EX.NO.: 10
DATE: 21.08.2025

DEEP LEARNING ALGORITHM FOR FACE DETECTION WITH VGGFACE2

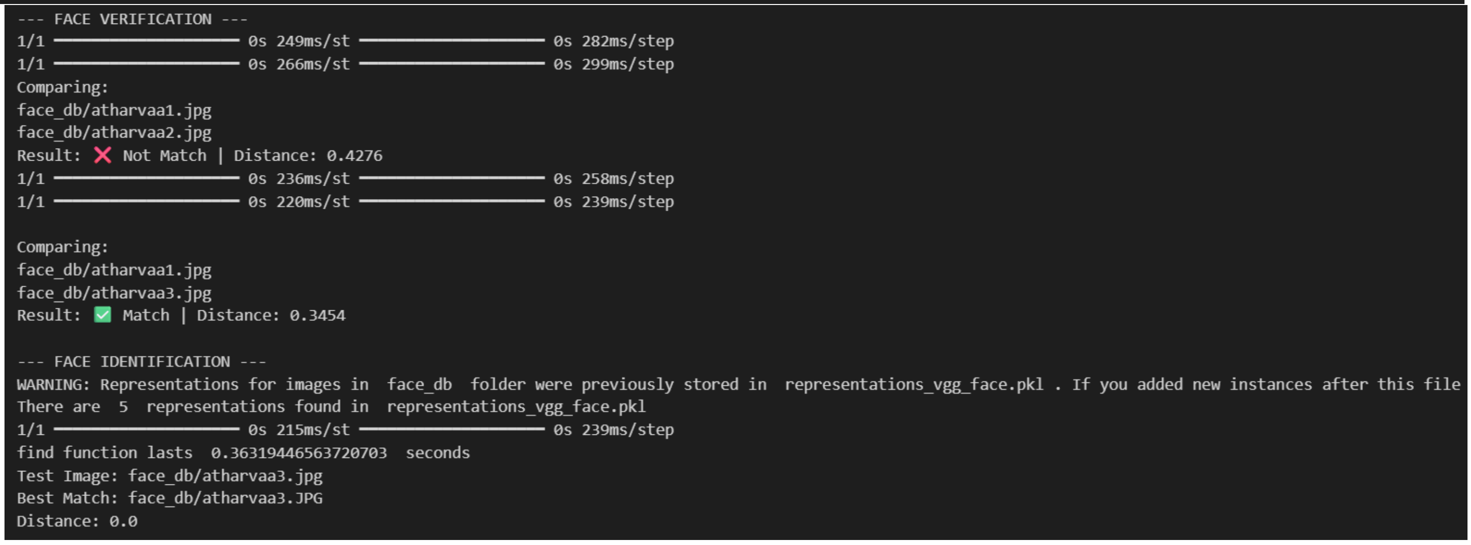
AIM
To detect, verify, and identify faces in images using deep learning (VGG-Face model) with bounding box visualization.

ALGORITHM
1. Patch missing Keras layers for compatibility.
2. Import DeepFace and required libraries.
3. Load images for verification or identification.
4. Compute face embeddings using VGG-Face model.
5. Compare embeddings to calculate distance.
6. Decide match for verification or find best match in database for identification.
7. Display results and visualize matched images.

