



More than Meets the Eye

– An Overview of Facial Recognition and its Applications in Retail

Key Highlights

- 1) The global market for facial recognition applications brought in revenue of US\$178 million in 2016, accounting for 4% of the total biometric solutions market. It is the second-most-adopted biometric technology after fingerprint scanning, which accounted for 91% of the total revenue.
- 2) Existing applications of facial recognition technology are found mainly in the security space. From criminal investigations to unlocking smartphones, facial recognition technology has been integrated into surveillance systems for better safety and security, but has yet to become a tool to boost sales in the retail industry.
- 3) Facial recognition will likely remain a niche technology in retail. Because of privacy issues and the cost associated with maintaining facial recognition solutions, we believe the technology lacks clear advantages over fingerprint technology. The growth in adoption may continue, but will likely come from niche applications such as face tracking on drones, smartphones and cameras, and advanced security systems.

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Biometric Market Overview

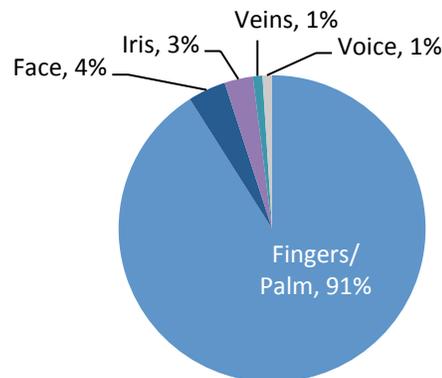
Biometric technology includes the scanning and analysis of body features such as fingers, palms, the face, the iris, voice and veins for the purpose of identifying an individual. It has a multitude of applications such as for the industrial, security, consumer and healthcare markets. According to Yole Développement, a market research firm specializing in semiconductors for biometric products, around 91% of revenue in the biometric market is attributed to technologies used for finger or palm scanning. This is likely driven by consumer electronics, particularly smartphones with fingerprint sensing, as 86% of fingerprint sensors shipped are used in smartphones. Facial recognition accounts for only 4% of revenue, as it is generally less accurate and unreliable when compared to fingerprint security systems. The global biometric hardware market is estimated to be worth US\$4.45 billion, with the consumer market accounting for 65% in 2016.



Source: Shutterstock

The use of biometric technology in the consumer market is expected to continue to grow at a CAGR of 10.4% over the next five years (2016–2021), according to Yole Développement. During the same period, the industrial market and the homeland and security markets are expected to grow by a CAGR of 8.1% and 6.9%, respectively.

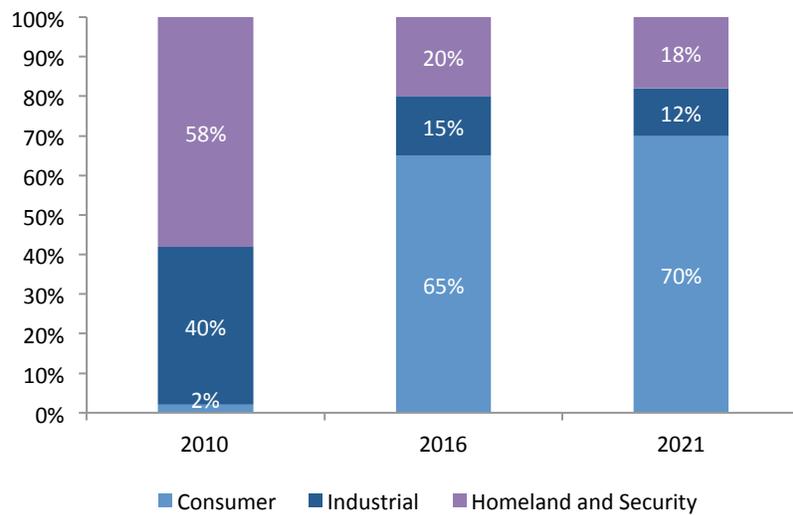
Figure 1. Revenue in the Biometric Market, by Applications



Source: Yole Développement



Figure 2. Revenue in the Biometric Market, by Sector



Source: Yole Développement

Facial Recognition

The key factor driving the growth of the facial recognition market is the growing investment in surveillance systems worldwide. At the same time, facial recognition technology raises serious concerns about both privacy and the potential misuse of personal information, and we believe these concerns are strong enough to curb the growth of this market.

For example, last year in June, Snapchat was sued for allegedly violating the Illinois Biometric Information Privacy Act, which requires companies to get written consent from users before collecting biometric information.

In October 2016, over 50 civil liberties groups sent a letter to the Justice Department’s Civil Rights division requesting an investigation into the growing use of facial recognition technology by police forces. The unsupervised use of facial recognition systems could threaten the privacy and civil liberties of millions, the letter stated.

