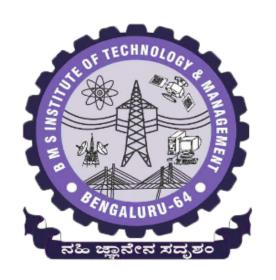# BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT
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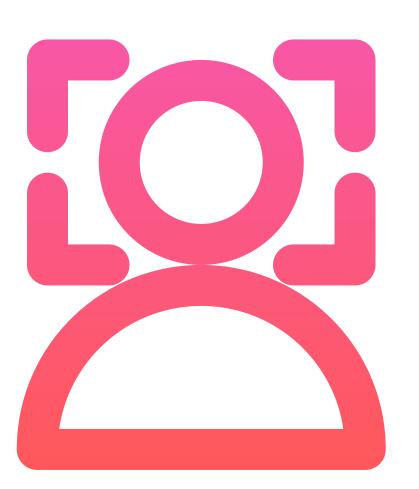**DEPARTMENT OF CSE**

Technical Seminar On

"Comparative Study On Various Facial Recognition Algorithms"

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Contents

Abstract

Comparative study of facial recognition algorithms.

The algorithms will be compared based on their accuracy, their architecture, their training dataset, and their loss functions to determine the best facial recognition algorithm. Some of the algorithms bring compared are VGG19, Facenet by Google, Deepface by Facebook, Alexnet and Local Binary Pattern Histogram (LBPH).

Introduction

01 Several algorithms and strategies to recognize faces.

02 Significant advancements in technology enable a wide range of use cases across industries.

03 The issue in the present day is "what is the best facial recognition system for me?"

In the context of COVID-19, there is a greater emphasis on contactless interactions. Facial recognition is acknowledged as the most accurate and simple method to establish individual identity.

Methodology

Facial Recognition Algorithms

⭐ AlexNet

AlexNet is the name of a convolutional neural network (CNN) architecture that is used for object detection tasks. It t is an incredibly powerful model capable of achieving high accuracies on very challenging datasets. The architecture consists of eight layers: five convolutional layers and three fully-connected layers.
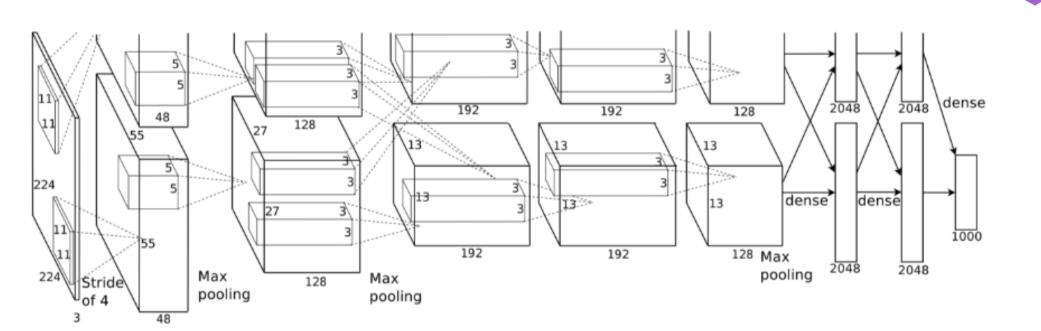

Fig 3.1 AlexNet Architecture

Methodology

Facial Recognition Algorithms

⭐ VGGFace

VGGFace refers to a series of models developed for face recognition. This VGG architecture is classified in two parts:
- VGG16- It has 13 CRP(Convolution Relu Pooling) and 3 Fully connected layers.
- VGG19- It has 16 CRP(Convolution Relu Pooling) and 3 Fully connected layers.
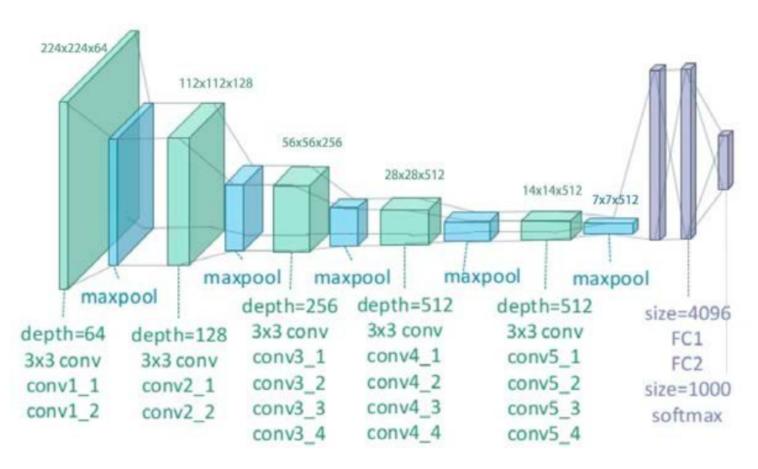

