

FACE SHAPE CLASSIFICATION

CONTENTS





SECTION 1

LITERATURE REVIEW

	A Computer Aided System to Identify the Face Shape of a Person using Machine Learning and Image Processing Techniques	Face Shape Classification from 3D Human Data by using SVM
Tools used for image capture	Google image search	[TC] ² 3D body scanner
Processing Techniques	<ul style="list-style-type: none"> ● Resizing ● Cropping ● Noise Removal ● Data Augmentation 	<ul style="list-style-type: none"> ● Head Segmentation ● Face Plane Computation ● Feature Extraction
Accuracy	58.3%	73.68%
Dataset	4200 frontal face images	209 3D body scans

	Probabilistic neural network and invariant moments for men face shape classification	Face shape classification using Inception v3
Tools used for image capture	Google / Mobile Camera	Internet
Processing Techniques	<ul style="list-style-type: none"> ● Gray Scaling ● Contrast Enhancement ● Binarization ● Feature Extraction 	<ul style="list-style-type: none"> ● Upright Rotation ● Center Cropping ● Padding ● Feature Extraction ● Normalization
Accuracy	80%	97.8%
Dataset	120 male facial images	500 female celebrity images

	Face shape classification based on bilinear network with attention mechanism	Hybrid based model face shape using ensemble method for hair style
Tools used for image capture	High resolution professionally taken photographs	It could be a cell phone's camera.
Processing Techniques	<ul style="list-style-type: none"> ● M-RetinaFace (face alignment) ● Attention mechanism with the lightweight EfficientNet bilinear network, AB-CNN (feature extraction) ● Bilinear pooling layer (classification) 	<ul style="list-style-type: none"> ● Haar cascade for face detection. ● VGG-19 and hand craft features extraction. ● Multiple classifiers have been used. ● Ensemble method is used to get final output.
Accuracy	Average accuracy of 89.8% (not shared)	Overall accuracy of 86.5%
Dataset	5500 images divided into 5 categories each category with 1100 images. (kaggle celebrity)	400 images of both males and females of normal people.

3D-GUIDED FACE SHAPE CLASSIFICATION-2019		A computer Aided System to identify the face shape of a person using machine learning and lineage processing techniques
Tools used for image capture	Professional Cameras	High resolution images using Professional Cameras
Processing Techniques	Decision Tree, Random Forest and SVM (linear kernel) algorithms	<ul style="list-style-type: none"> ● Annotation (Using Dlib's 68-point facial landmark detector) ● Assess the annotation ● Select images (correctly landmarks) ● Calculate distances, ratios and angles ● Model Selection (Gradient Boosted Trees Classifier)
Accuracy	39%, 45% and 42%, respectively	70%
Dataset	there are 17 or 18 celebrities, each with 5 or 10 images in each face shape category to get total of 100 images in each category which makes the total up to 500	5000 images of the global female celebrities, Each category 1000 images. training set of category contains 800 images whereas the testing set contains 200 images. Kaggle Face shape dataset.



SECTION 2

METHODOLOGY

DATASET

DISTRIBUTION

- Combined Dataset

Celebrity Faces Dataset

Source: Kaggle

Number: 5000 female images

Number of Classes: 5

Oval, Oblong, Square, Round, Heart

Face Shape Dataset

Source: GitHub

Number: 1000 female images

Number of Classes: 5

Oval, Oblong, Square, Round, Heart

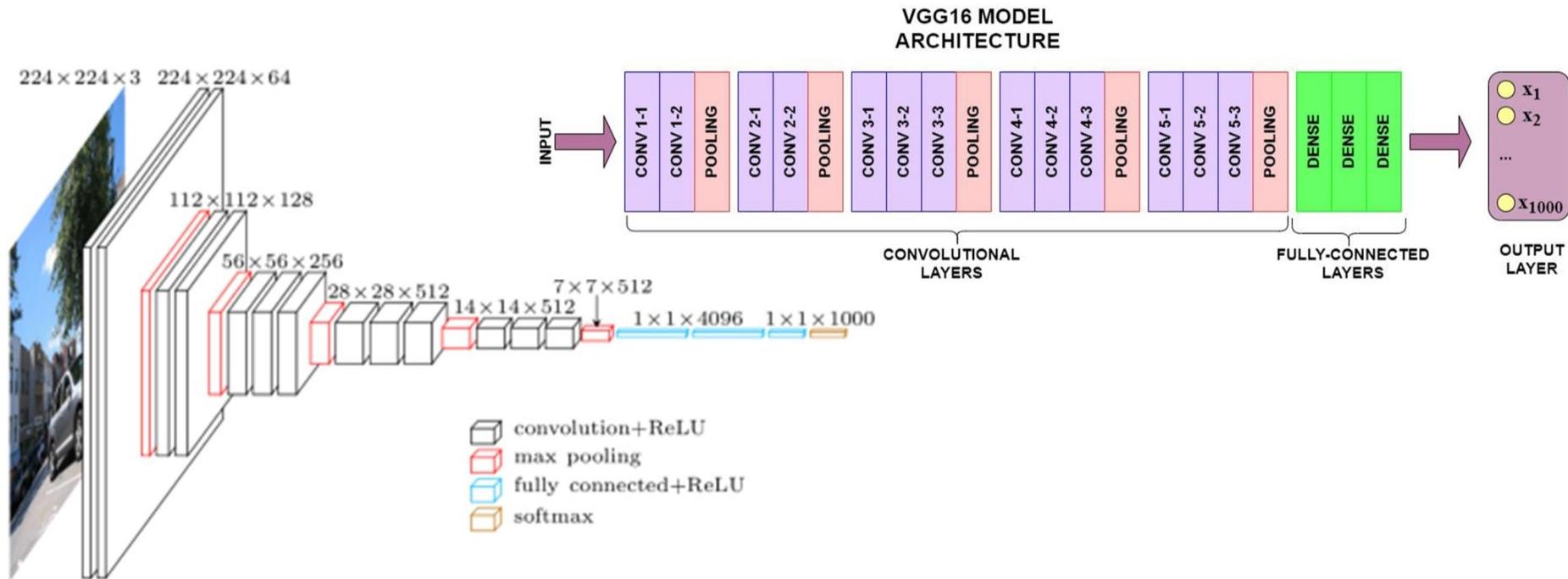
- Train/Validation/Test Ratio: 75/5/20 %