Software

Software is no longer a hurdle for companies wanting to integrate facial recognition technology into their systems, as there is a great variety of options available.

There are generally two approaches for companies to start deploying facial recognition software: 1) acquire code, either from open source or commercial software, and use it within their original applications; and 2) use web or cloud services.

1) Acquire code

Freeware: This is an open source code, which allows user to modify and tailor the code to their in-house system.

Commercial software: Software vendors offer Software Development Kits (SDKs) for integrating their technology with a company’s in-house applications. Most of these offer face-finding as an interface.

2) Web services

The client simply contacts a web server, sends the image(s) to process and waits for the results to come back.

Figure 3. Available Facial Recognition Source Code

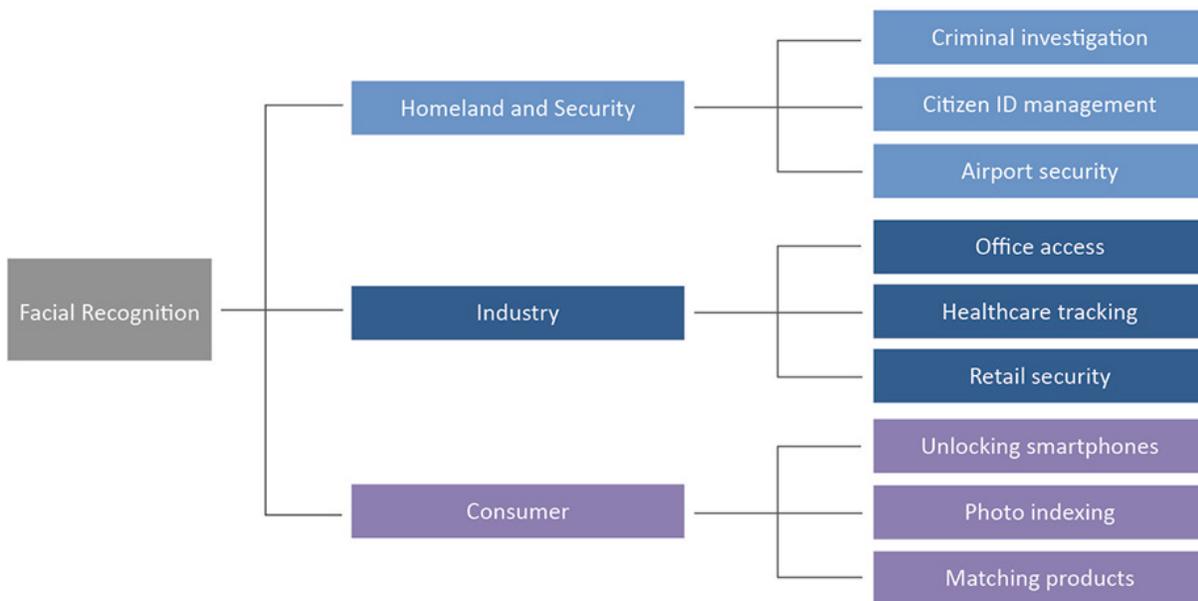
| Type | Source Code Name |
|---------------------|--|
| Web services | Google Vision API, Microsoft Project Oxford, Face++, BiID, Betaface |
| Freeware | Google Mobile Vision API, OpenCV (Intel’s Open Source Computer Vision initiative), Dlib C++ Library, Visage, Face Detection using Support Vector Machine (SVM) |
| Commercial software | Cognitec, KeyLemon, Emotient, Visage Technologies AB, Luxand, Sightcorp, Tastenkunst, Betaface, Ayonix, Qualcomm Snapdragon SDK, FacioMetrics |

Source: facedetection

Applications and Examples

The applications for facial recognition can be split into three categories: Homeland and security, industry and consumer.

Figure 4. Applications of Facial Recognition



Source: Yole Développement



Below, we outline several applications for facial recognition technology currently in use.

- **Selfie pay:** MasterCard's Identity Check app supports both fingerprint and facial recognition for online payments. The app allows users to confirm a transaction by showing their face to their smartphone's camera.
- **Retail store security:** Luxury retailer Saks is reportedly bringing facial recognition technology to Canadian locations. Camera feeds will be viewable from the company's New York headquarters—both for security and for the purposes of tracking customers.
- **Smart-home security:** Chui is an intelligent doorbell that uses facial recognition to make a home keyless, secure and individualized. The face effectively becomes the key that can unlock the front door. In addition, Chui can scan visitors' faces and tells you who is at the door.
- **Glasses matching:** Vi-See's glasses take an accurate reading of a consumer's face using a 76-point face recognition system (FRS), which takes into account facial size, shape, temple and bridge width. Suitable photo-realistic models of different frames are then selected by the system for the consumer to make their selection from.
- **Searching for lost children:** Helping Faceless is an Android app that cross checks photos of children on the streets with an NGO database of missing children. The user takes a photo of a child they find on the street and uses the app to upload the photo to the Helping Faceless server, which uses facial recognition algorithms to try and match the photo to the lost children's faces in their database. Any positive matches are shared with validated NGOs, who in turn help these kids.

