# Unlocking *facial recognition* technology in healthcare

Capgemini invent

# 1 

## INTRODUCTION

Facial recognition technology (FRT) is about to outperform other biometric modalities and accurately unmask deepfakes. This technology acts as a quick and efficient verification system, matching the face recognized in a still or video frame with a human face on a database.

The benefits of FRT are now being realized across various sectors, such as consumer products, where its use has become pervasive in devices like smartphones. Increasingly, it is being applied to improve efficiency and fraud prevention.

FRT is also revolutionizing healthcare, from patient identification and monitoring to preventing criminal deception.

# 2

## USES OF FACIAL RECOGNITION TECHNOLOGY ACROSS INDUSTRIES

The growing importance of FRT is also supported by increased investment by tech giants. For example, Intel partnered with Brazil's Hoobox Robotics and developed Wheelie 7, an adapter kit that can be installed on wheelchairs to enable users to control them with their facial expressions.

Many companies are benefitting from using FRT, not just from the security and marketing perspective, but also for creative applications. For example, J&J's Listerine Smile Detector app uses FRT to detect a smile and alert the visually challenged through vibration or sound, informing users that they are being smiled at.

Increased adoption of facial recognition is seen across many sectors, driven by improvements in cloud-based services and 3D-based recognition.

### RETAIL

**FRT is used in multiple ways to:**

- Identify shoplifters
- Send alerts to security after identifying a shoplifter
- Analyze customer buying patterns to personalize the experience
- Verify payments
- Prevent fraud

FRT assists in automating the shopping experience and minimizing retail crime

### HEALTHCARE

**Latest advancements help in:**

- Seamless check-in and check-out process for patients and staff
- Access control of premises
- Patient identification
- Patient monitoring
- Screening and diagnosis

From patient identification and monitoring to fraud prevention, FRT is revolutionizing healthcare

### AUTOMOTIVE

**Driving safety is increased by:**

- A personalized driving experience
- Analyzing facial expressions, such as fatigue or drowsiness
- Sending timely alerts to drivers to avert accidents
- Prompting drivers to take a break when needed

Facial movement combined with driving data provides enhanced driver safety

### BFSI

**FRT is used in:**

- eKYC
- Security and surveillance
- E-banking
- Access control
- Fraud prevention

Banks are more open to FRT, as more users access banks via phones and computers

*Figure 1: Key uses across sectors*

# 3

## MARKET OVERVIEW

The size of the facial recognition market is projected to reach $19.3 billion by 2032, up from $5.1 billion in 2022.[1] It is expected to grow at a CAGR of 14.6% from 2023 to 2032.

Retail and e-commerce dominate the end-user market with a 22.1 percent market share in 2022.

The healthcare segment is quickly adopting FRT and is expected to have increased market share in the coming years.

Cloud-based facial recognition services are expected to gain more momentum as enterprises begin using it to enhance their security.

BFSI, eCommerce, and education segments are expected to grow vertically in using cloud-based facial recognition due to adoption of digital platforms.

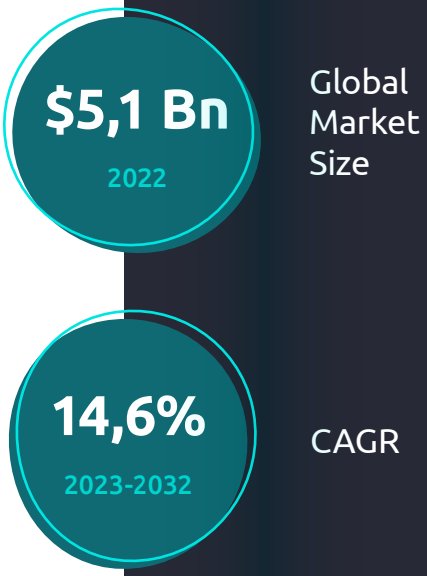


*Figure 2: The projected size of the FRT market*

[1] *GlobeNewswire (2023) Facial Recognition Market Revenue to Hit USD 19.3 Bn by 2032; North America dominates with 37.8% of the Market Share*

# 4 

## FACIAL RECOGNITION TECHNOLOGY IN HEALTHCARE

Facial data usage, storage, and sharing in healthcare are expected to be amplified in the coming years. This will likely be a result of its capability for enhancing the security of patient health information and enabling touch-free appointment check-ins, along with its perceived accuracy in matching patients.

While the obvious role of FRT is patient identification, this very process helps overcome security breaches and imposter incidence. It also helps health-insurance players to evaluate and make informed decisions.

For example, Fedo, a tech and data-based company, intends to use an AI-based platform with facial analysis to predict an individual's risk of developing different diseases and their subsequent propensity to claim over the next four years.

