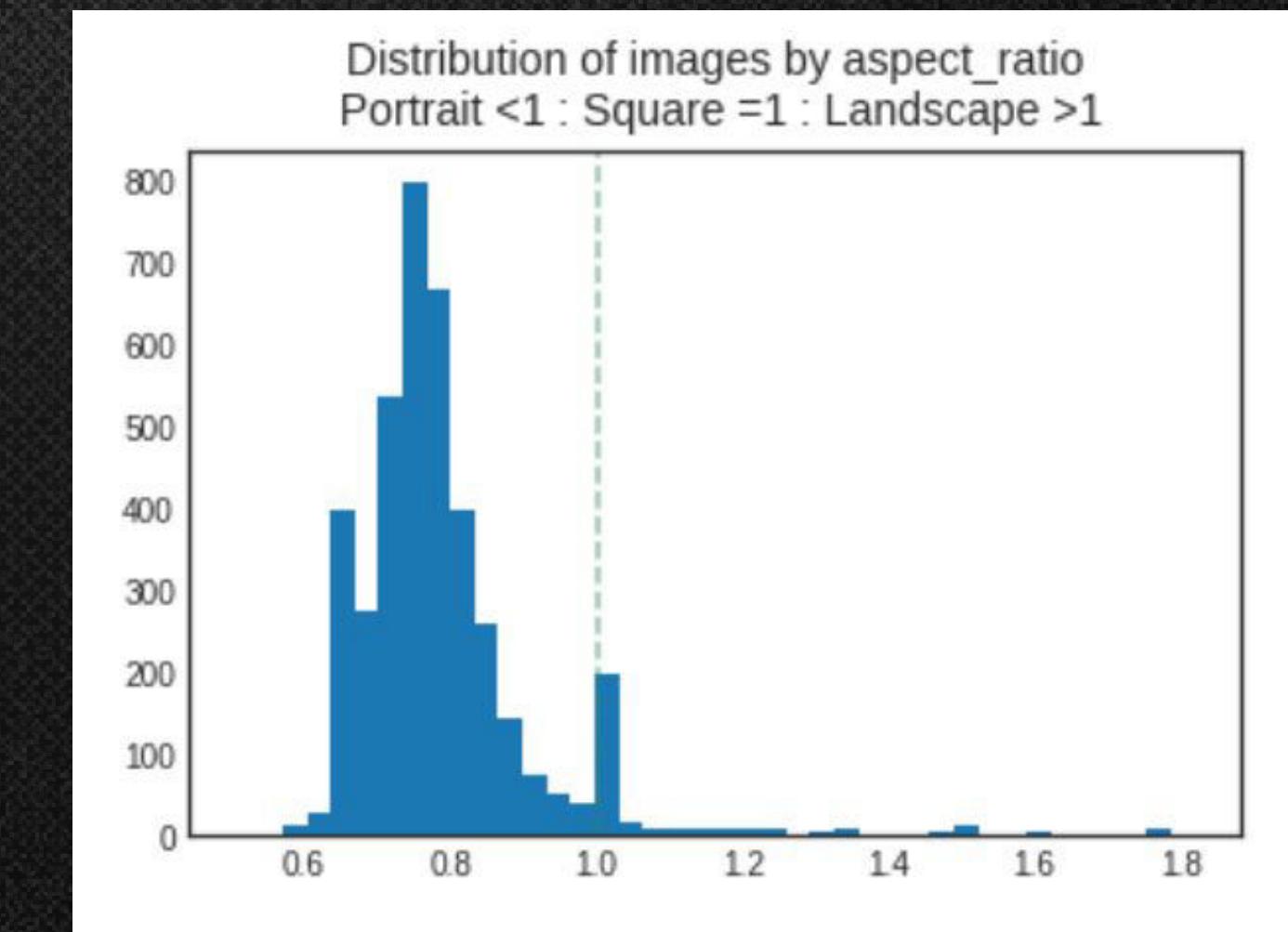
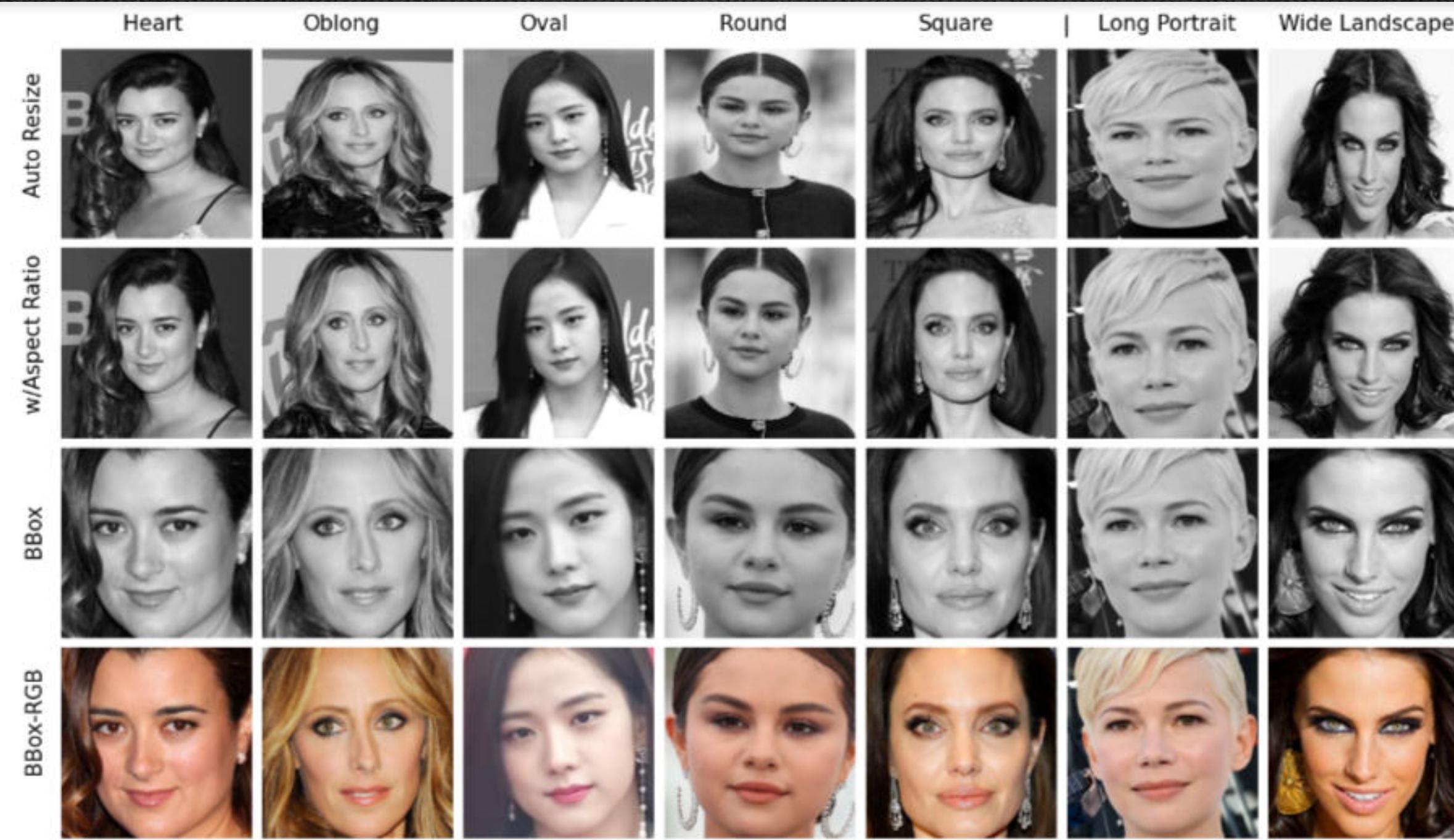


