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CIT_0460 Computer and information security

Project

The Group

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Project Title: Biometric Authentication
“Face Print”

Overview to the project:

- Abstract.
- Objectives.
- How its work? □ influencing factors □ Related Works.
- Pros. & Cons.
- Solutions.

Abstract

Facial recognition technology, commonly referred to as "faceprint" technology, is a biometric technology that uses artificial intelligence algorithms to analyze and identify unique facial features and patterns in digital images or video frames. The technology works by creating a mathematical representation of a person's face, known as a faceprint, and comparing it to other faceprints stored in a database to determine a match.

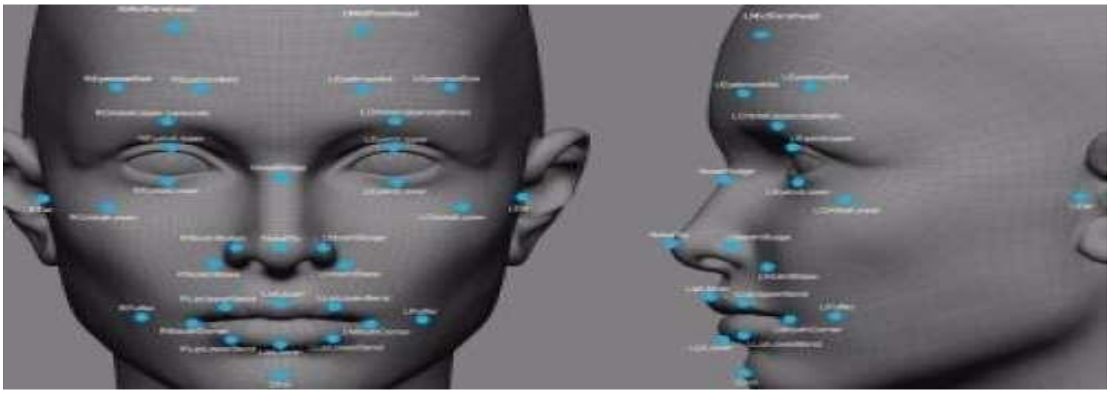
Faceprint technology has been widely adopted in various applications, including security, law enforcement, and customer experience enhancement.

Objectives:

- Understand how face printing works.
- Factors affecting the face print.
- Review the advantages of using a face print.
- A review of some problems in using the face print.
- Try to solve problems.
- Case studies.

How its works?

Faceprint technology uses a person's unique facial features, like the heights and depths of their face, to recognize and identify them. It has at least 80 nodal points on a person's face and uses computer algorithms to compare and match these points to confirm the person's identity.



These are the most important points measured by the program:

1. Nose width.
2. The distance between the eyes.
3. The shape of the cheekbones.
4. The depth of the eye sockets.
5. Jaw line length.

influencing factors

Factors affecting the face print:

Unlike finger prints or DNA, which do not change throughout a person's life ,The opposite of facial features that can change according to some factors, including:

1. Cosmetic surgery.
2. Age.
3. Cosmetics.
4. picture quality.

Pros. & Cons.

Pros of Faceprint Authentication:

1. Convenience: Faceprint authentication is a fast and easy method of identification, which can make everyday tasks like accessing a smartphone or logging into an online account more convenient.

2. Security: Faceprint authentication provides a high level of security because it is based on unique physical features that cannot be easily duplicated.

3. Speed: Faceprint authentication is often faster than other biometric authentication methods like fingerprint or iris scanning.

Cons of Faceprint Authentication:

1. Privacy Concerns: The use of faceprint authentication raises privacy concerns, particularly with regards to the storage and use of sensitive personal data.

2. False Positives and False Negatives: Faceprint authentication is not 100% accurate and can result in false positives, where the system identifies the wrong person, or false negatives, where the system fails to identify the right person.

3. Technical Challenges: Faceprint authentication is a complex technology that requires sophisticated algorithms and hardware, which can result in technical challenges and system failures.

How to Solve these Cons.?

To address the cons of faceprint authentication:

1. For privacy concerns, companies can implement strong privacy policies and security measures and be transparent about personal data collection, use and storage.