# KEY TRENDS IN HEALTHCARE

## DISEASE DIAGNOSIS:

Facial monitoring in combination with AI aids disease diagnosis for medical treatments. This is achieved by using smart devices and their many benefits. It is now feasible to use FRT to identify certain genetic syndromes that have distinct facial dysmorphism.

Researchers at the University of Colorado are using 3D-facial images to diagnose rare genetic disorders in children by matching features in a dedicated database. This has helped to reduce the time necessary to reach a diagnosis and determine the number of tests required.

## EMOTION DETECTION:

Patient emotions are helping doctors to determine the accurate treatment for a better cure. Facial emotion recognition (FER) is being leveraged to detect autism, depression, and neurodegenerative disorders, as well as to prevent suicides.

Apple and UCLA are studying the use of the iPhone's facial recognition, patterns of speech, and an array of other passive behavioral traits to detect depression.

Apple is also part of studies (e.g., the ResearchKit launched with Duke University, Johns Hopkins, and Oregon Health and Science University)[2] that aim to detect cognitive decline and autism in children. The studies utilize iPhone and Apple Watch data.

## PAIN MANAGEMENT:

This area is one of the top use cases for FRT. Patient facial gestures are read to measure pain levels, helping to reveal the time needed for pain medication.

Experts from the USF Health Morsani College of Medicine partnered with facial expression recognition experts at the USF College of Engineering to develop a tool to monitor facial expressions, body movements, and crying of infants for evidence of distress from pain.

## TOUCHLESS ACCESS:

The use of FRT for access control in healthcare institutes safeguards onsite admission, limits crowding in high-traffic areas, and enables employees to seamlessly unlock doors and other entry points with their face, with or without a mask.

VHC Health has partnered with CERTIFY Health to use facial biometrics for a patient identification check-in system at Virginia Hospital Center. The partnership was established to mitigate patient misidentification and fraud.

## WATCHLIST ALERTS:

Detected using FRT, real-time notifications are sent when a known threat or carrier of infection enters a facility.

This ensures staff and other patients are adequately informed and protected.

## PATIENT MONITORING:

FRT is used to monitor patients in healthcare facilities and identify risky behavior.

Patients at the Yokohama City University ICU were monitored to predict potentially dangerous behaviors, such as inadvertently removing their breathing tubes.

[2] *Apple (2015) Apple Announces New ResearchKit Studies for Autism, Epilepsy & Melanoma*

