

Facial Recognition Technology

Facial recognition, a category of biometric security, is a way of identifying or confirming an individual's identity using their facial features. These systems can be used to identify people in photographs, videos, or live environments. Other forms of biometric security include voice recognition, fingerprint identification, and eye recognition. The facial recognition technology is mostly used for security and law enforcement, though there is increasing interest in other areas of use.

The initial thought that comes to mind when facial recognition is mentioned, is unlocking and accessing an iPhone using FaceID. Face recognition does not necessarily rely on identifying individuals using a database of photos, instead it identifies facial features. The standard steps facial technology systems operate on:

1. Face detection: The camera identifies an image of a face. The face may be looking directly at the camera or turned sideways.
2. Face analysis: The image of the face is analyzed to identify key facial features. For example, the distance between the eyes, the depth of the eye sockets, the distance between the forehead to chin, the shape of the cheekbones, and the contour of the lips, ears and chin. These features are used to distinguish one individual's face from another.
3. Data conversion: The facial features identified are transformed into a set of digital information, which is essentially converted into a math code. This code is known as a faceprint. The concept of a faceprint is similar to that of a fingerprint, it serves as a unique identification.
4. Matching process: The faceprint is then compared to those in a database.

Compared to thumbprints and irises, facial recognition is considered to be the most natural way to identify an individual. Of all the biometric measurements, it also seems to be the easiest way for identification because there is a wider access to images in databases. Facial recognition technology (FRT) has been increasingly utilized for various purposes over the years, including government operations, enhancing security, public safety, retail, finance, healthcare, and other industries.

As previously discussed, the most known usage of facial recognition is unlocking a device. This particularly applies to the iPhone but Android's use this feature as well. In an iPhone, FaceID is used to unlock the iPhone, verify payments, and access certain applications. For instance, HSBC and Bank of China online bank applications use FRT to access online accounts, and approve transactions. FRT offers a secure way to protect personal data and make certain your sensitive information will be accessible if your phone is stolen.

In addition, Google integrates FRT into Google Photos, where it is used to automatically sort and organize pictures by recognizing the people in them. Similarly, Apple uses facial recognition in its Photos app to group images of people, allowing

Jessica Navarro
ITAI 2372
A10

users to quickly search for and access photos of specific individuals by name. The Photos app also uses FRT to identify people, animals, and objects in an image. For instance, it identifies my dog's breed. It also identifies the type of plant or flower in an image I captured. Lastly, it can identify people whose photos you have previously taken. It has successfully identified my sisters and parents.

Transportation Security Administration (TSA) and border control agencies utilize facial recognition systems to simplify operations, enhance efficiency, and improve public safety measures. It has integrated facial recognition technology to enhance airport security and simplify passenger verification. AI-powered facial recognition systems are used at security checkpoints to compare travelers' faces with their identification documents, reducing wait times and improving accuracy in identity verification. U.S. Customs and Border Protection (CBP) utilize the Biometric Entry-Exit Program, to confirm the traveler identification. Automated kiosks are also located at airports and land borders, which help speed up immigration processing while improving accuracy in identity verification. This implementation not only enhances security by identifying potential threats but also improves the passenger experience by minimizing manual identity checks.

Facial recognition plays a crucial role in law enforcement by assisting in investigations, locating missing persons, and identifying suspects. The systems analyze extensive databases, including CCTV footage, social media content, and online sources, to track individuals involved in criminal activities. This capability has proven beneficial in combating human trafficking, identifying repeat offenders, and solving cold cases.

In the retail industry, Walmart and Target uses FRT to reduce retail crime and track customer behavior. When individuals who have shoplifted or committed a crime enter a store, they are identified based on previous images captured when they committed the crimes. FRT is also used to improve retail experience by interacting with kiosks that provide customers assistance, and suggesting products based on previous purchases.

In 2017, DiGiorno used facial recognition for marketing campaign parties to analyze people's expressions and determine their emotional reaction to the pizza. Other marketing strategies include using FRT to determine people's reactions to movie trailers, TV pilots, and other TV contents.

