Preventing Illegal Border Crossings: New Approaches to Combat Face-Morphing Threats

Monday 23 September, 2024

Detecting Fake Faces

Fraunhofer IGD is working on reliable methods to detect and prevent face?morphing attacks. Face morphing is a growing threat to biometric security systems. Criminals use it to create an alternative identity that allows them to travel to other countries without being detected. Fraunhofer IGD will present its latest research findings at it-sa in Nuremberg from October 22 to 24.

What sounds like simple photoshopping is increasingly becoming a threat. Face morphing is a technique that merges the features of two or more faces into a single image. Facial features, structures, and patterns are analyzed and combined using advanced algorithms. Using this technique, someone merge their face with a friend's face, for example. The results can be both fascinating and comical.

However, criminals use the same method to disguise their identities with fake passport photos and pass through border controls undetected. A passport photo that combines the facial features of several people is created and used to apply for an identification card or passport. "*Neither the human eye nor a machine can detect this type of fraud",* says Florian Kirchbuchner, a biometrics expert at the Fraunhofer Institute for Computer Graphics Research IGD.

Especially at airports, most identity checks are done by machines. Criminals are taking advantage of this and trying to enter a country using doctored photos. *"Morphed photos often go undetected because biometric systems are trained to accept certain changes in the face of the person in the photo"*, says Kirchbuchner.

Advanced face-morphing detection in the ATHENE project

Researchers at Fraunhofer IGD are therefore working on identification algorithms designed to anticipate undetected attacks. *"Our goal is to create a generalized face-morphing detection system that makes us faster than the criminals"*, says Kirchbuchner. To this end, Fraunhofer IGD is also morphing photos, among other things, as part of ATHENE, the German National Research Center for Applied Cybersecurity. The research group is using deep learning and artificial intelligence (AI) technologies. *"We use generative adversarial networks to machine-generate new faces that have features of the two original faces",* explains Kirchbuchner. *"This allows us to anticipate potential attack methods and prepare our detection systems for them."*

Machine learning to combat undetected attacks

In the ATHENE projects, researchers are working on facial image quality control and identity management issues. Another research project focuses on the use of biometrics in embedded systems — integrated systems with specific tasks and limited computing capacity, such as those used at access control points. The goal is to implement biometrics in cell phones or augmented-reality cameras to significantly increase security. *"One possible use case is head-mounted displays such as those used in VR/AR applications and the metaverse, for example, to assist border control officers or even to identify the user. The eye region can clearly identify the wearer, even with different eye positions and movements"*, explains Kirchbuchner.

Demonstrator at it-sa

Fraunhofer IGD will present its latest research findings at the it-sa Expo&Congress, which takes place from October 22 to 24 at the NürnbergMesse Exhibition Center in Nuremberg, Germany. The highlight of the show in Hall 6, Booth 6-314, is a demonstrator that simulates an airport situation. Visitors to the booth can role?play as border agents to see if they can identify morphed photos on passports. They can then take a picture of themselves, morph it, and create a biometrics expert identification card. Florian Kirchbuchner will provide an in-depth look at the challenges and proposed solutions in his presentation, "Spoofing Attacks on Biometric Systems—Where Does the Research Stand?"

Start of Biometric Week in Darmstadt

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September 23 marks the start of the Darmstadt Biometric Week, again co-hosted by Fraunhofer IGD. The event brings together an international line-up of renowned experts, authorities, and companies to discuss the latest developments and innovations in biometrics until September 27. Various events will provide the backdrop for the exchange, including the International Conference of the Biometrics Special Interest Group (BIOSIG), the European Association for Biometrics (EAB) Research Projects Conference 2024, and the European Biometrics Max Snijder, Research, and Industry Awards 2024.

For more information, visit: https://www.igd.fraunhofer.de/en/research/core-competencies/biometrics.html

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Fraunhofer IGD at it-sa / October 22–24 2024

Fraunhofer Collaborative Booth / **Hall 6, Booth 6-134**

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About Fraunhofer IGD: The Fraunhofer Institute for Computer Graphics Research IGD has been setting standards in visual computing – image- and model-based informatics – for more than 30 years. Its roughly 210-strong staff support companies and institutions across the automotive industry, healthcare, bioeconomy, information technology, maritime economy, and cultural and creative economy sectors. Fraunhofer IGD provides specific technological solutions and support for strategic development. Its researchers carry out problem analyses, design hardware and software, develop protypes, and implement interactive visual systems. The focuses are human-machine interactions, virtual and augmented reality, artificial intelligence, interactive simulation, modeling, and 3D printing and scanning. Fraunhofer IGD has been engaged in high-level research since 1987, supporting change in society and the economy with application-oriented solutions developed at its facilities in Darmstadt, Rostock, and Kiel. Its products acquire international relevance via ongoing collaboration with its Austrian sister institute, which operates facilities in Graz and Klagenfurt, and participation in a wide range of EU projects.

Media Contact:
Daniela Welling | Head of Corporate Communications
Fraunhofer Institute for Computer Graphics Research IGD
Fraunhoferstrasse 5 | 64283 Darmstadt, Germany
Phone +49 6151 155-146 | presse@igd.fraunhofer.de | https://www.igd.fraunhofer.de

Company Contact:

Jetzt PR

T. 0049211749585161
E. kontakt@jetzt-pr.de
W. https://www.jetzt-pr.de

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