2. To reduce false positives and false negatives, companies can improve and update their algorithms and use multiple forms of biometric authentication.

3. To address technical challenges, companies can invest in quality hardware and software and conduct regular maintenance.

Related Work

Posted by	Title	Year	Article
IBM and published in the Proceedings of the IEEE	Faceprint Recognition Accuracy. The Impact of Skin Tone and Facial Hair	2018	It evaluated the impact of skin tone and facial hair on the accuracy of faceprint recognition systems, finding that the recognition accuracy of faceprint systems was lower for individuals with darker skin tones and those with facial hair.
researchers from the University of Oxford and published in the Journal of Computer Security.	Investigating the Reliability of Faceprint Authentication for Mobile Devices	2019	It evaluated the reliability of faceprint authentication for mobile devices, including factors such as lighting conditions, facial expressions, and user demographics. The study found that the accuracy of faceprint authentication was significantly impacted by these factors.
researchers from the Massachusetts Institute of Technology (MIT) and published in the Journal of Financial Security.	Evaluating the Effectiveness of Faceprint Authentication in Financial Transactions	2020	It evaluated the effectiveness of faceprint authentication in financial transactions, including factors such as user adoption and security. The study found that faceprint authentication was effective for financial transactions but also highlighted the need for increased security measures to protect sensitive financial data.

researchers from the University of California, Berkeley and published in the Journal of Privacy and Confidentiality.	A Study of Faceprint Privacy Concerns and Risks	2019	It investigated privacy concerns and risks associated with faceprint technology, including issues related to data privacy and security. The study found that the widespread use of faceprint technology raises significant privacy and security concerns and highlights the need for strong privacy and security regulations.
researchers from Stanford University and published in the Proceedings of the ACM Conference on Fairness, Accountability, and Transparency	Faceprint Recognition: An Analysis of Algorithmic Bias	2020	It analyzed the potential for algorithmic bias in faceprint recognition systems, including the impact of demographic factors such as race and gender. The study found that faceprint recognition systems can exhibit significant algorithmic bias, particularly for individuals from demographic groups that are underrepresented in training data.
researchers from Carnegie Mellon University and published in the Journal of Computer Security.	Faceprint Authentication for Access Control: An Empirical Study	2017	It evaluated the use of faceprint authentication for access control, including factors such as user convenience and security. The study found that faceprint authentication was a convenient and secure method of access control but also highlighted the need for strong privacy and security measures to protect sensitive data.

researchers from the University of Cambridge and published in the Journal of Privacy and Confidentiality.	Faceprint Privacy and Security: An International Comparative Study	2019	It compared the privacy and security of faceprint technology across several countries, including laws and regulations related to faceprint use. The study found that privacy and security regulations for faceprint technology vary widely across countries and highlighted the need for consistent privacy and security regulations across the world.
researchers from the University of Texas at Austin and published in the Journal of Public Transportation.	Faceprint Authentication in Public Transportation: A Case Study	2018	It investigated the use of faceprint authentication in public transportation, including factors such as user convenience and security. The study found that faceprint authentication can be a convenient and secure method of payment and access control in public transportation, but also highlighted the need for strong privacy and security measures to protect sensitive data.

Some algorithms used

Deep Learning Algorithm: A deep learning algorithm uses neural networks to identify and analyze facial features, such as eyes, nose, mouth, and cheekbones, to create a unique face print.
PCA Algorithm: Principal Component Analysis (PCA) is a statistical method used to reduce the number of variables in a large dataset. In facial recognition, PCA is used to extract the most significant features of a face, reducing the complexity of the data and improving recognition accuracy.
SVM Algorithm: Support Vector Machines (SVM) is a machine learning algorithm that can be used for facial recognition. SVM works by creating a boundary between different classes of data, which in this case are different faces. This algorithm is particularly useful for recognizing faces in images with different angles, lighting, or expressions.
LBP Algorithm: Local Binary Patterns (LBP) is a simple and efficient algorithm for facial recognition. This algorithm works by dividing an image into smaller regions and comparing the intensity patterns within each region. LBP is particularly useful for recognizing faces in images with different illumination conditions.

The reference

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