A Facial Recognition Acquisition Spree

Many large US technology companies have acquired software companies that specialize in facial recognition to strengthen their products. We list several of these below.

- **Apple** has purchased Emotient, a startup that uses artificial intelligence (AI) to read people's emotions by analyzing facial expressions. In June last year, Apple introduced an upgrade in Photo in iOS 10 that will soon catalog pictures according to the faces in them.
- **Facebook** has acquired MSQRD, a face-swapping app, and FacioMetrics, which specialized in using machine learning algorithms to let smartphones analyze faces in real time through the frame of a camera. These acquisitions could be Facebook's attempt to compete with Snapchat.
- **Google** acquired several startups to strengthen its position in search engine. These include: PittPatt, which can match people across photos, videos and more; Moodstocks, which develops machine-

learning-based image recognition technology for smartphones; and Viewdle, which can automatically tag photos.

- **Snapchat** owns a patent that could blur out faces in public videos or photo messages for those who have chosen non-disclose in their privacy settings. It also brought Seene and Obvious Engineering for 3D facial recognition to increase the depth and flexibility of analyzing facial images.

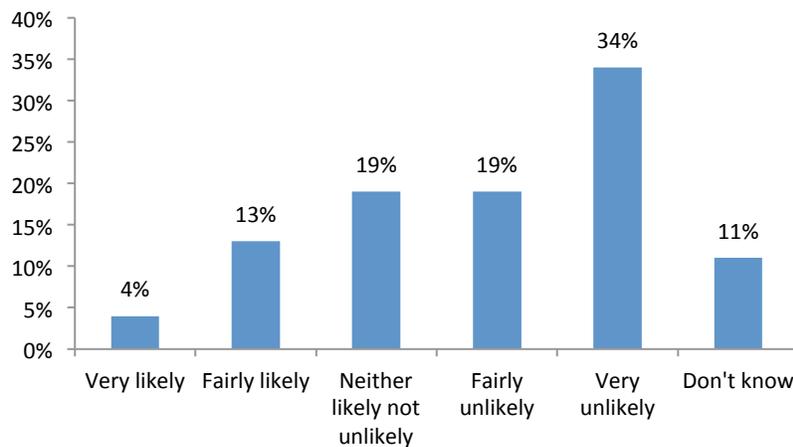
The Future

Facial recognition could eventually bode well with retail marketing. Like the movie *Minority Report* fantasizes, shoppers in the future could be identified with optical sensors and targeted with personalized advertisements.

However, three giant retailers, Walmart, Giorgio Armani and Macy’s reported testing facial recognition back in 2015, then they either denied the development or gave up on using the technology. It is clear that the potential of violating consumers’ privacy has fundamentally turned this technology into a sensitive subject.

The following statistic presents the results of a 2015 omnichannel retail survey, which asked consumers in the UK how likely they would be to use facial recognition technology if available when purchasing in-store. This question was phrased by the source as follows: “How likely or unlikely do you think you would be to use each of the following in-store technologies if they were available? – facial recognition.”

Figure 5. Likelihood of Consumers Using In-Store Facial Recognition if Available in the UK in 2015



Source: YouGov; The BIO Agency

Around 53% of respondents claimed they would be unlikely to use facial recognition when shopping in-store, of which 34% claimed to be very unlikely to use facial recognition.

This could mean consumers are either concerned about their own privacy being exposed in an unauthorized matter or that facial recognition does

not add value to their shopping experience. Either way, retailers in developed markets so far have strayed away from implementing facial recognition in their stores at scale.

On the other hand, in China where the regulation around privacy is less clearly defined, facial recognition is seeing wider adoption. Ant Financial Services Group and China's Ministry of Public Security adopted Face++, China's first cloud-based facial recognition platform developed by Megvii, and KFC China piloted a facial recognition ordering tool in Shanghai which suggests food choices based on people's age, sex, and mood.

Figure 6. KFC Facial Recognition Will Suggest an Order Based on Your Mood, Age and Gender



Source: Weibo, KFC

Despite these advances, we believe large scale adoption of facial recognition in retail still a ways out, especially in developed markets where privacy concerns take paramount importance. That said, we will continue to see innovative applications and experiments that push the envelope when it comes to how consumers interact with the technology in physical retail environments.



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