Image Preprocessing

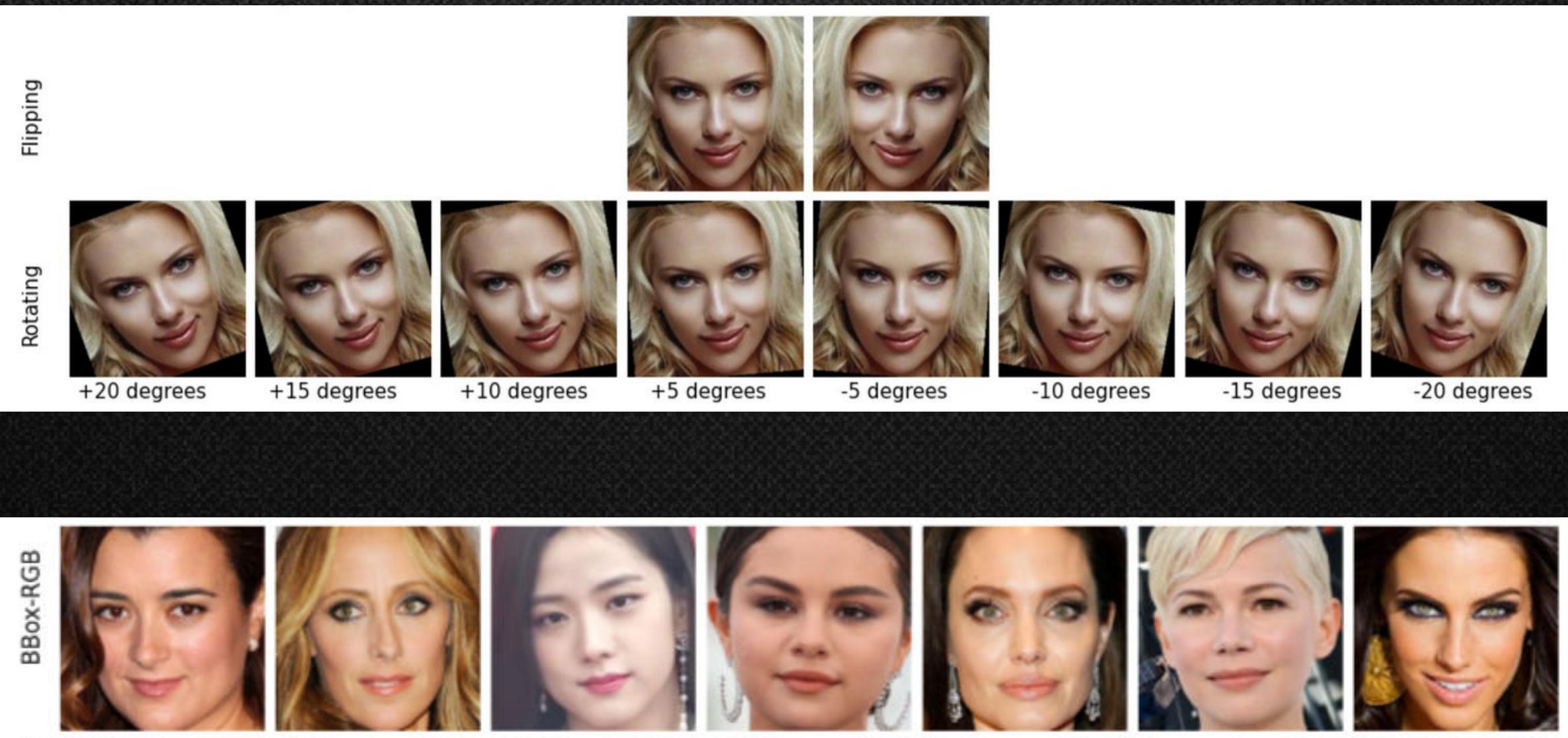


Modelling

| | Training Accuracy | Validation Accuracy |
|----------------|-------------------|---------------------|
| Auto Resize | 73.90% | 42.70% |
| w/Aspect Ratio | 72.50% | 47.30% |
| BBox | 89.82% | 66.3% |
| BBox-RGB | 94.17% | 71.20% |

The bounding box helps improve accuracy as seen in models 3 & 4. Model 4 with RGB color images performed slightly better than Model 3 with grayscale images. However, both models 3 & 4 are overfitting.