Preprocessing:

- Cropping
- Normalization
- Horizontal Flipping
- Sharpening

CNN MODEL

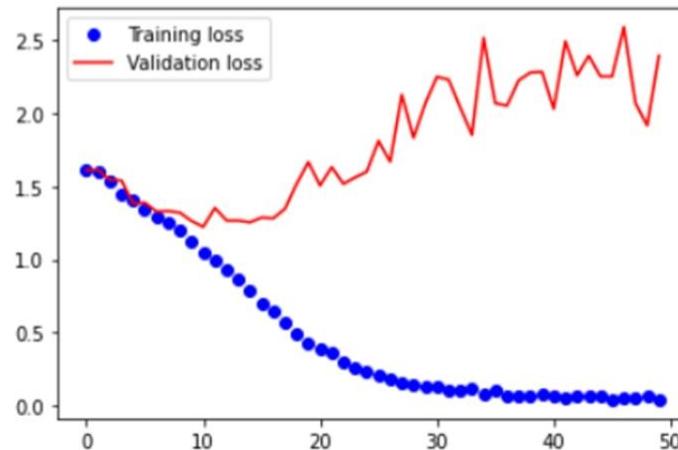
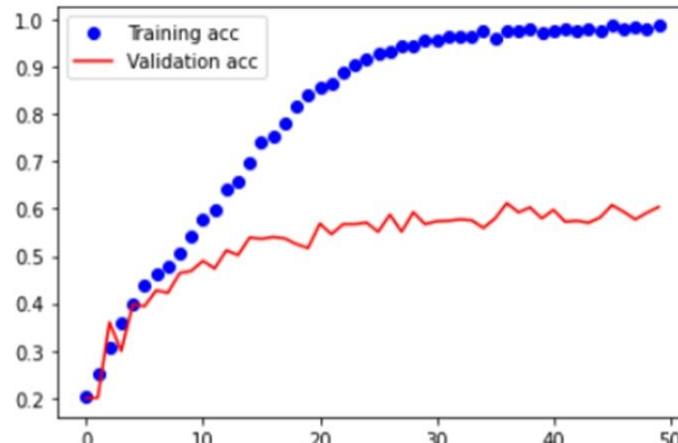
ARCHITECTURE (VGG-16)



