Innovative Technology
INTELLIGENCE IN VALIDATION

Anti-spoofing in Automated Age Verification: Technical Report

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ICU[1] from Innovative Technology Ltd. (ITL) is a device that automatically verifies age to allow access to age restricted premises or to approve the purchase of age restricted goods. Any device pertaining to permit access to restricted goods or premises not only must achieve high accuracy in age estimation[2] but must also ensure mechanisms are in place to combat potential fraudulent behaviour (such as a printed photograph of an older subject). The ICU has demonstrated a robust ability to detect both 2D images but also pseudo-3D images - where printed images were physically bent to make curved objects. ICU correctly identified the subject as an attempted spoof.

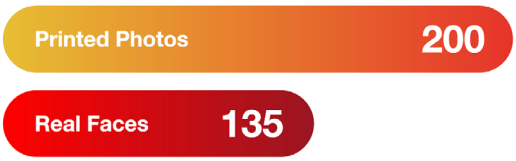
Introduction

The ability to detect potentially fraudulent activity is a crucial step before any biometric algorithm is applied. In the absence of spoof detection, any algorithm is vulnerable to different types of attack including images/videos on mobile phones, printed paper etc.

ICU has implemented a stereo vision camera system to tackle this problem. Essentially the unit can estimate the face depth and then check if it matches with a 3D face template model. This ensures that a 2D source such as tablets, mobile phones and printed paper are easily detected as an attempt at deception. However, traditional stereo vision camera systems can still be vulnerable to pseudo-3D objects. For example, physically bending a 2D photograph can result in a pseudo-3D object which can deceive a system based on detecting depth. ICU has implemented further checks to ensure that the unit is not susceptible to such spoofing attacks.

Method

To test the accuracy of the method we collected a total of 335 'presentations' of which 135 are of real faces and 200 printed faces /photographs (see images below).



In over half of the 200 printed faces, the photographs were bent or curved either vertically or horizontally to create pseudo-3D objects, in order to try and deceive the 3D detection system.

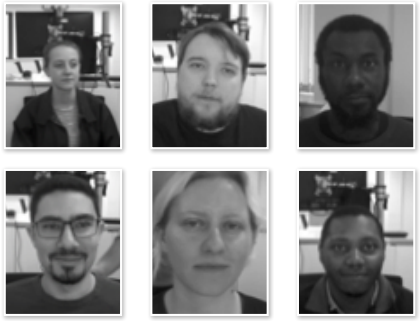


FIGURE 1:

Example of real subjects presenting to the unit

FIGURE 2:

Examples of fraudulent behaviour. This was a mixture of 2D objects (printed photographs, images on tablets/phones) and pseudo-3D objects

Results

Out of the 135 real faces ICU classified correctly 130, which lead to an accuracy of 96.3%. Six returned as potential spoofs – i.e. where the unit believed that the subject was actually a photograph and did not allow the transaction to proceed. The six failures recorded were mainly due to acute poses where the subject was not looking directly into the unit and inadequate exposure of one of the cameras. The subjects passed on subsequent reattempts to the ICU.

Of the 200 photographs that were presented to the unit, all were correctly identified by ICU as a spoof attempt – even those that were distorted to create pseudo-3D images. This 100% success rate in detecting potential spoofs means that ICU cannot be fooled by 2D photographs, but also curved photographs (3D) - proving the capability of the unit's robust 3D anti-spoofing detection system.

Conclusion

The ICU has demonstrated that any attempt at deceiving the system has failed with a 100% success rate in detecting deliberately created spoofs. A subject cannot fraudulently gain access to age restricted goods or premises by presenting an image of an older subject or when creating a pseudo-3D image.

This result, coupled with the ICU's 96%[2] high accuracy rate in detecting under 18s, means that the unit can be deployed with high confidence to automate age verification and to reduce the risk of fraudulently purchasing age restricted goods or gaining access to age restricted premises or services.

[1] https://innovative-technology.com/products/products-main/806-icu-2

[2] Please see ITL technical paper which demonstrates ICU accuracy of 96% in detecting subjects under 18 years of age: https://innovative-technology.com/images/pdocuments/datasheets/ICU_TechnicalPaper.pdf