Image Preprocessing



Modelling

Image Augmentation

Training
Accuracy

80.20%

Validation
Accuracy

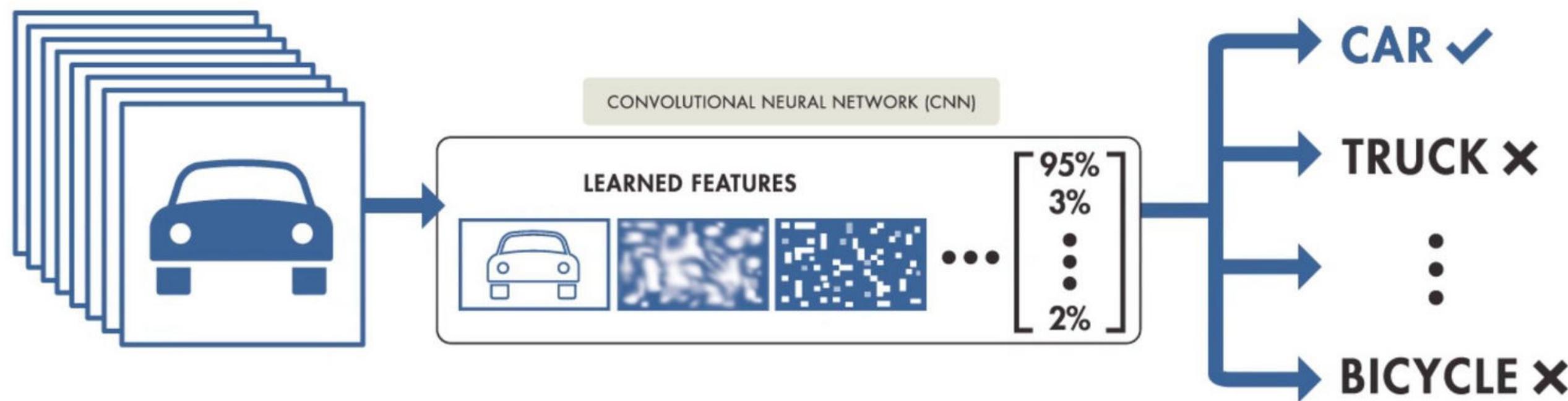
76.90%

BBox-RGB

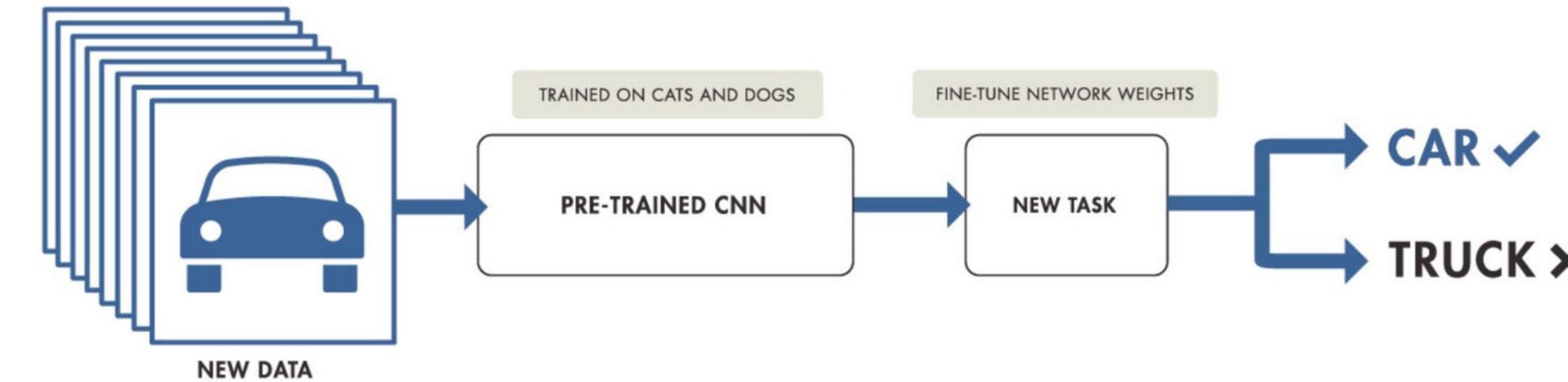
94.17%

71.20%

TRAINING FROM SCRATCH

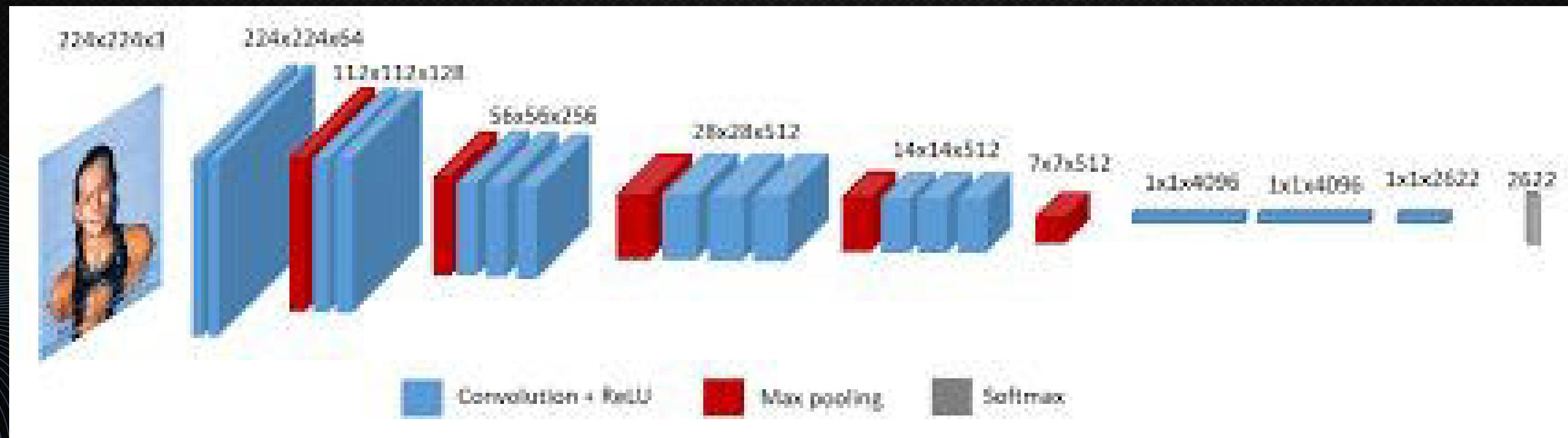


TRANSFER LEARNING



Transfer Learning VGG-face

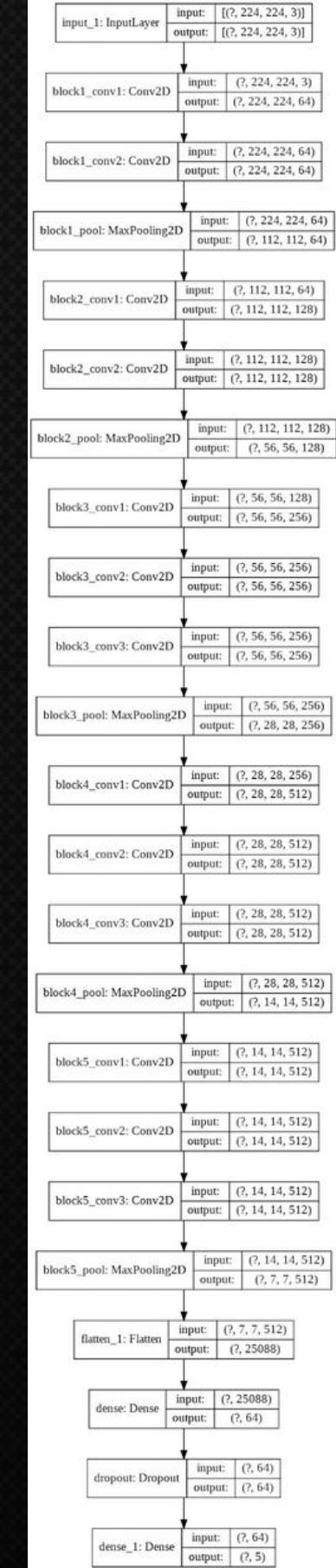
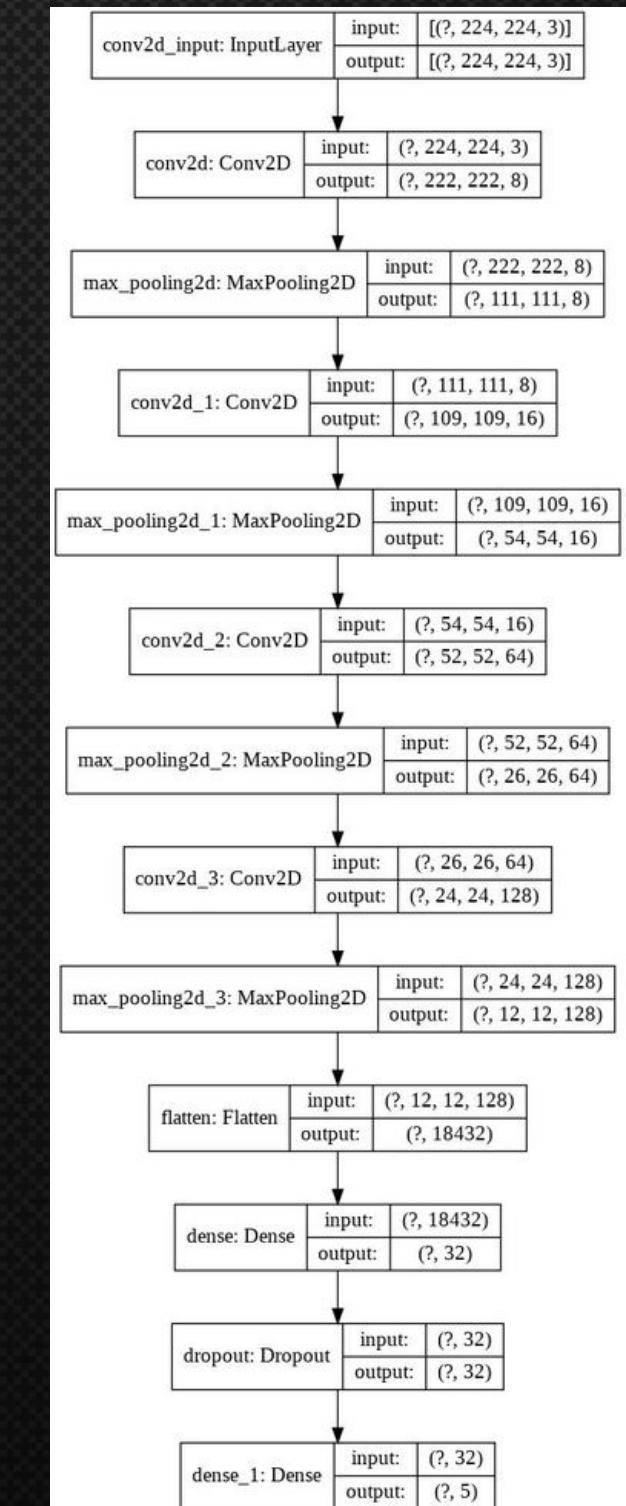
VGG-Face pre-trained weights
(trained on 2.6 Million images)