OUTPUT

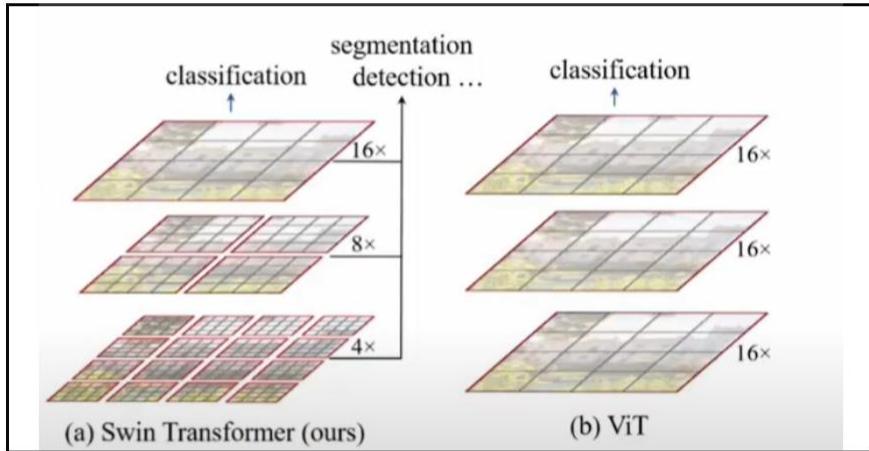
Training Accuracy : 96%

Testing Accuracy : 55%



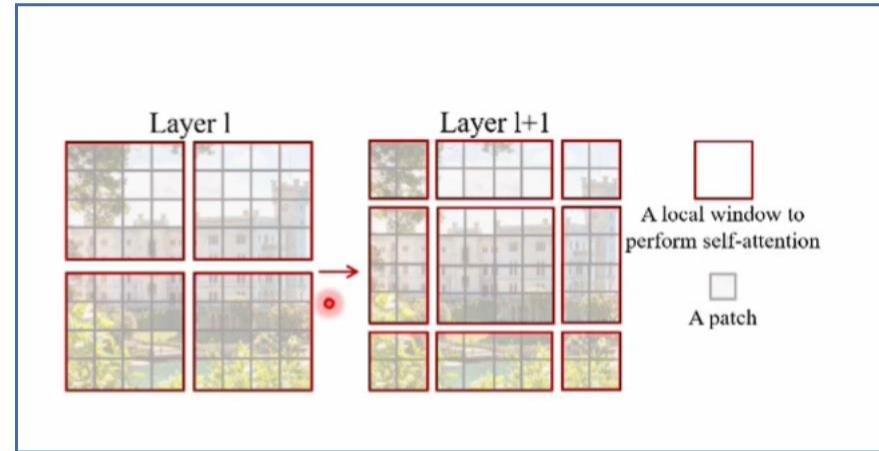
TRANSFORMERS MODEL

TRANSFORMERS



Vision Transformer

- Self attention globally
- Quadratic Computation Complexity

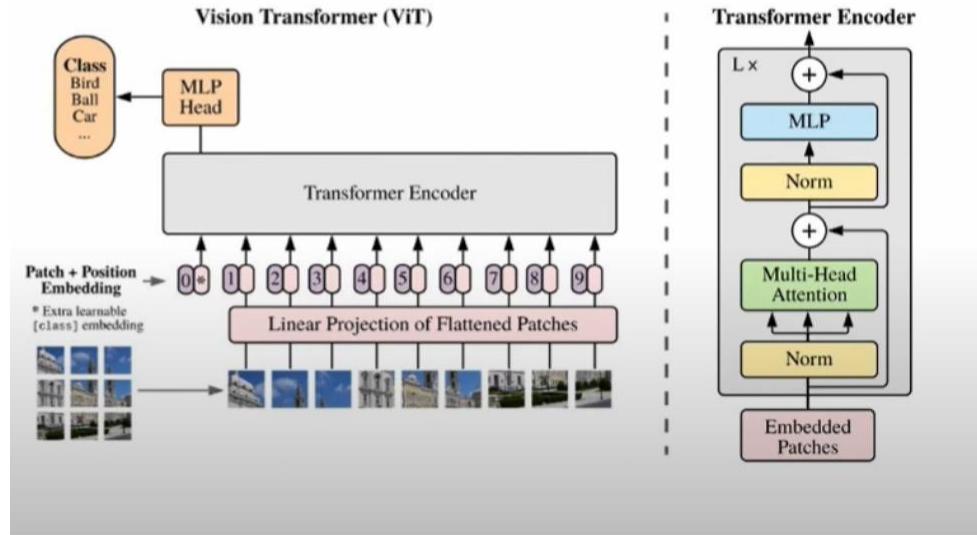


Swin Transformer

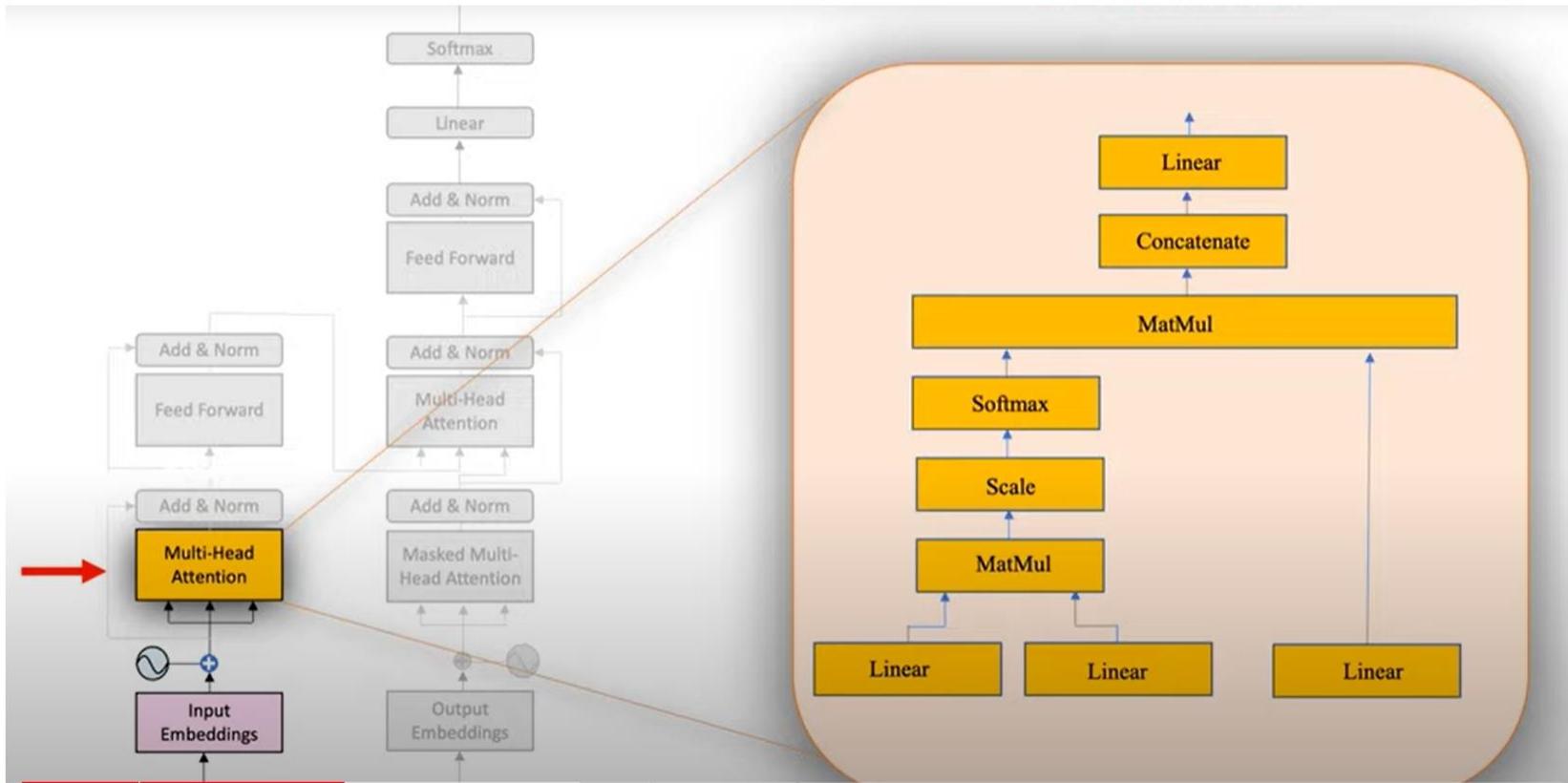
- Hierarchical architecture
- Self attention locally
- Linear Computational complexity
- Shifted Window

