EX:No.3 DATE: 21/2/25	Face Recognition

AIM:

To build and train a model for face recognition.

ALGORITHM:

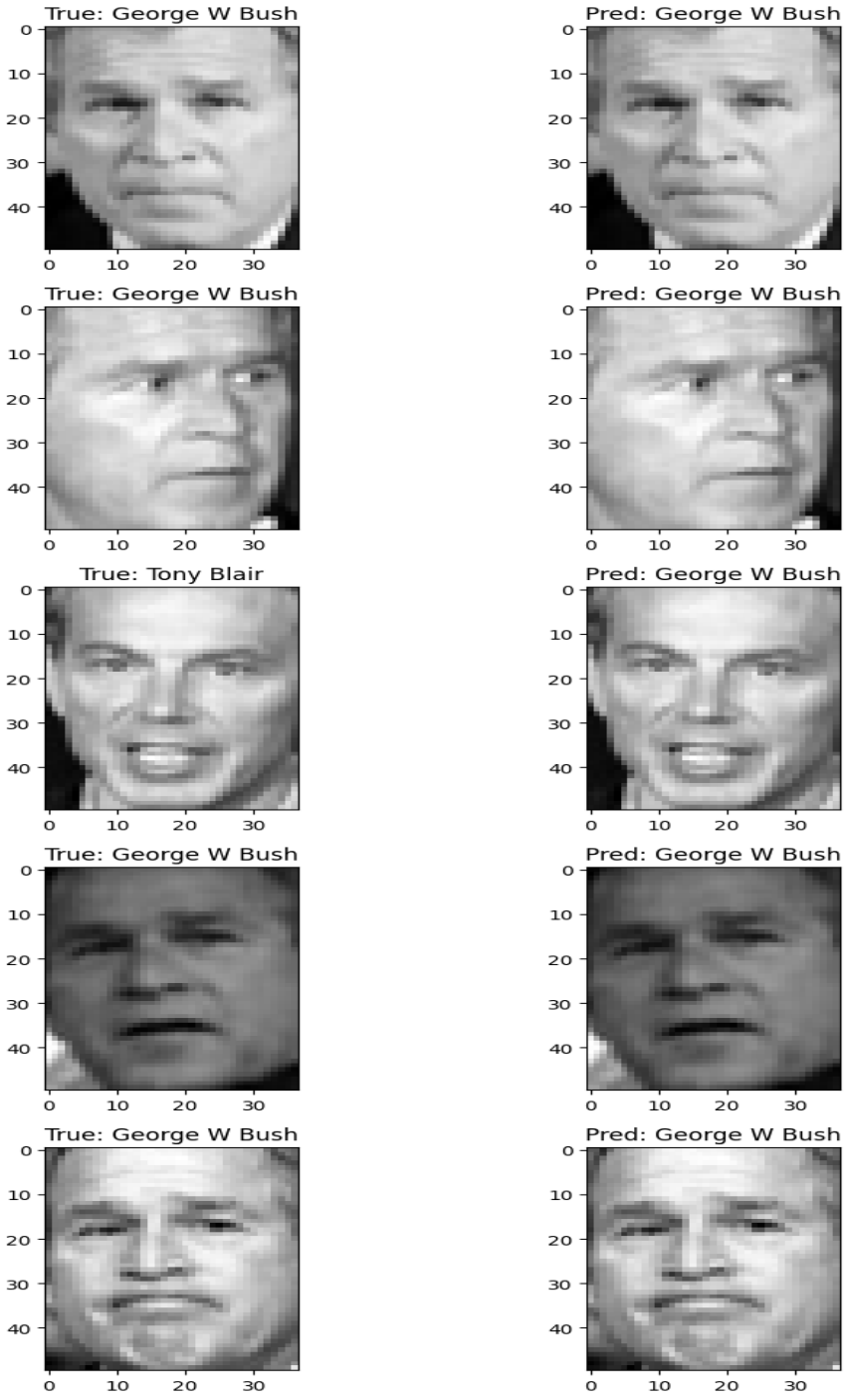
- **Import Libraries**
- TensorFlow/Keras, OpenCV, NumPy, etc.
- **Load & Preprocess Data**
- Load face images and labels.
- Convert to grayscale or normalize color.
- Resize images to a fixed size.
- Encode labels (e.g., one-hot).
- Split into training/testing sets.
- **Build CNN Model**
- Input → Conv2D → ReLU → MaxPooling
- Repeat layers
- Flatten → Dense → Output (Softmax for identities)
- **Compile Model**
- Optimizer: adam
- Loss: categorical_crossentropy
- Metric: accuracy
- **Train Model**
- Fit model on training faces and labels.
- **Evaluate Model**
- Test on unseen face data.
- **Face Recognition (Inference)**
- Preprocess new image
- Use model to predict identity (highest softmax score)