Architecture

From Scratch

VGG-16



Modelling

Training from Scratch

Training
Accuracy

80.20%

Validation
Accuracy

76.90%

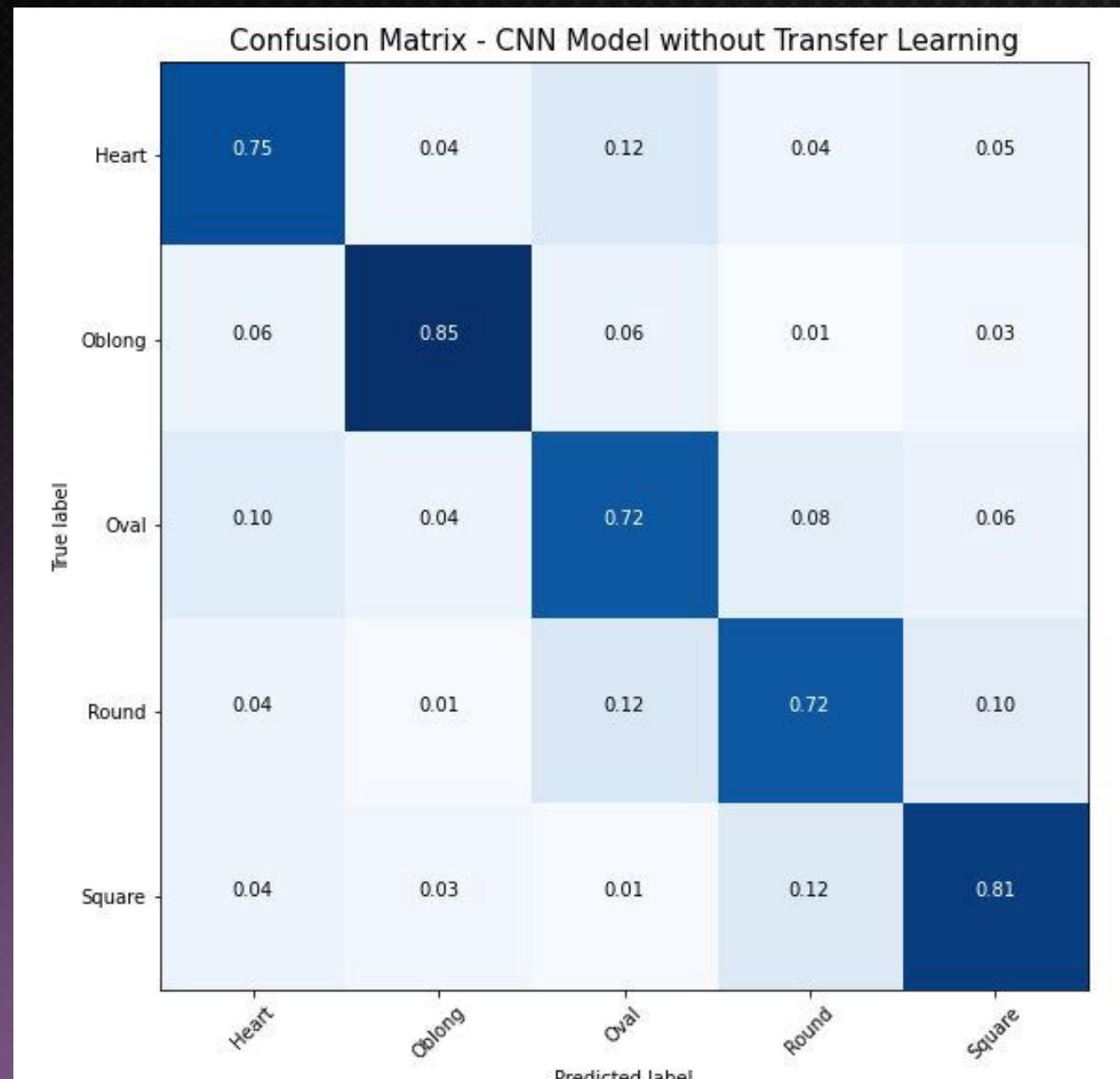
Transfer Learning

97.37%

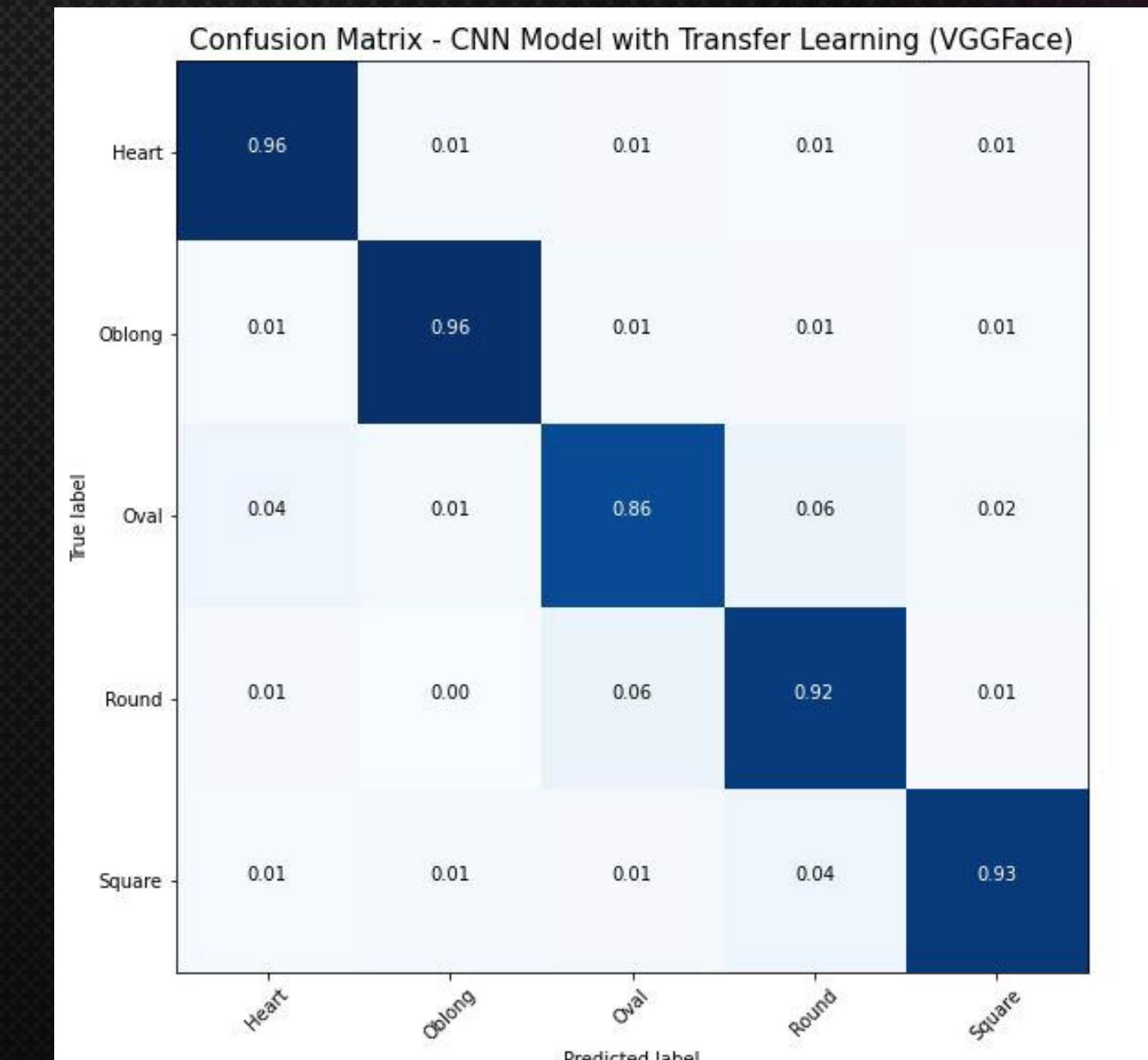
92.20%

Confusion Matrix

Training from Scratch



Transfer Learning

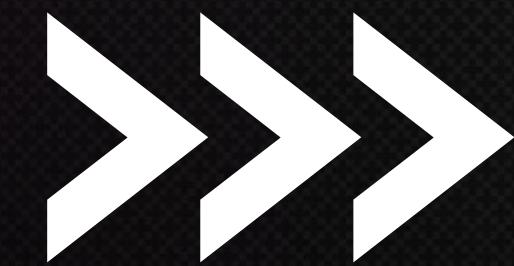


User Friendly GUI

The screenshot shows a mobile application interface for "GlassFit". At the top, there is a purple header bar with the "GlassFit" logo on the left and "Profile" and "Home" buttons on the right. Below the header, a large white button contains the text "Face Shape Predictor - Results". Inside this button, a message states: "The predicted face shape is Heart, so Cat-Eye frame will suit you." Below this message is a blue button labeled "Browse for frames". A large image of a pair of black cat-eye glasses is displayed prominently. To the left of the glasses, the text "CAT-EYE" is written in bold capital letters. Below the main image, there is a grid of four smaller product cards, each featuring a different cat-eye frame:

| Product | Image | Price | Action |
|-----------|-------|-------|-----------------------------|
| Product 1 | | ₹999 | Add to Cart |
| Product 2 | | ₹799 | Add to Cart |
| Product 3 | | ₹1149 | Add to Cart |
| Product 4 | | ₹2119 | Add to Cart |

Demo Time



GlassFit

Profile

Try Our Face Shape Predictor

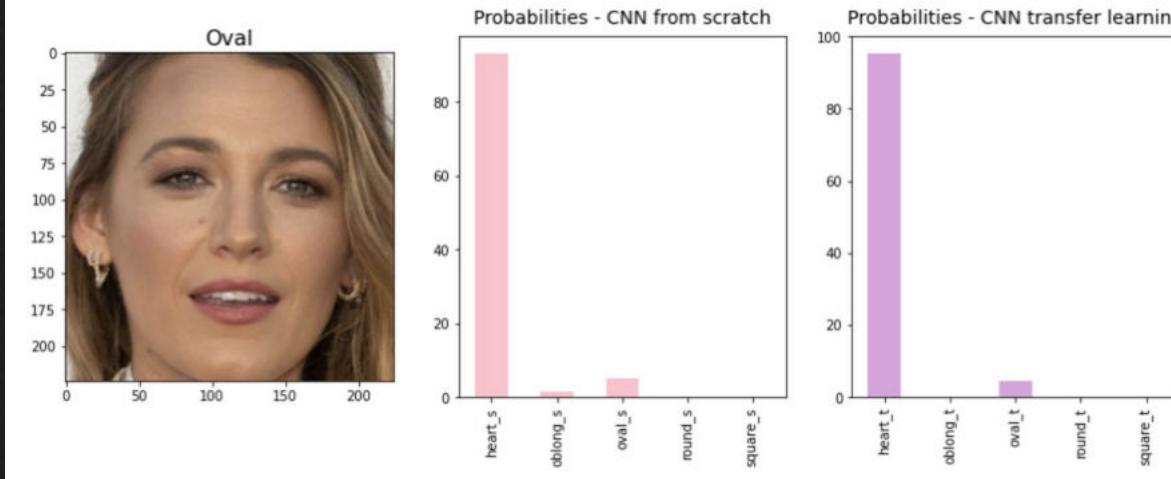
We provide assistance in selecting the most flattering eyewear frames for your face, taking into account your face-shape.