INTRODUCTION

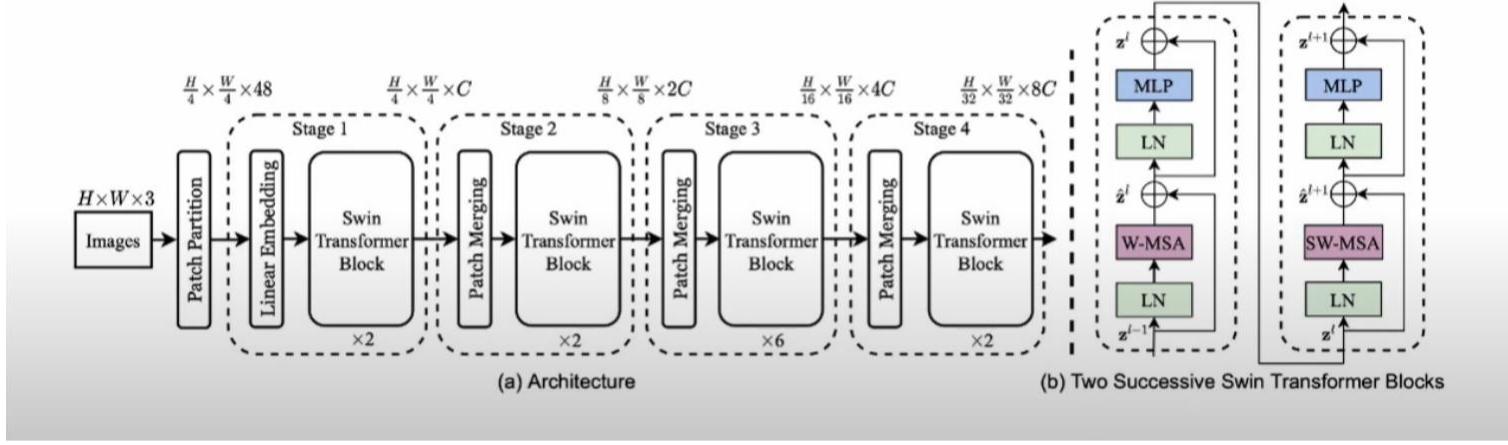
- Convolution run piece after piece , Transformer whole at once (parallel)
- Inputs are fed in parallel
- Unique positional embedding
- Projection to C dimension
- Softmax layer ate MLP head



ATTENTION IS ALL YOU NEED



OVER ALL ARCHITECTURE



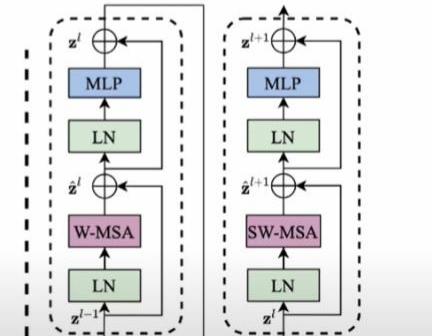
- Swin Transformer Blocks

$$\hat{\mathbf{z}}^l = \text{W-MSA}(\text{LN}(\mathbf{z}^{l-1})) + \mathbf{z}^{l-1},$$

$$\mathbf{z}^l = \text{MLP}(\text{LN}(\hat{\mathbf{z}}^l)) + \hat{\mathbf{z}}^l,$$

$$\hat{\mathbf{z}}^{l+1} = \text{SW-MSA}(\text{LN}(\mathbf{z}^l)) + \mathbf{z}^l,$$

$$\mathbf{z}^{l+1} = \text{MLP}(\text{LN}(\hat{\mathbf{z}}^{l+1})) + \hat{\mathbf{z}}^{l+1},$$



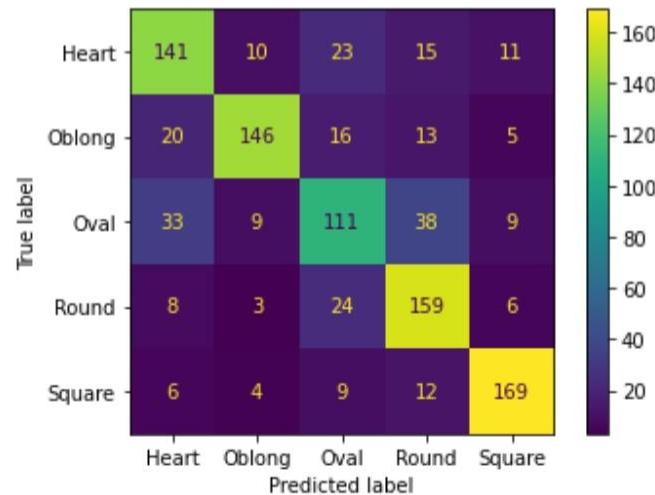
OUTPUTS

Train Accuracy : 80%

Validation Accuracy : 73%

Testing Accuracy : 72.5%

	precision	recall	f1-score	support
Heart	0.68	0.70	0.69	200
Oblong	0.85	0.73	0.78	200
Oval	0.61	0.56	0.58	200
Round	0.67	0.80	0.73	200
Square	0.84	0.84	0.84	200
accuracy			0.73	1000
macro avg	0.73	0.73	0.73	1000
weighted avg	0.73	0.73	0.73	1000



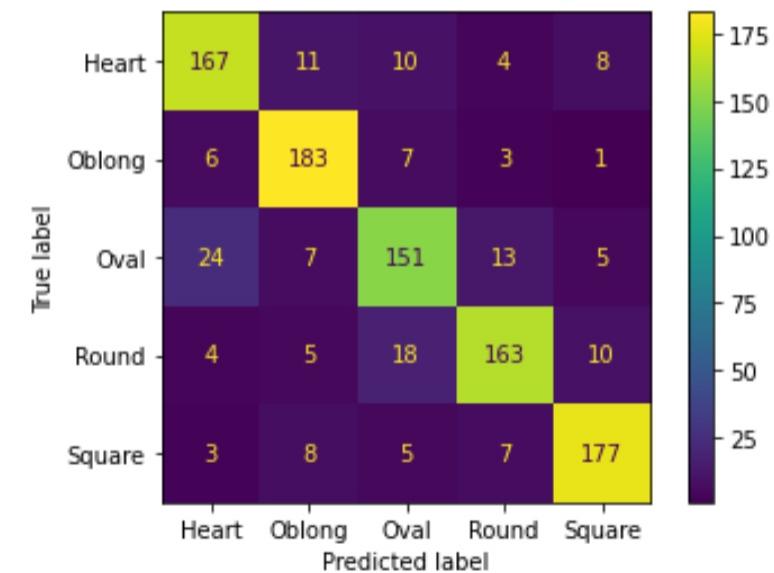
IMPROVED OUTPUTS

Train Accuracy : 89%

Validation Accuracy : 84.5%

Testing Accuracy : 84%

	precision	recall	f1-score	support
Heart	0.82	0.83	0.83	200
Oblong	0.86	0.92	0.88	200
Oval	0.79	0.76	0.77	200
Round	0.86	0.81	0.84	200
Square	0.88	0.89	0.88	200
accuracy			0.84	1000
macro avg	0.84	0.84	0.84	1000
weighted avg	0.84	0.84	0.84	1000

