What is face detection?

What is face detection?

How can computers detect objects in images?

- **Commonalities** between all of the faces in terms of features help.

- Face detection algorithms like **Viola-Jones algorithm** in very popular.

- Similar concepts can be applied for detection of faces for **other applications**.

What is face detection?

Face detection is key!

Face detection is the **first step** towards any face-related technology like face detection or recognition.

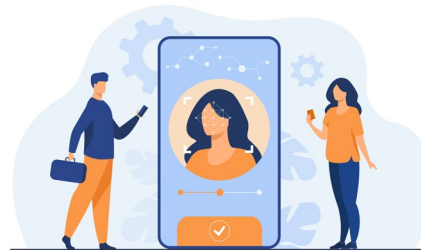# What is face recognition?

What is **face recognition**?

Face recognition is one of the most used applications of OpenCV.

- Face recognition is a method of **verifying the identity** of a person using their face.

- **Deep learning** is super popular for face recognition applications.

- Face recognition is used across **hundreds** of applications.
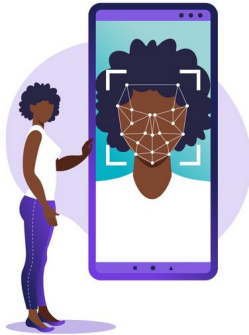
How is **face recognition** achieved?

Face recognition can be achieved using many sources:

- Images from a **dataset**

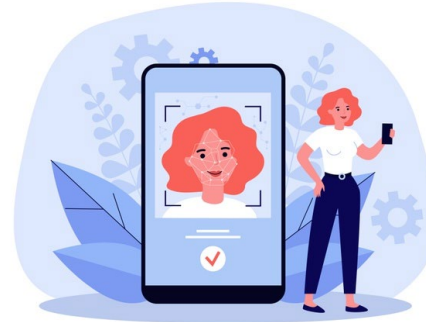- Live **webcam** feed

- **Recorded** videos

Is **recognition** different from detection?

Face recognition and face detection are two different applications:

Face detected

Hello Kathy!

Applications of face recognition

Applications of face recognition

Numerous applications:

- Locking mechanism for your devices 🔒

- Prevention of retail crime

- Finding missing people

- Identify people on social media platforms

Applications of face recognition

Numerous applications:

- Helping ease the travel load on airports

- Aiding forensic investigations

- Track school attendance

- Identity validation at ATMs

Face recognition using
Deep Learning
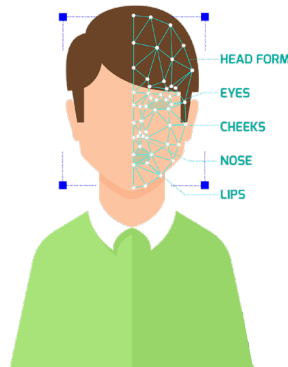
Face recognition using Deep Learning

Dataset for training

- Training a complex network required here will take a **significant amount** of data and computation power.

- A **pre-trained network** trained by Davis King on a dataset of ~3 million images is used to speed up the process.

- The network outputs a **vector of 128 numbers** which represent the most important features of a face.
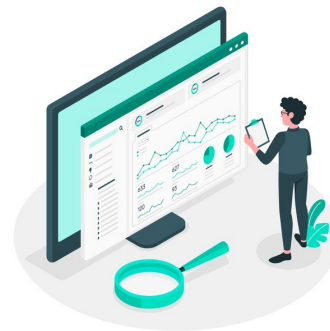
Face recognition using Deep Learning

Step 1: Face detection

The exact **location/coordinates** of face is extracted from media.

Face recognition using Deep Learning

Step 2: Feature Extraction

$$f\left(\ \blacksquare\ \right) = \begin{pmatrix} 0.112 \\ 0.067 \\ 0.091 \\ 0.129 \\ 0.002 \\ 0.012 \\ 0.175 \\ \vdots \\ 0.023 \end{pmatrix}$$

Face embedding is used with each face to convert it into a vector and this technique is called **Deep Metric Learning**.

Face recognition using Deep Learning

Step 3: Training a neural network

A neural network may output faces which **look very similar** to each other. What is the solution here?

Face recognition using Deep Learning

Step 4: Feature map across the face

After training the network, it understands to **group similar looking faces** together into one category.

Face recognition using Deep Learning

Step 5: Embeddings for images are obtained after training

- The first step is to **compute** the face embedding for the image using the same network.

- Embeddings of Putin were **not saved** while the embeddings of George Bush was!

Introduction to OpenCV

Introduction to OpenCV

Computer vision

- Computer Vision is a **bridge** between computer software and visualizations.

- It allows computers to **understand** and learn about the visualizations in the surroundings.

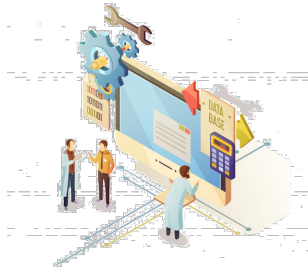- **Example:** Determining the fruit based on the color, shape and size.

Using OpenCV

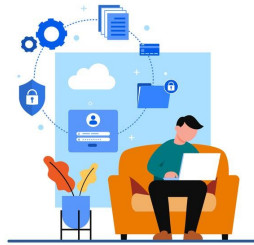**OpenCV is the most popular library for face recognition.**

- OpenCV is an **open-source** library.

- It is supported by **various programming languages** such as R, Python and more.

- It runs on most of the **platforms** such as Windows, Linux and MacOS.

How is **OpenCV** used?

Four simple steps:

Gather the data

Data processing

Model Training

Model Evaluation

Face detection with OpenCV using Python

Summary