UPLOAD

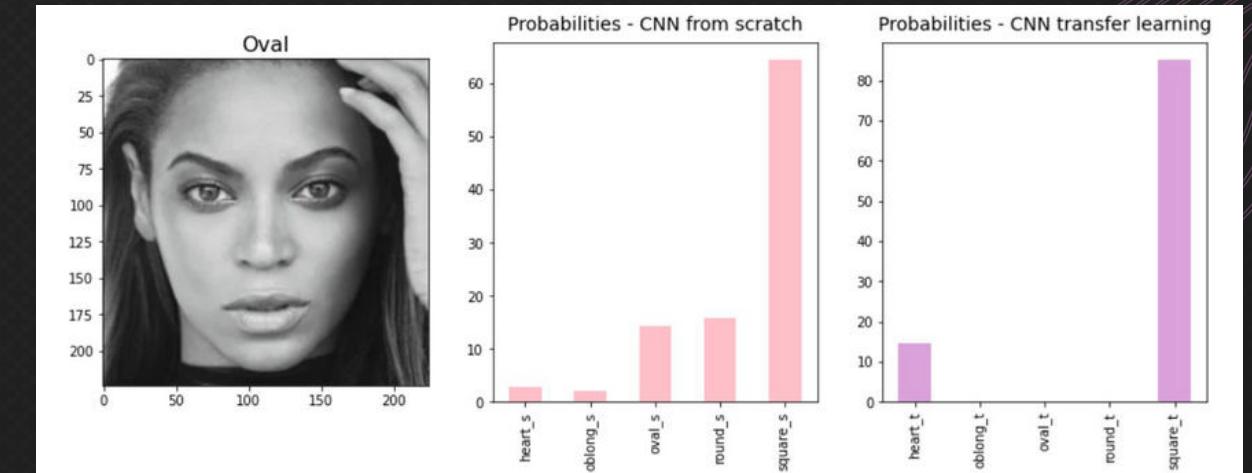
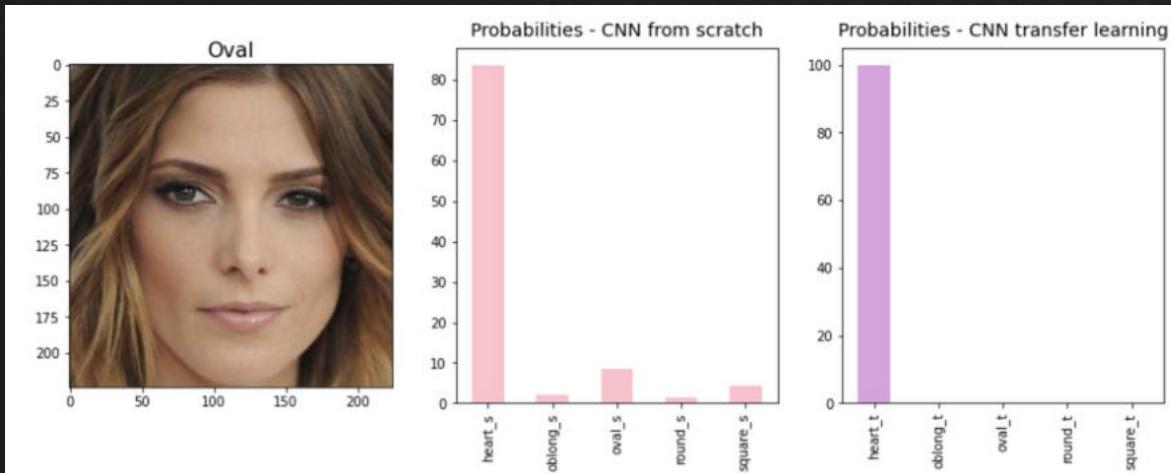
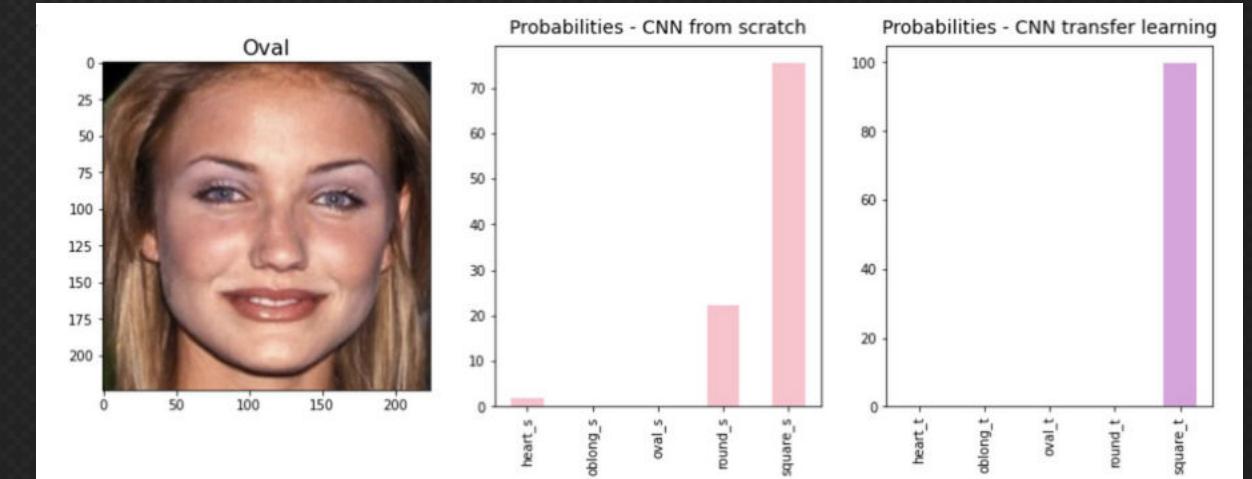
Round ₹300