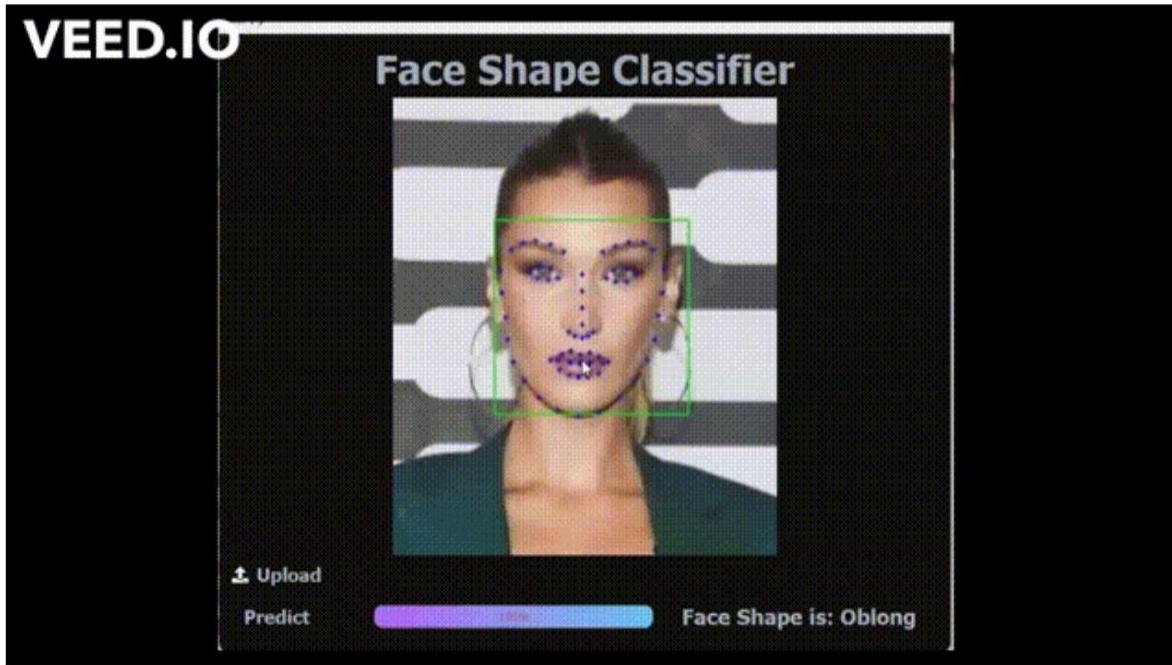




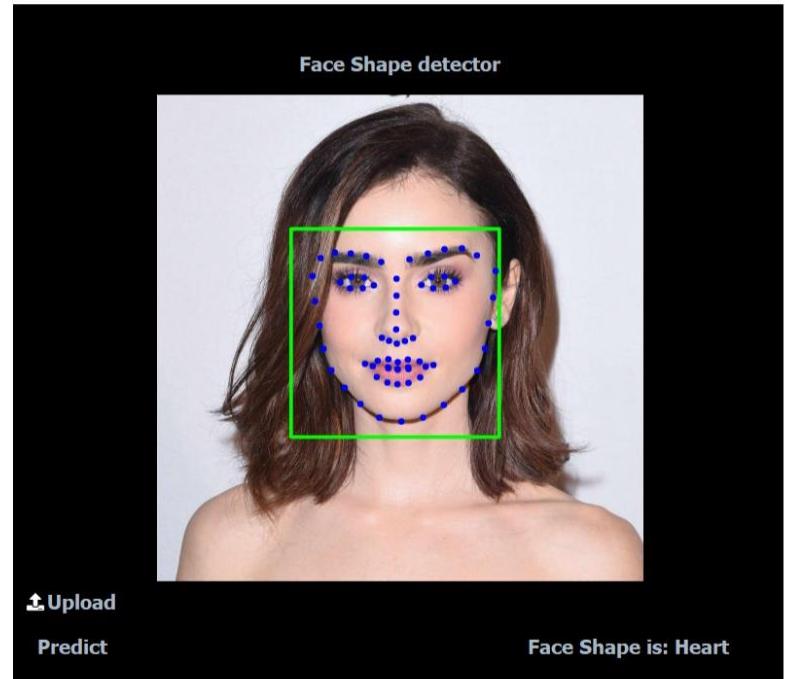
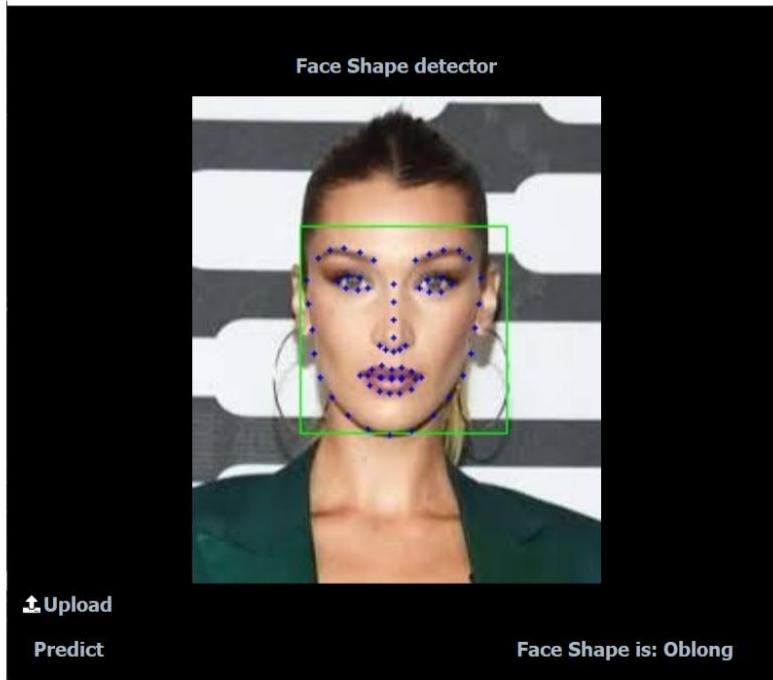
SECTION 3