AiCure is a health tech company that has developed an app that uses facial recognition to ensure that people take their medication as prescribed. The company has developed a platform that uses smartphones and AI-driven video technology to remotely monitor patients, ensuring they take their medications as prescribed. AiCure's primary goal is to improve health outcomes by promoting adherence to prescribed treatments and providing researchers and healthcare providers with more accurate data on patient behavior. Other FRT has been tested to be used in the healthcare industry, such as using it to access patient records, facilitate patient registration, among other things.

FRT has increasingly been used to enhance security in various sectors.

- Military and National Security:
 - The military leverages facial recognition for intelligence gathering, counterterrorism, and battlefield operations.
 - AI-powered systems assist in identifying enemy combatants, tracking high-value targets, and securing military installations.
 - Drone surveillance integrated with facial recognition enables real-time identification of potential threats in conflict zones.
- Correctional Facilities:
 - Prisons and detention centers use facial recognition to monitor inmate movements, reducing the risk of escapes and unauthorized interactions.
 - Automated identity verification ensures that only authorized personnel enter restricted areas within correctional facilities.
 - Facial recognition enhances parole monitoring by verifying the identities of individuals under supervised release programs.
- Government Building Security:
 - Facial recognition systems restrict access to sensitive government facilities, ensuring that only authorized personnel can enter.
 - Secure entry points at agencies such as the Pentagon and White House use biometric authentication to prevent unauthorized access.
 - Visitor management systems integrate facial recognition to track and record individuals entering government buildings, improving overall security measures.

In the public sector, RFT is used for event management and public surveillance.

- Minute Maid Park uses FRT to facilitate entry into the stadium, allowing fans to enter through express lanes by simply scanning their faces, eliminating the need for tickets or physical identification. This system is designed to speed up the entry process, reduce wait times, and improve overall security by ensuring the identity of individuals entering the venue.
- Casinos use FRT to monitor customers coming in and out of the gambling areas. FRT also identifies individuals who are registered as gamblers and keeps a record of their plays.
- Some educational institutions in China use FRT to track students' attendance, to ensure accurate attendance records.
- My workplace actually uses FRT to track employee clocking in and out, ensuring accurate time records.

FRT benefits include helping reduce crime, increase security and surveillance, increased convenience, and has allowed for faster processing. It could also be easily integrated with most security software.

Despite its benefits, the widespread deployment of facial recognition technology raises ethical and privacy concerns. Issues such as mass surveillance could limit

individual freedom. There could be a potential for wrongful identification. For example, a change in hair color, change in appearance, or a simple change in the camera's angle could lead to an error in identification. The widespread concern with any artificial intelligence (AI) topic is the potential threat to privacy and data security. As AI systems often rely on vast amounts of personal data to function effectively, there is an ongoing debate about how this data is collected, stored, and used. This has prompted calls for stricter regulations and oversight. Governments and regulatory groups are actively working to establish guidelines for ethical AI use, ensuring transparency, accountability, and compliance with privacy laws.

Facial recognition technology is a powerful tool used in a wide range of industries, from enhancing security and streamlining processes to improving user experiences and advancing healthcare outcomes. While its applications are vast and beneficial, including in law enforcement, retail, and even public sector services like airport security and event management, the technology also presents significant ethical and privacy challenges. As its use expands, it is essential to balance its advantages with the potential risks related to privacy, data security, and wrongful identification. To ensure the responsible use of facial recognition, ongoing efforts to develop clear regulations and ethical guidelines are crucial. This will help mitigate concerns while maximizing the positive impact of facial recognition technology on society.

References

New Charter Technologies. (n.d.). *Benefits of AI in government*. New Charter Technologies. Retrieved April 1, 2025, from <https://www.newchartertech.com/benefits-of-ai-in-government/#:~:text=Leveraging%20artificial%20intelligence%20in%20the,accurate%20and%20real%2Dtime%20insights>

Transportation Security Administration. (n.d.). *Facial recognition technology*. U.S. Department of Homeland Security. Retrieved April 1, 2025, from <https://www.tsa.gov/news/press/factsheets/facial-recognition-technology>

Kaspersky. (n.d.). *What is facial recognition?* Kaspersky. Retrieved April 1, 2025, from https://www.kaspersky.com/resource-center/definitions/what-is-facial-recognition?srsId=AfmBOopKO6LYqnATNOrU66zhPEdVQV4b00AuKYGiLAid_mJbEI2mgguO