CODE AND OUTPUT
```
# -----------------------------
#  🔹 PATCH FOR DEEPFACE + KERAS 3
# -----------------------------
import tensorflow as tf
from tensorflow.keras import layers

# Patch LocallyConnected2D
if not hasattr(layers, "LocallyConnected2D"):
    class LocallyConnected2D(layers.Layer):
        def __init__(self, *args, **kwargs):
            super().__init__()
        def call(self, inputs):
            return inputs
    layers.LocallyConnected2D = LocallyConnected2D

# -----------------------------
# Patch find_input_shape for Keras 3
# -----------------------------
import deepface.commons.functions as functions
def patched_find_input_shape(model):
    return 224, 224
functions.find_input_shape = patched_find_input_shape

# -----------------------------
#  🔹 IMPORTS
# -----------------------------
from deepface import DeepFace
import os
import matplotlib.pyplot as plt
from PIL import Image
```

```python
# ----------------------------
#  🔹 FACE VERIFICATION
# ----------------------------
def face_verification():
    print("\n--- FACE VERIFICATION ---")

    img1 = r"face_db/atharvaa1.jpg"
    img2 = r"face_db/atharvaa2.jpg"
    img3 = r"face_db/atharvaa3.jpg"

    # Compare img1 vs img2
    result = DeepFace.verify(img1_path=img1, img2_path=img2, model_name="VGG-Face")
    print(f"Comparing:\n{img1}\n{img2}")
    print("Result:", "✅ Match" if result["verified"] else "❌ Not Match",
          "| Distance:", round(result["distance"], 4))

    # Compare img1 vs img3
    result = DeepFace.verify(img1_path=img1, img2_path=img3, model_name="VGG-Face")
    print(f"\nComparing:\n{img1}\n{img3}")
    print("Result:", "✅ Match" if result["verified"] else "❌ Not Match",
          "| Distance:", round(result["distance"], 4))

# ----------------------------
#  🔹 FACE IDENTIFICATION
# ----------------------------
def face_identification():
    print("\n--- FACE IDENTIFICATION ---")

    db_path = "face_db"  # Database folder

    if not os.path.exists(db_path):
        print(f"[ERROR] Database folder '{db_path}' not found. Please create it and add
images.")
        return

    test_img = r"face_db/atharvaa3.jpg"  # Test image

    results = DeepFace.find(img_path=test_img, db_path=db_path, model_name="VGG-Face")

    if results is not None and not results.empty:
        df = results

        # Get best match (lowest distance)
        best_match = df.iloc[0]

        test_identity = test_img
        match_identity = best_match['identity']
        distance = round(best_match['VGG-Face_cosine'], 4)  # use correct column name
for distance
```

```python
        print(f"Test Image: {test_identity}")
        print(f"Best Match: {match_identity}")
        print(f"Distance: {distance}")

        # ----------------------------
        # Visualization
        # ----------------------------
        fig, axes = plt.subplots(1, 2, figsize=(8, 4))

        axes[0].imshow(Image.open(test_identity))
        axes[0].set_title("Test Image")
        axes[0].axis("off")

        axes[1].imshow(Image.open(match_identity))
        axes[1].set_title(f"Best Match")
        axes[1].axis("off")

        plt.show()
    else:
        print("❌ No match found in the database.")


# ----------------------------
# 🔹 MAIN EXECUTION
# ----------------------------
if __name__ == "__main__":
    face_verification()
    face_identification()
```



```
--- FACE VERIFICATION ---
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 249ms/st ━━━━━━━━━━━━━━━━━━━━ 0s 282ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 266ms/st ━━━━━━━━━━━━━━━━━━━━ 0s 299ms/step
Comparing:
face_db/atharvaa1.jpg
face_db/atharvaa2.jpg
Result: ❌ Not Match | Distance: 0.4276
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 236ms/st ━━━━━━━━━━━━━━━━━━━━ 0s 258ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 220ms/st ━━━━━━━━━━━━━━━━━━━━ 0s 239ms/step

Comparing:
face_db/atharvaa1.jpg
face_db/atharvaa3.jpg
Result: ✅ Match | Distance: 0.3454

--- FACE IDENTIFICATION ---
WARNING: Representations for images in  face_db  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after this file
There are  5  representations found in  representations_vgg_face.pkl
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 215ms/st ━━━━━━━━━━━━━━━━━━━━ 0s 239ms/step
find function lasts  0.36319446563720703  seconds
Test Image: face_db/atharvaa3.jpg
Best Match: face_db/atharvaa3.JPG
Distance: 0.0
```

INFERENCE

The system can verify if two images are of the same person and identify the most similar face from a database. Smaller embedding distances indicate higher similarity, making it useful for authentication and face recognition applications.