“Difficult” images misclassified by both models

Oval misclassified as Heart

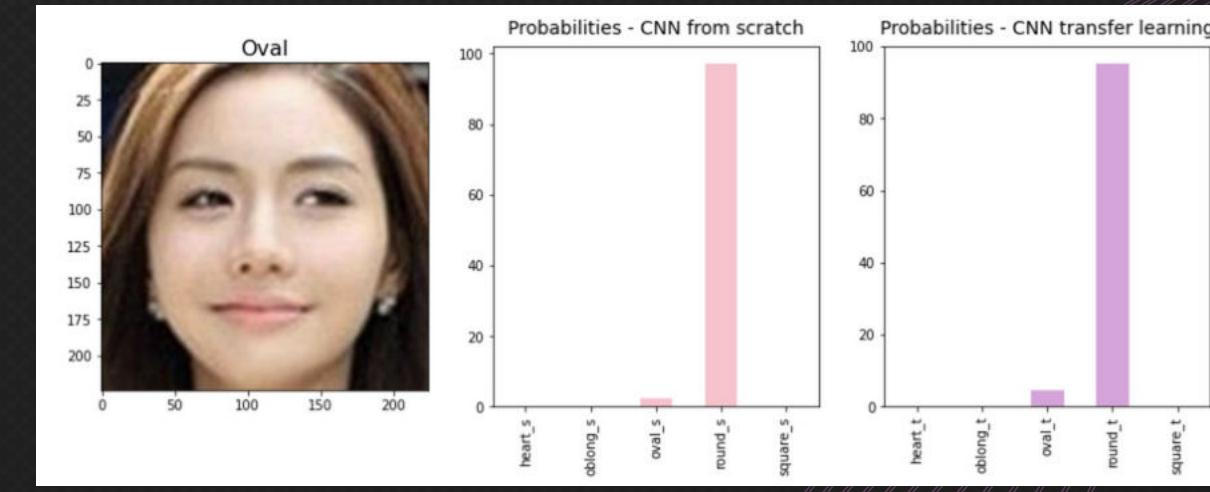
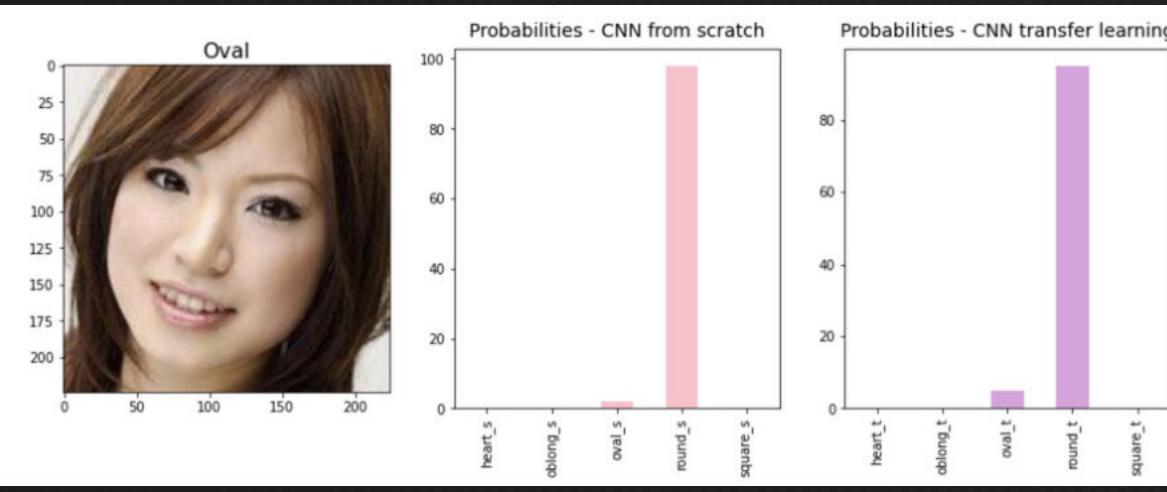
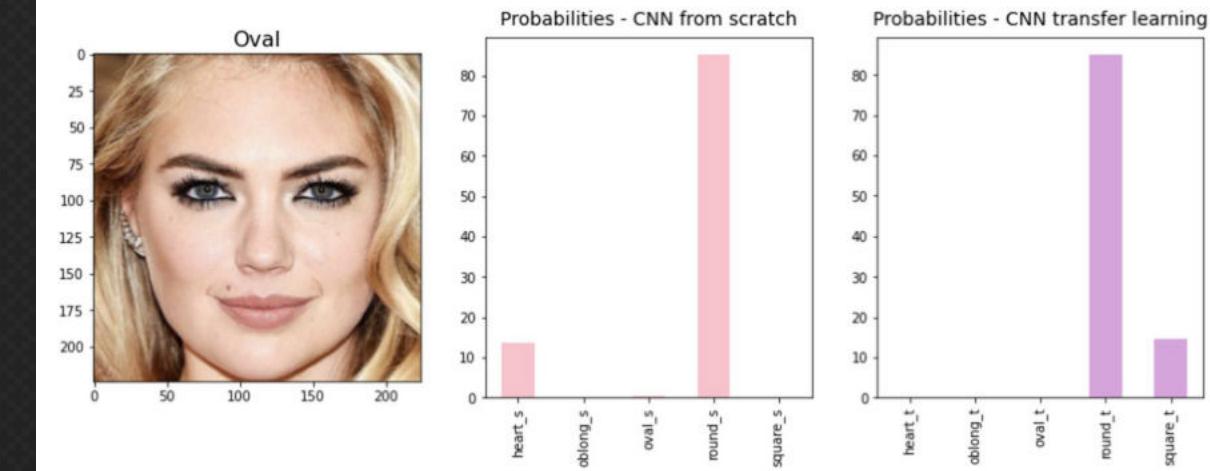
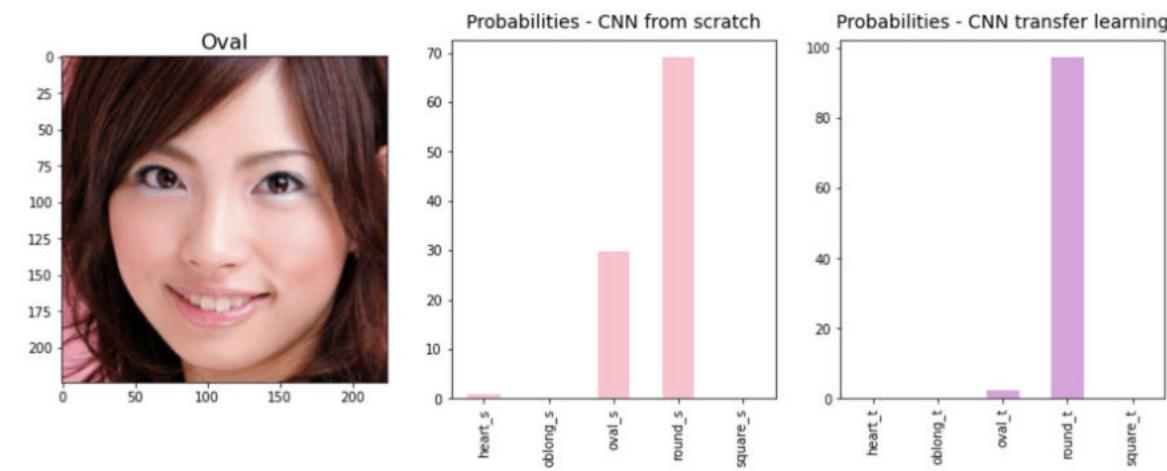