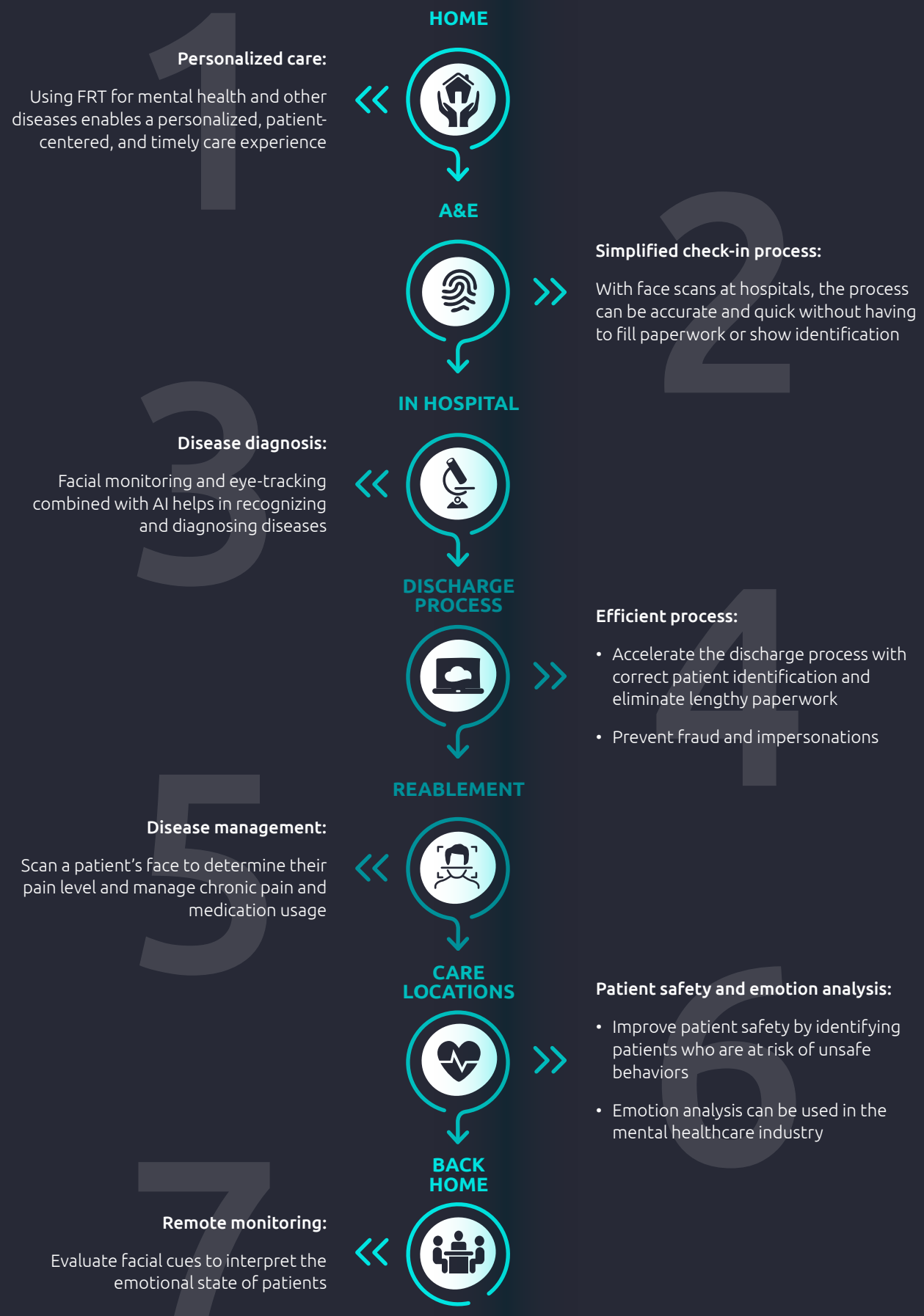


*Figure 3: Mapping a potential patient journey at a hospital using FRT[3]*

*[3]Capgemini Invent India (2023)*

FRT use goes beyond security and patient identification, expanding into diagnosis and treatment. Tools like neural networks and machine learning (ML) can improve FRT and help to correctly diagnose, reduce pain, and save lives.

FRT offers significant value propositions to both patients and healthcare professionals (HCPs). When integrated with analytics platforms, it can provide valuable data and insights for analyzing patient facial expressions, patterns, and trends to identify potential health conditions, assess pain levels, and monitor treatment progress.

This data-driven approach supports evidence-based decision-making and improves patient care through a streamlined and personalized healthcare experience, improved safety, and enhanced access to services.

## BENEFITS OF FRT IN HEALTHCARE

### PRACTITIONER BENEFITS:

FRT offers several benefits to healthcare practitioners. However, as with any technology, it is essential to strike a balance between its advantages and the ethical considerations involved.

FRT helps improve the practitioner-patient relationship. It ensures accurate patient identification, therefore reducing the risk of medical errors. FRT also facilitates secure access to a database and medical software for accessing classified clinical and medical information safely.

### PATIENT BENEFITS:

This technology enhances the overall patient healthcare experience and improves medical outcomes.

It aids in identity theft prevention, increases trust in the healthcare practice, strengthens the patient-practitioner relationship, and improves the security of classified personal health information.

### HOSPITAL/ CARE CENTER BENEFITS:

FRT can offer numerous benefits to hospitals and care centers in the healthcare industry, improving various aspects of operations and patient care.

This technology enables efficient and seamless patient flow, aids in accurate identification of patient files, supports the efficient maintenance of patient records through data governance to avoid duplicate records, and improves the patient relationship with the healthcare practice.

## FRT KEY USE CASES IN HEALTHCARE

The sensitivity of FRT is promising, and research shows the possible advantage of clinicians using it for enhanced decision making. By analyzing facial features, expressions, and patterns, FRT can aid in the early detection of various medical conditions. Another key area where FRT is used in diagnosis and treatment is in pain-level assessment, enabling HCPs to provide appropriate pain management.

# KEY EXAMPLES OF FRT IN USE

## PAINCHEK

This is a digital pain assessment tool that uses AI, facial recognition, and smartphone technology to intelligently automate the pain assessment process at the point of care.

## FACE2GENE

This is a suite of phenotyping applications that only analyze deidentified facial data from uploaded photos for various uses, such as matching phenotypes to genetic disorders based on gestalt, and the automatic calculation of anthropometric growth charts, etc.

Face2Gene and their software can diagnose up to 50 percent of the 8,000 known genetic syndromes using facial patterns.

## VISIONM8

As an Android computer-vision app, visionM8 can detect people without appropriate face coverings and is designed for deployment in retail stores, hospitality services, and public organizations.

## BLUESKEYE AI

B-Social is a technology enabling the measurement and interpretation of expressive behaviour, helping track apparent valence and enabling the measurement of expressed happy, calm, and agitated states, etc.

## NURALOGIX

Take a selfie, know your healthie™!

Nuralogix has developed a comprehensive, video-based, health-and-wellness measurement app called Anura that can identify a user's general wellness within 30 seconds.

Anura is an affective AI technology that can measure many health indicators from the convenience of your home, using only a smartphone camera.