RESULTS

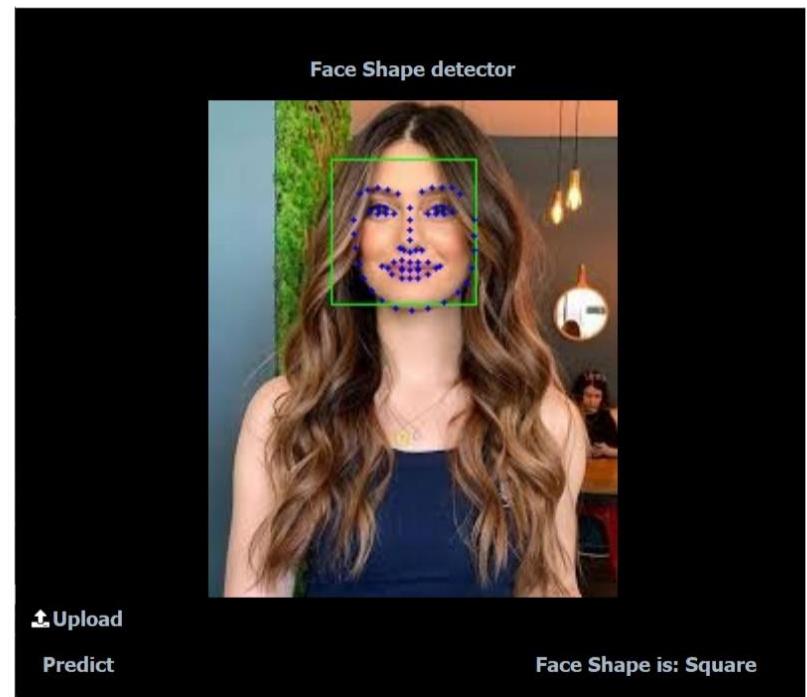
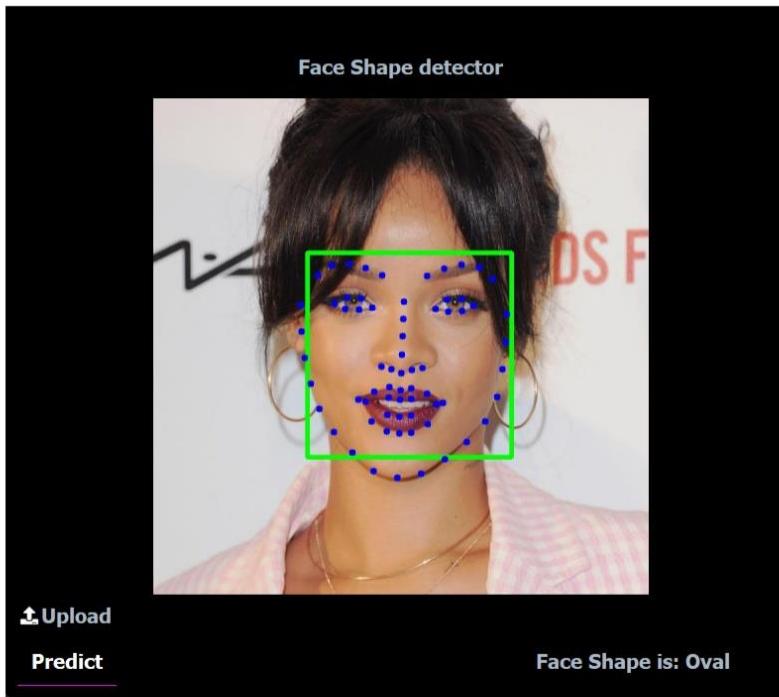
OUR DESKTOP APPLICATION DEMO