Fig 3.2 VGG-Face 19 Architecture

Methodology

Facial Recognition Algorithms

⭐ DeepFace

DeepFace is a deep neural network developed by Facebook. It is used for the purpose of face recognition. It follows the flow of detection, alignment, representation, and classifcation to achieve the task. It doesn't matter if the face is tilted, at an angle, or in bad lighting. DeepFace is trained for multi-class face recognition i.e. to classify the images of multiple people based on their identities.
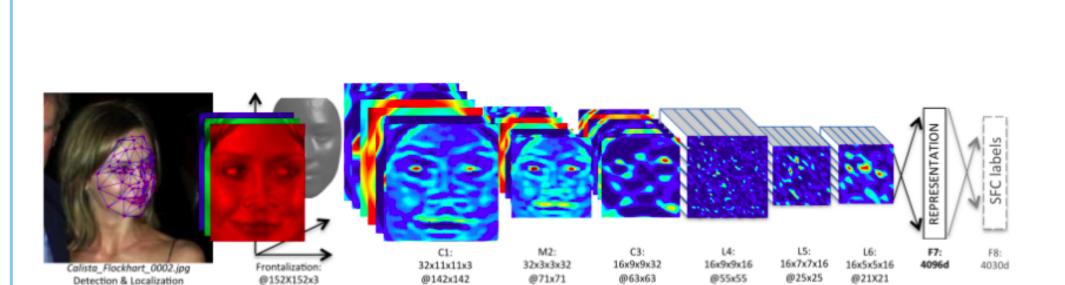

Fig 3.3 Architecture of DeepFace

Methodology

Facial Recognition Algorithms

⭐ FaceNet

FaceNet is the name of the facial recognition system that was proposed by Google Researchers. FaceNet is a Deep Neural Network used for face verification, recognition, and clustering. It generates a high-quality face mapping from the images using deep learning architectures such as ZF-Net and Inception. Then it used a method called triplet loss as a loss function to train this architecture

type	output size	depth	#1×1	#3×3 reduce	#3×3	#5×5 reduce	#5×5	pool proj (p)	params	FLOPS
conv1 (7×7×3, 2)	112×112×64	1							9K	119M
max pool + norm	56×56×64	0						m 3×3, 2		
inception (2)	56×56×192	2		64	192				115K	360M
norm + max pool	28×28×192	0						m 3×3, 2		
inception (3a)	28×28×256	2	64	96	128	16	32	m, 32p	164K	128M
inception (3b)	28×28×320	2	64	96	128	32	64	L_2, 64p	228K	179M
inception (3c)	14×14×640	2	0	128	256,2	32	64,2	m 3×3,2	398K	108M
inception (4a)	14×14×640	2	256	96	192	32	64	L_2, 128p	545K	107M
inception (4b)	14×14×640	2	224	112	224	32	64	L_2, 128p	595K	117M
inception (4c)	14×14×640	2	192	128	256	32	64	L_2, 128p	654K	128M
inception (4d)	14×14×640	2	160	144	288	32	64	L_2, 128p	722K	142M
inception (4e)	7×7×1024	2	0	160	256,2	64	128,2	m 3×3,2	717K	56M
inception (5a)	7×7×1024	2	384	192	384	48	128	L_2, 128p	1.6M	78M
inception (5b)	7×7×1024	2	384	192	384	48	128	m, 128p	1.6M	78M
avg pool	1×1×1024	0								
fully conn	1×1×128	1							131K	0.1M
L2 normalization	1×1×128	0								
total									7.5M	1.6B