Oval misclassified as Square

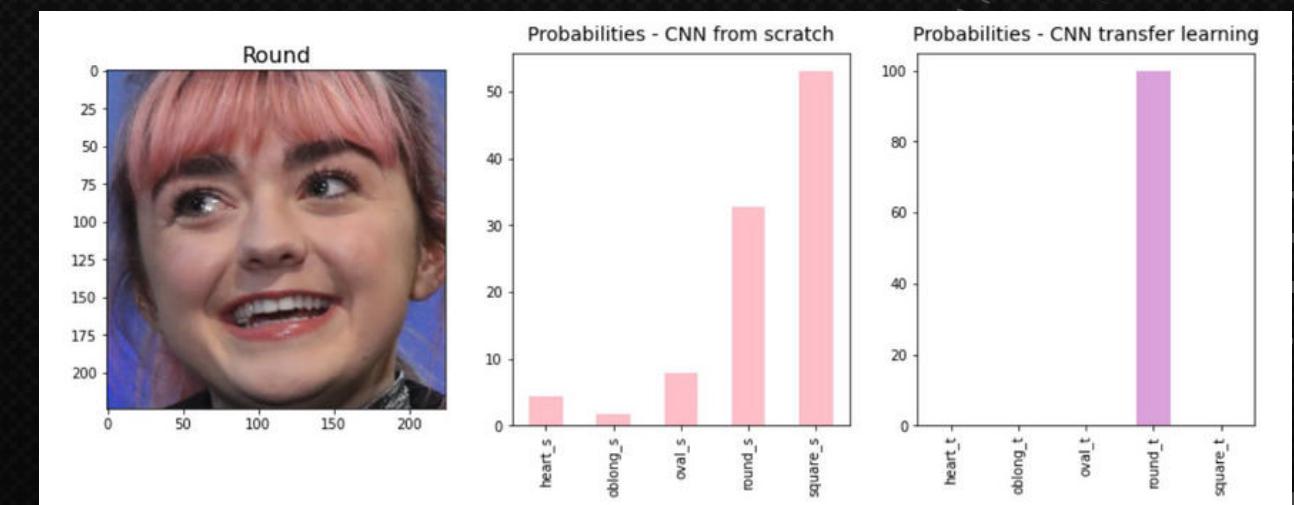
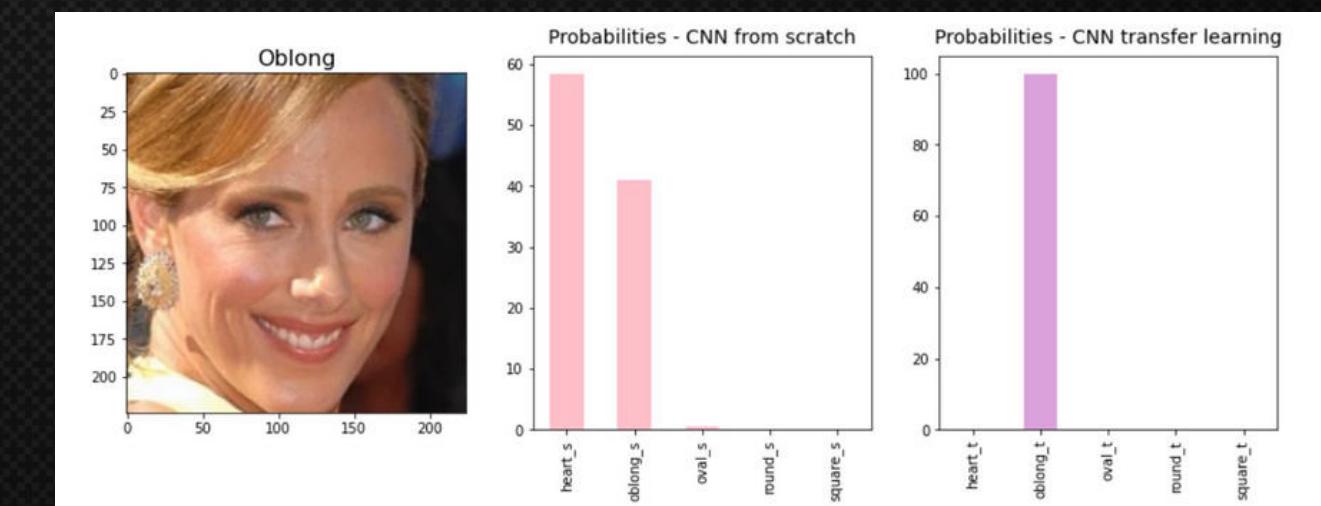
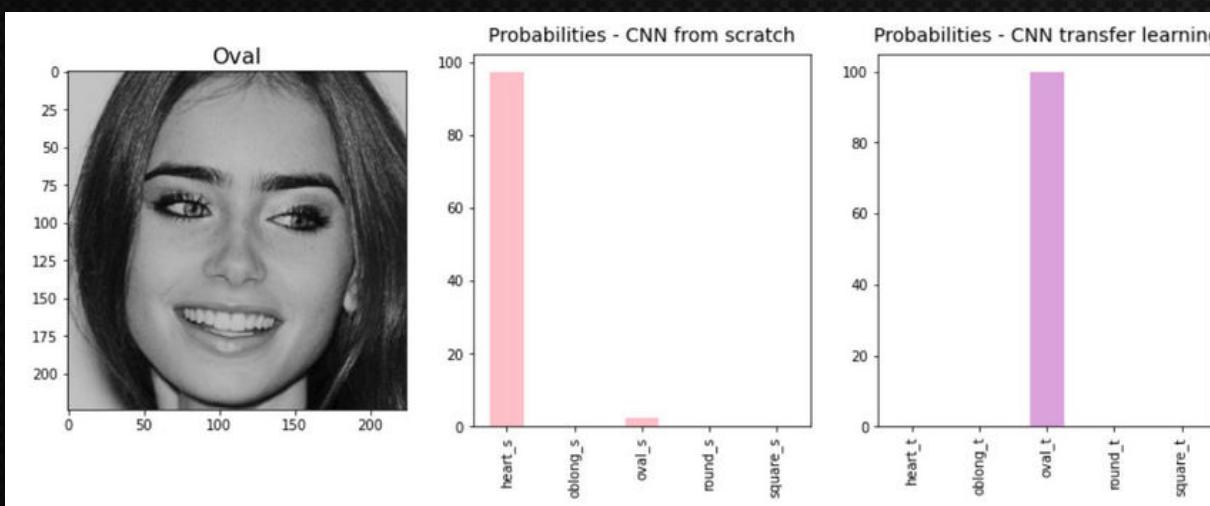
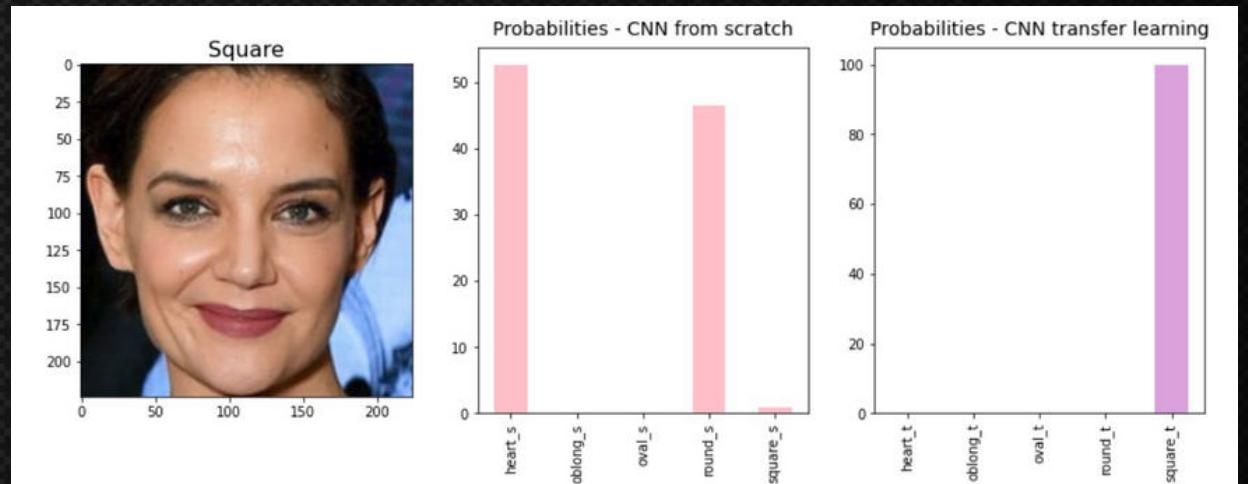
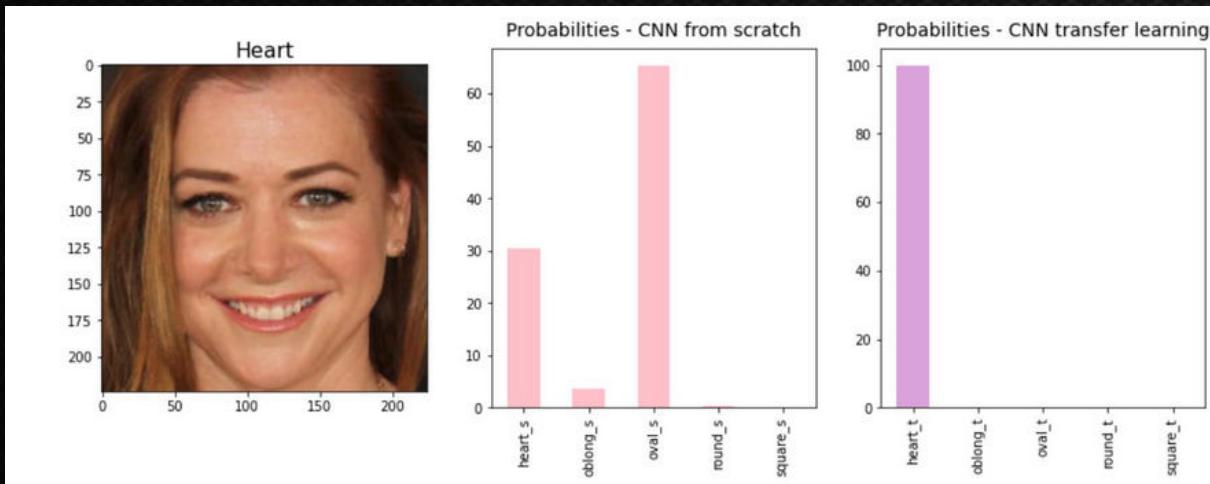