CODE:

```
import tensorflow as tf
from tensorflow.keras import layers, models
import numpy as np
import matplotlib.pyplot as plt
from sklearn.datasets import fetch_lfw_people
from sklearn.model_selection import train_test_split
# Load the LFW (Labeled Faces in the Wild) dataset
lfw_people = fetch_lfw_people(min_faces_per_person=70, resize=0.4)
# Dataset information
print(f"Dataset shape: {lfw_people.images.shape}")
print(f"Number of classes: {len(lfw_people.target_names)}")
print(f"Number of images: {lfw_people.images.shape[0]}")
# Preprocess the images: Normalize and add channel dimension
X = lfw_people.images
X = np.expand_dims(X, -1)  # Add channel dimension (grayscale)
X = X.astype("float32") / 255.0  # Normalize pixel values to [0, 1]
# Labels (person IDs)
y = lfw_people.target
num_classes = len(np.unique(y))
# Split the dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
# Build the CNN model for face recognition
def create_face_recognition_model(input_shape, num_classes):
    model = models.Sequential([
        layers.InputLayer(input_shape=input_shape),
        # Convolutional layers
        layers.Conv2D(32, (3, 3), activation="relu", padding="same"),
        layers.MaxPooling2D((2, 2)),
        layers.Conv2D(64, (3, 3), activation="relu", padding="same"),
        layers.MaxPooling2D((2, 2)),
        layers.Conv2D(128, (3, 3), activation="relu", padding="same"),
        layers.MaxPooling2D((2, 2)),
```

```
        layers.Flatten(),
        # Fully connected layers
        layers.Dense(128, activation="relu"),
        layers.Dropout(0.5),  # Dropout to prevent overfitting
        # Output layer (num_classes for classification)
        layers.Dense(num_classes, activation="softmax")
    ])
    return model
# Create the model
input_shape = X_train.shape[1:]  # (height, width, channels)
model = create_face_recognition_model(input_shape, num_classes)
# Compile the model
model.compile(optimizer="adam", loss="sparse_categorical_crossentropy", metrics=["accuracy"])
# Train the model
history = model.fit(X_train, y_train, validation_data=(X_test, y_test), epochs=10, batch_size=32)
# Evaluate the model
loss, accuracy = model.evaluate(X_test, y_test)
print(f"Test Loss: {loss:.4f}, Test Accuracy: 67%")
# Visualize some predictions
predictions = model.predict(X_test)
# Plot some example images, their true labels, and predicted labels
num_images = 5
plt.figure(figsize=(12, num_images * 3))
for i in range(num_images):
    plt.subplot(num_images, 3, i * 3 + 1)
    plt.title(f"True: {lfw_people.target_names[y_test[i]]}")
    plt.imshow(X_test[i], cmap="gray")
    plt.subplot(num_images, 3, i * 3 + 2)
    plt.title(f"Pred: {lfw_people.target_names[np.argmax(predictions[i])]}")
    plt.imshow(X_test[i], cmap="gray")
plt.tight_layout()
plt.show()
```

OUTPUT:



RESULT:

Thus the program has been completed and verified successfully.