Methodology

Facial Recognition Algorithms

⭐ LBPH

LBPH (Local Binary Pattern Histogram) is a Face-Recognition algorithm it is used to recognize the face of a person. It is known for its performance and how it is able to recognize the face of a person from both the front and the side. It uses a Local Binary Pattern (LBP), which is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number.
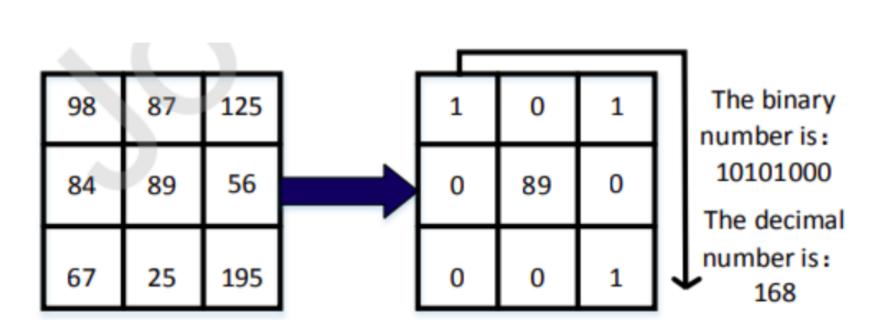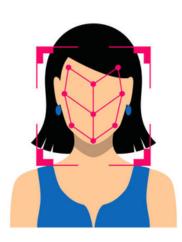
98	87	125
84	89	56
67	25	195

1	0	1
0	89	0
0	0	1

The binary number is: 10101000

The decimal number is: 168

Fig 3.5 Schematic diagram of the LBP neighbourhood process

Working Principle

Every facial recognition system follows a certain few key steps. These are listed below

Key steps

01 Face Detection - locating image of a face

02 Face analysis - identifying facial landmarks

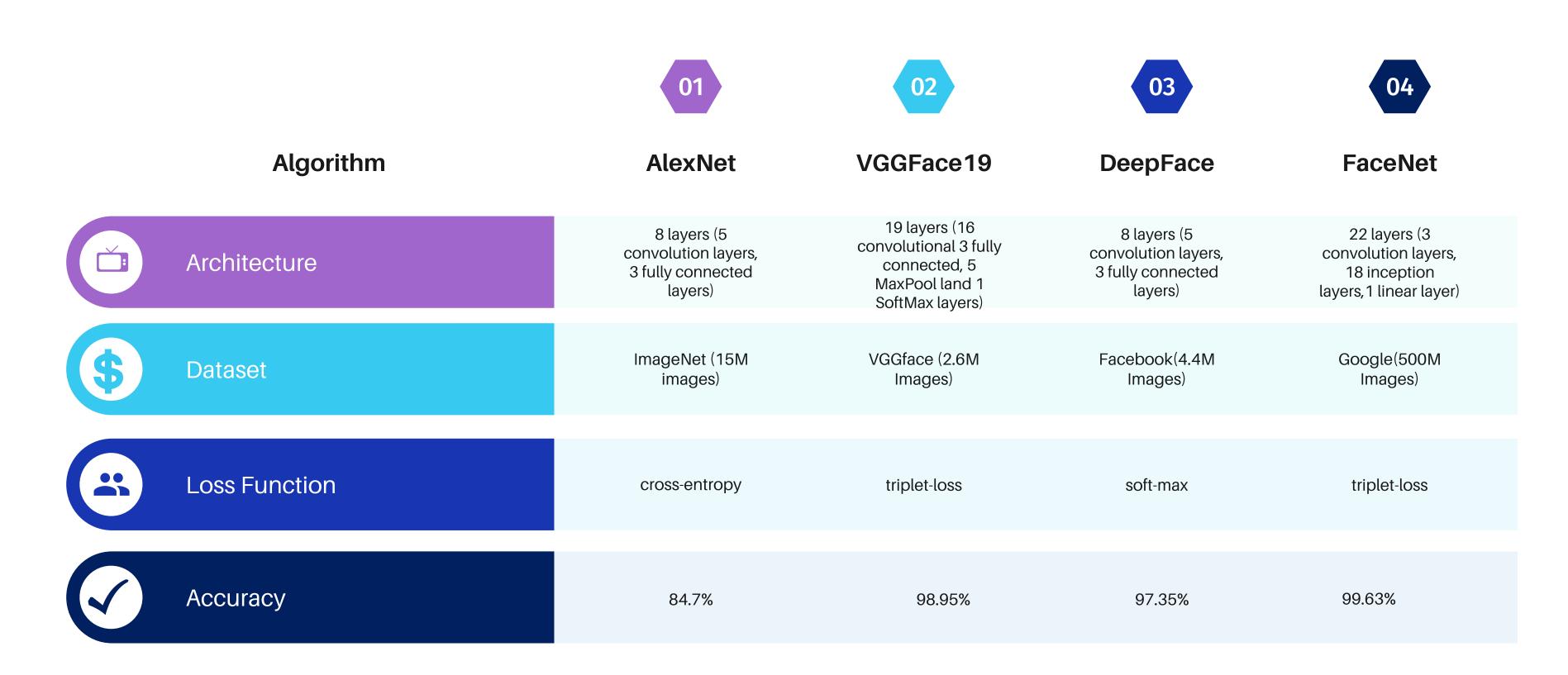**03** Converting image to mathematical data for analysis