Mostly “Asian” Oval more mistaken as Round

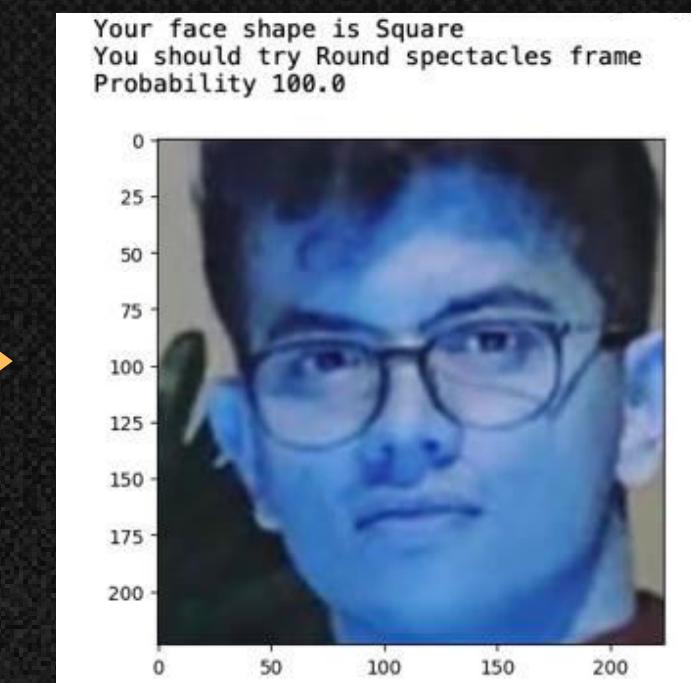
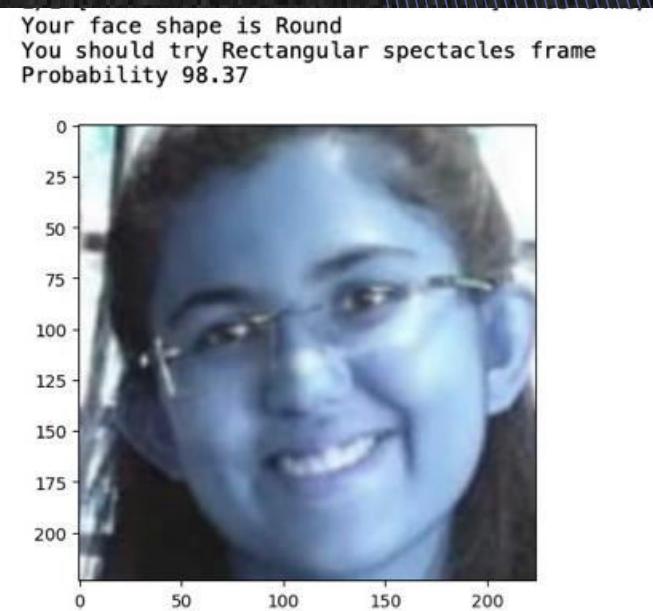
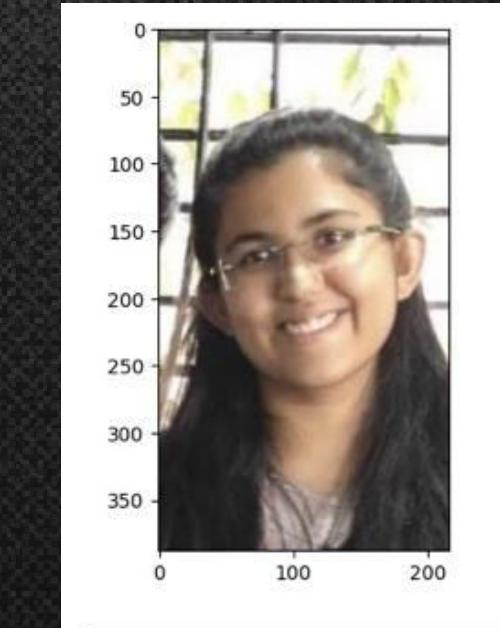
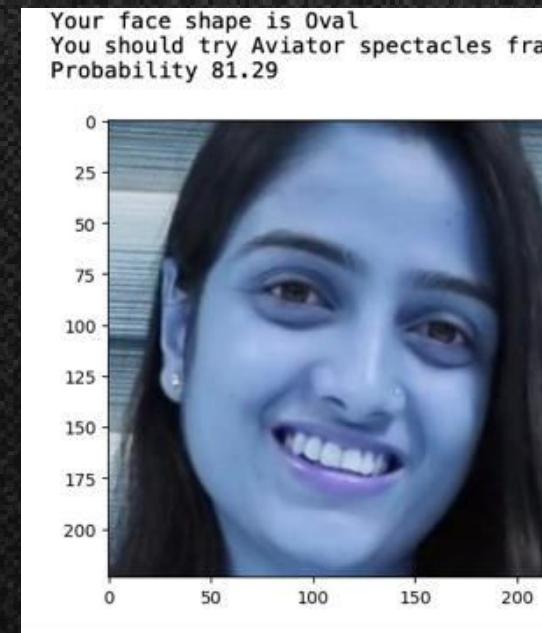
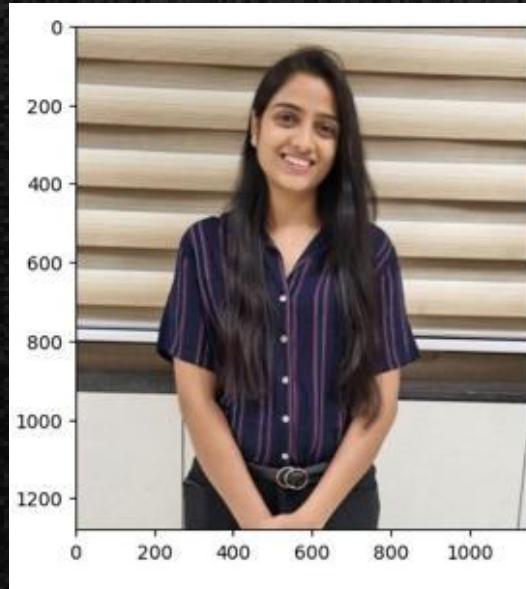
Oval misclassified as Round



Improvement from Transfer Learning : 100% probability of the predicted class



Predictions



Conclusion

- The model predicted the five face shapes well with 92.7% accuracy
- Key drivers are:
 - Face Detection (Bounding Box)
 - Image Augmentation with flip & rotation
 - Pretrained weights from VGG-Face

Our Journey





Trained on adult female faces

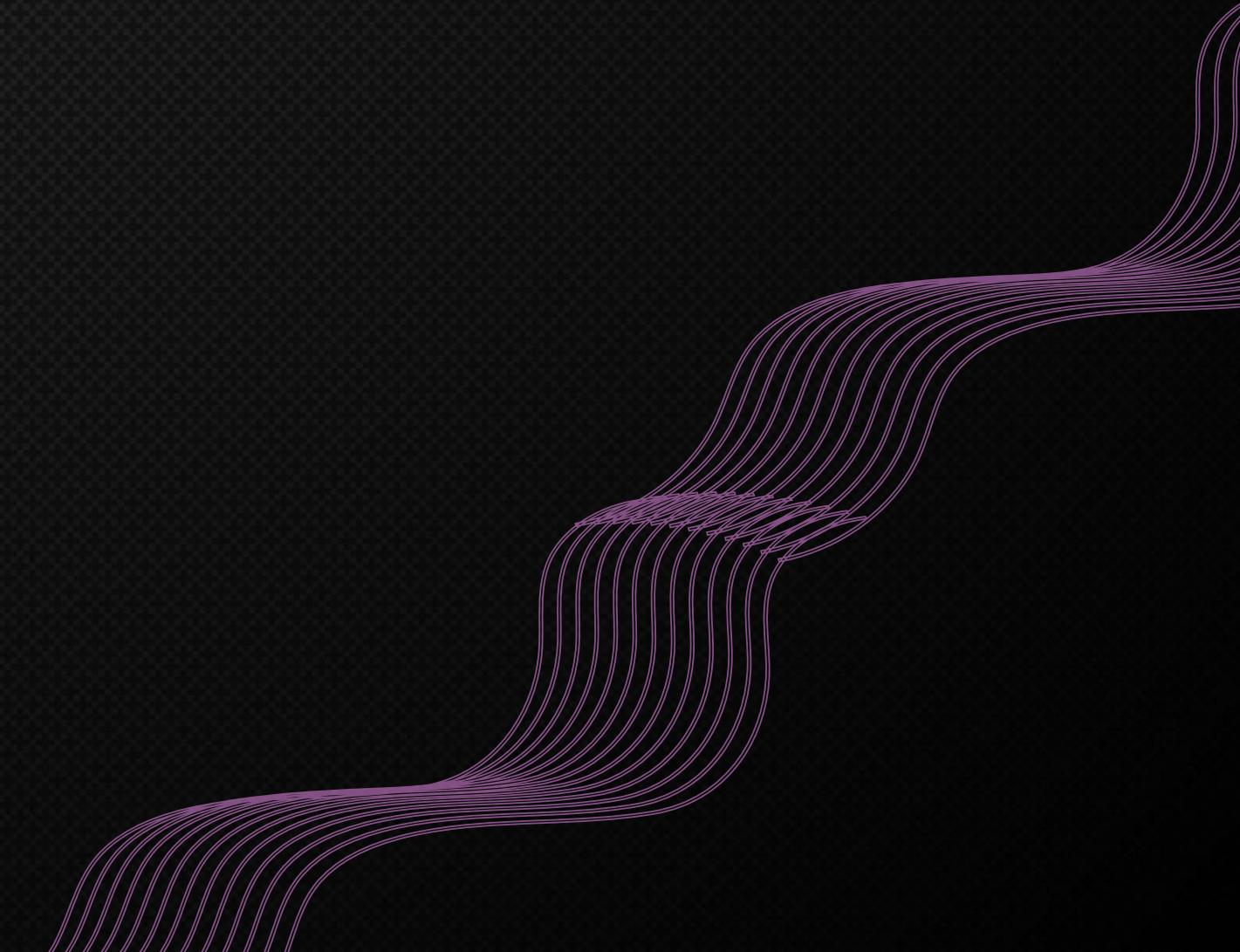


Lower accuracy on OVAL faces



Predictions depend on input image (angle, pose, cropping)

Limitations



Way Forward

Because we won't
stop here!

Extend training to:



Male Face Shapes



Different ages and races



With/Without Glasses

Under the guidance of

Special thanks for guiding
us along the way!

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Thank You