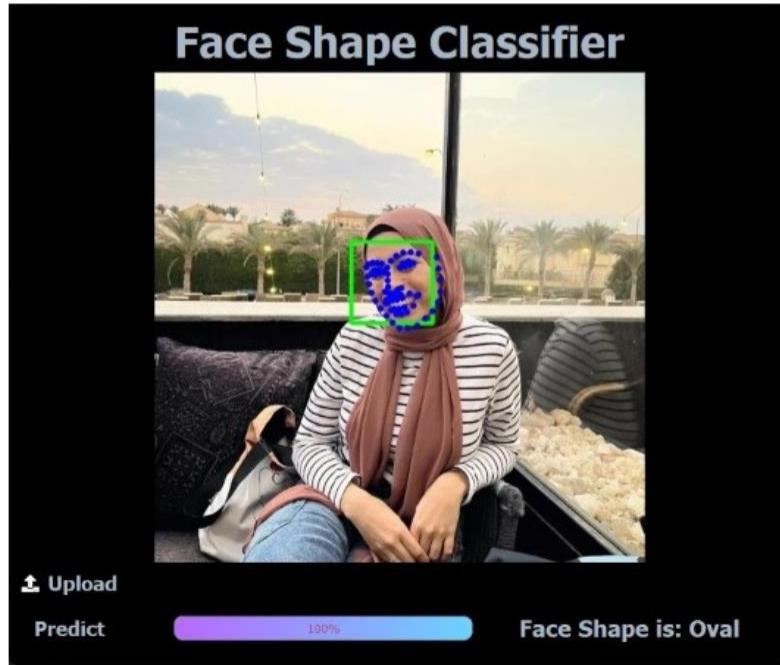
RESULTS FROM OUR APPLICATION



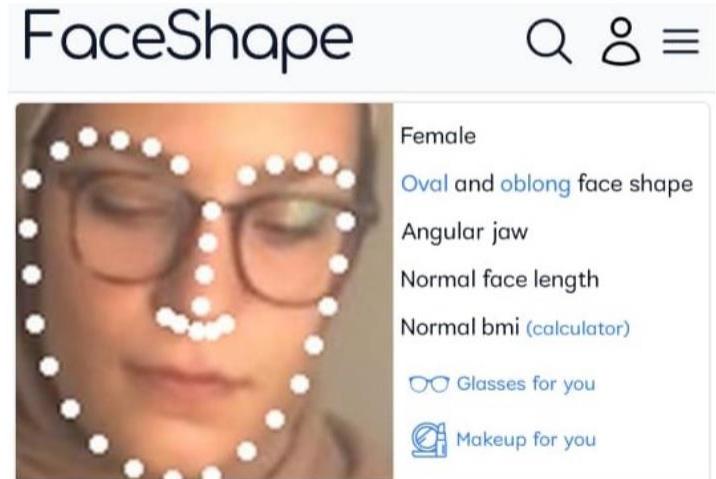
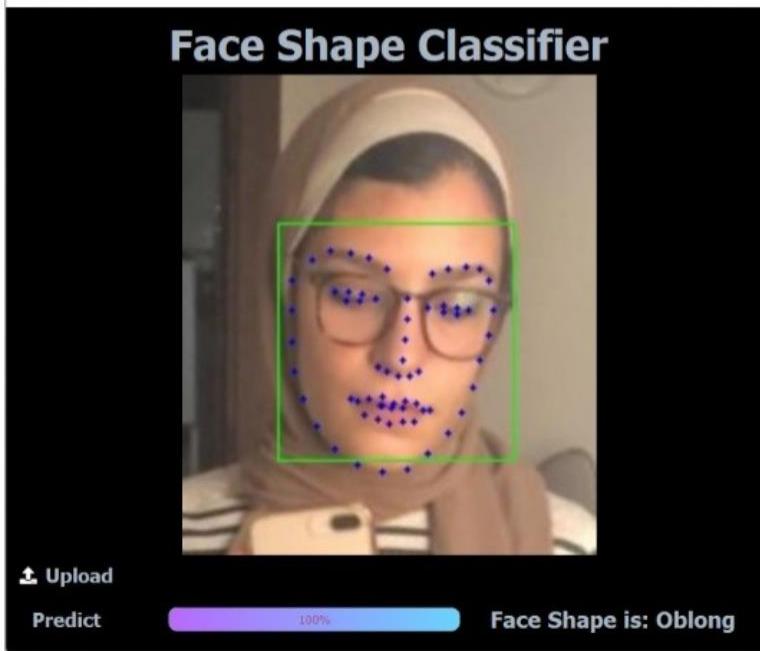
RESULTS FROM OUR APPLICATION



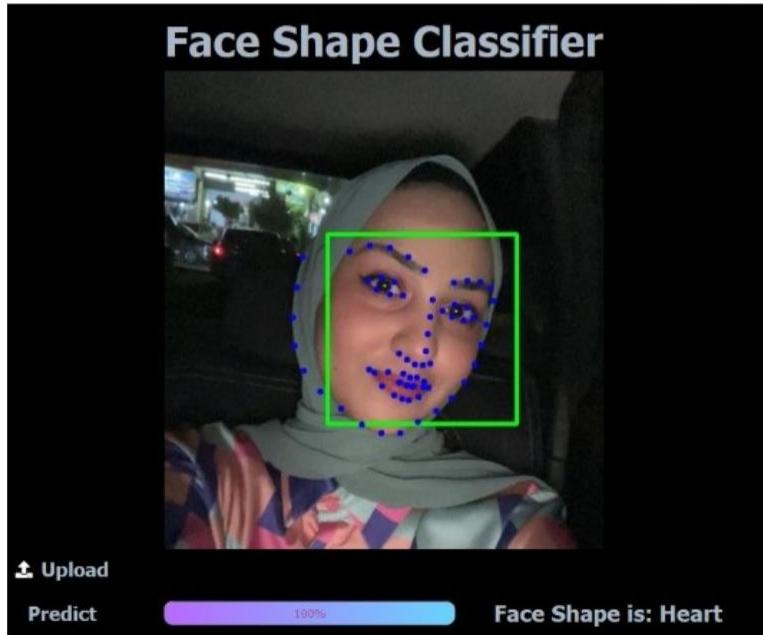
RESULTS FROM OUR APPLICATION COMPARED TO OTHER APPLICATIONS



RESULTS FROM OUR APPLICATION COMPARED TO OTHER APPLICATIONS



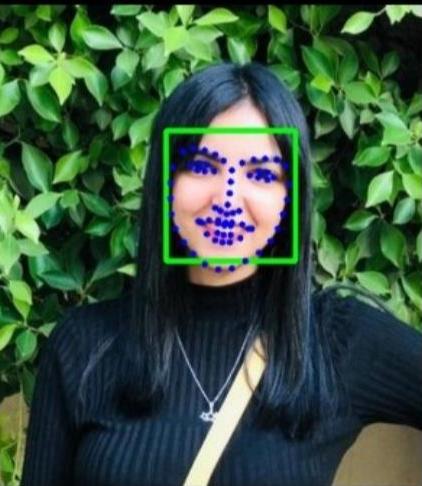
RESULTS FROM OUR APPLICATION COMPARED TO OTHER APPLICATIONS



A screenshot of another face analysis application. The interface includes a large image of a woman's face with white dots marking key points. To the right of the image, several text labels provide analysis results: "Female", "Oval and heart face shape", "Angular jaw", "Normal face length", "Normal bmi [\(calculator\)](#)", "Glasses for you", and "Makeup for you". Below this section, the text "Celebrity lookalikes: Sana Amin Sheikh [\(best match\)](#), Lekha Washington, Mimi Chakraborty, more." is shown. At the bottom right is a blue button labeled "Try again".