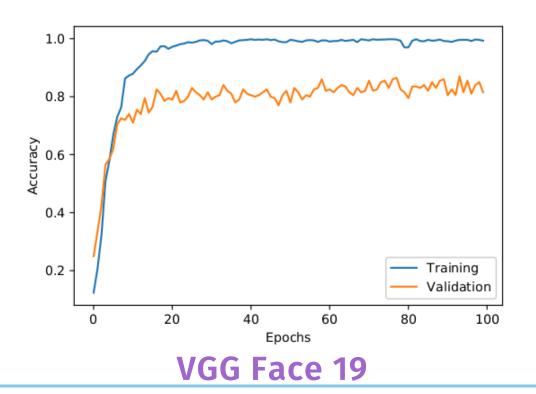**04** Finding a match against a database of known faces
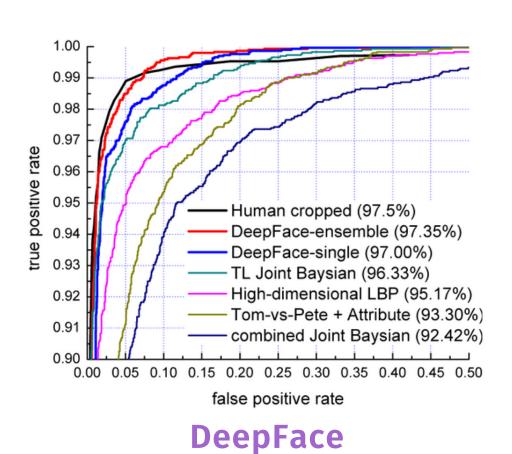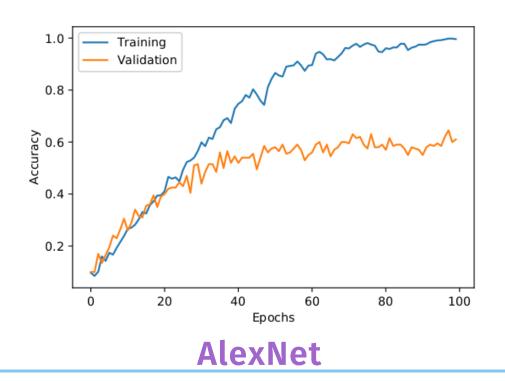
Results

Let's begin.

Comparison

Algorithm	01 AlexNet	02 VGGFace19	03 DeepFace	04 FaceNet
Architecture	8 layers (5 convolution layers, 3 fully connected layers)	19 layers (16 convolutional 3 fully connected, 5 MaxPool land 1 SoftMax layers)	8 layers (5 convolution layers, 3 fully connected layers)	22 layers (3 convolution layers, 18 inception layers, 1 linear layer)
Dataset	ImageNet (15M images)	VGGface (2.6M Images)	Facebook(4.4M Images)	Google(500M Images)
Loss Function	cross-entropy	triplet-loss	soft-max	triplet-loss
Accuracy	84.7%	98.95%	97.35%	99.63%

Comparison

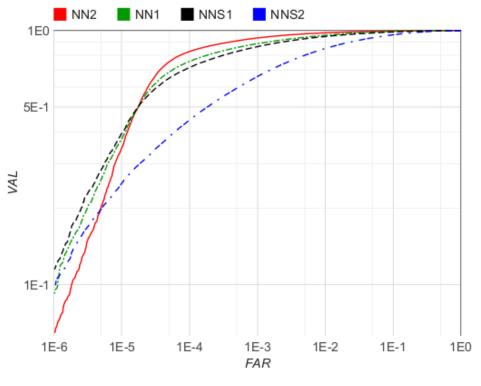VGG Face 19

AlexNet

DeepFace

FaceNet

Conclusions

01 FaceNet has the highest accuracy of 99.63% in 2-D facial recognition algorithms.

02 FaceNet is also the most reliable as it is trained with a dataset of 500 Million images.

03 VGGFace19 is also pretty accurate however, the dataset size is less.

Conclusions

04
3D facial recognition captures more features than the 2D facial recognition algorithms but it is yet to reach the level of accuracy as 2D recognition algorithms.

05
In the coming future with better computation and hardware, the demand for 3D recognition will increase as it is more reliable and trustworthy than 2D recognition.

06
We already see big companies like Apple shifting to 3D technologies for facial recognition. It is predicted that more companies will shift to the 3D technology with improving the accuracy of the algorithms.

That's a wrap!

Thank you!

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Khushwinder Singh