RESULTS FROM OUR APPLICATION COMPARED TO OTHER APPLICATIONS

Face Shape Classifier



Upload

Predict

Face Shape is: Heart



22, Female
Heart and oval face shape
Angular jaw
Normal face length
Normal bmi (calculator)
Glasses for you
Makeup for you

Celebrity lookalikes: Olga Scheps (best match), Arthur Rackham, Hafsat Herzi, more.

Try again

RESULTS FROM OUR APPLICATION COMPARED TO OTHER APPLICATIONS

Face Shape Classifier



Upload

Predict

Face Shape is: Round



29, Female
Triangle and round face shape
Angular jaw
Normal face length
Normal bmi (calculator)
👓 Glasses for you
💄 Makeup for you

Celebrity lookalikes: Gina Gogean (best match), Zain Bhikha, Aqib Khan, more.

Try again

RESULTS FROM OUR APPLICATION COMPARED TO OTHER APPLICATIONS

Face Shape Classifier



Upload

Predict

Face Shape is: Round



31, Female

Triangle and round face shape

Defined jaw

Normal face length

High bmi (calculator)

Glasses for you

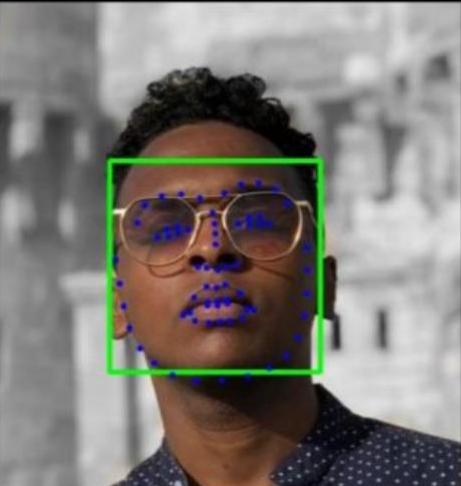
Makeup for you

Celebrity lookalikes: Dolly Bindra (best match), Maneka Gandhi, Lydia Mendoza, more.

Try again

RESULTS FROM OUR APPLICATION COMPARED TO OTHER APPLICATIONS

Face Shape Classifier



Upload

Predict

Face Shape is: Heart



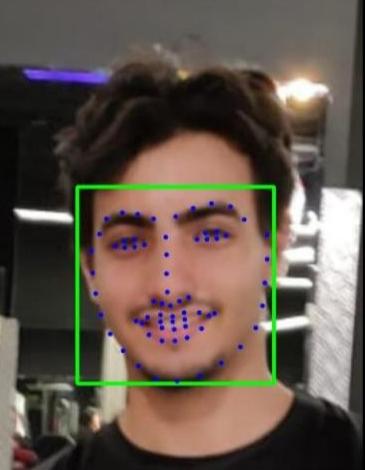
Male
Heart and oval face shape
Angular jaw
Normal face length
Normal bmi (calculator)
Glasses for you

Celebrity lookalikes: Tricky Stewart (best match), Allu Arjun, Darnell McDonald, more.

Try again

RESULTS FROM OUR APPLICATION COMPARED TO OTHER APPLICATIONS

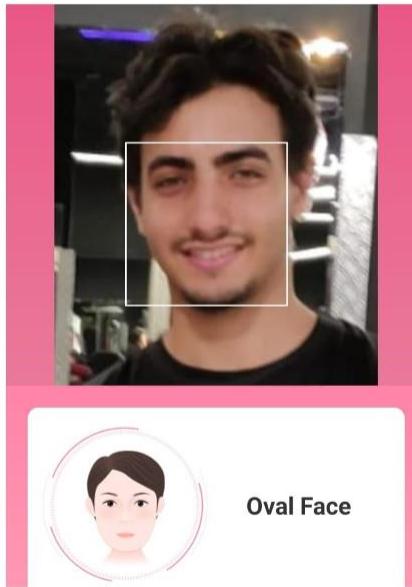
Face Shape Classifier



Upload

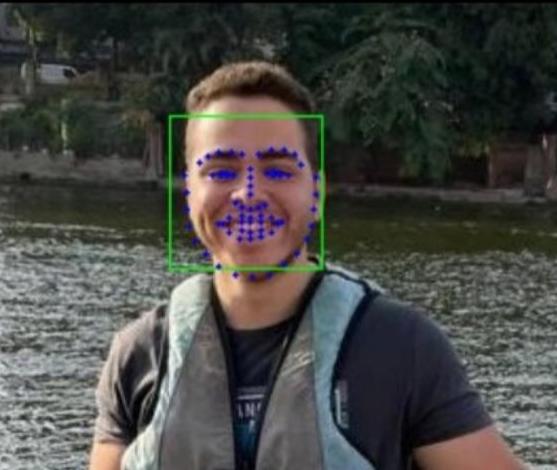
Predict

Face Shape is: Oval



RESULTS FROM OUR APPLICATION COMPARED TO OTHER APPLICATIONS

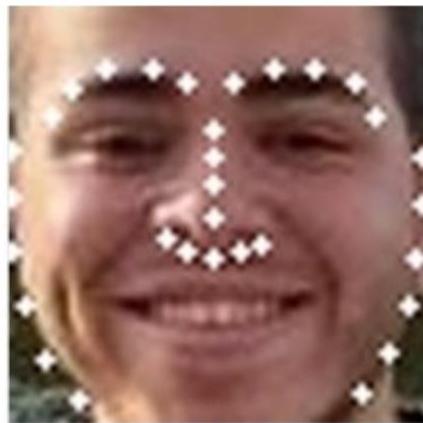
Face Shape Classifier



Upload

Predict

Face Shape is: Heart



27, Male
Heart face shape
Defined jaw
Normal face length
Normal bmi (calculator)
Glasses for you

Celebrity lookalikes: Alessandro Matri (best match), Marco Mengoni, Pedro Lamy, more.

THANKS