## PATIENT IDENTIFICATION

This software for hospitals identifies patients accurately before they get medical treatment, helping prevent costly medical errors in identification.

This smartphone app enables users to identify patients whenever necessary, conscious or unconscious. Its software detects duplicate records and can raise a patient's file upon identification.

[2] *Apple (2015) Apple Announces New ResearchKit Studies for Autism, Epilepsy & Melanoma*

## THE SCIENCE BEHIND FACIAL RECOGNITION SYSTEMS

To identify and verify individuals, facial recognition systems use biometrics and involve capturing, analyzing, and mapping facial features, patterns, and characteristics to find a match in a database of known faces.

**TYPES OF FACIAL RECOGNITION SYSTEMS:**

**2D** scanners

Cameras are used to record physical traits of a person's face with their features plotted on a grid. The facial points or faceprints are written into a database with a unique numerical code tied to the person's identity.

**3D** scanners

3D cameras are used for creating faceprints to capture the depth and contours of the eyes, nose, and mouth. 3D facial recognition systems have been gaining traction for reliable authentication that cannot be tricked by using another person's faceprint.

## FACIAL RECOGNITION PROCESS

1. **Detection**
   Process of locating a face in an input image
2. **Analysis**
   Mapping out features for each face
3. **Recognition**
   Determining a person's identity in the input

*Figure 4: The three stages of FRT*

## KEY CONSIDERATIONS FOR FRT IN HEALTH APPLICATIONS

Unlike other forms of data, faces cannot be encrypted, and data breaches that involve face recognition can have serious consequences. Organizations are working toward streamlining FRT usage to be legally compliant and ensure the safety and security of personal information.

## KEY CHALLENGES FOR FRT

**1 PRIVACY REGULATION:**

Privacy regulations and practices are catching up as the idea of a photo revealing private health information is comparatively new. Patient health records and personal health information handling is governed by the Health Insurance Portability and Accountability Act (HIPAA) and includes privacy protections for personally identifiable information. Facial images used by FRT would be protected by HIPAA.

**2 IDENTITY THEFT:**

With facial imagery being easy to collect, store, and also capture from remote distances, there is an increased risk of identity theft, stalking, and harassment. Unlike passwords and credit card information, faces cannot be easily changed. Synthetic ID fraud, where an entirely new identity can be created, is a growing crime and it can even fool FRT with fake faces.

**3 INFORMED CONSENT:**

Informed consent is required not only for collecting and storing patient images, but also for the specific purposes for which those images might be analyzed by FRT systems. Apart from informed consent and an awareness of the risks of patient privacy, the issue of bias in training FRT is something researchers also need to guard against.

**4 SECURITY:**

FRT comes with its own set of security risks, since a wide number of images are available publicly given that facial images can be captured remotely without a person's knowledge. Although HIPAA provides a framework for protecting patient privacy, FRT can be reidentified, even once anonymized, like other patient data.

**5 BIAS:**

FRT can have extreme rates of false positives and false negatives, and bias may lead to different types of discrimination against a certain population. Gender and race biases have been especially documented. Many of these technologies are based on ML algorithms that depend on faces used to program them and need to ensure a diverse background of people during development, testing, and use.

# KEY FUTURE TRENDS IN HEALTHCARE

## CARE-TAKING ROBOTS

- Robots are on their way to filling in for healthcare workers during shortages.
- FRT enables robots to have improved, personalized, and engaging interactions with patients.

## SMART MIRRORS

- A simple look in a mirror can reveal a person's blood pressure and stress level by combining FRT with a mirror's built-in camera.
- Advice such as getting a mole on cheek checked to recommending medication are some of the potential uses.

## CARE FOR HCPS

- Besides patient health, FRT can also be used for the well-being of HCPs, enabling them to detect burnout and depression.
- Facial analysis can reveal these symptoms and help proactively suggest stress-relieving measures.

## EXPANDED USE

- FRT can be explored in other areas of healthcare, such as detecting unlawful insurance imposters, criminals, and drug seekers.

## FUTURE OF DIAGNOSTICS

- The idea of diagnosing sickness with a selfie is becoming a reality.
- Computer models are designed to accurately predict health based on shape of face.

# 5

## CONCLUSION

The increased adoption of cloud-based technologies and Internet of Things (IoT) is creating great opportunities for further growth of facial recognition systems. How ready is your company for integration of FRT?

The use cases for FRT are tremendous and warrant extensive exploration. For example, the rising penetration of electronic medical records (EMRs) in life-sciences industries has had a significant effect on FRT's market share in biometrics, which is steadly increasing.

This technology is picking up steam and being used widely by HCPs and clinics. As a result, there is an enormous amount of biometric data getting collected. Whether FRT will be a friend or foe in the future depends on who possesses the data and how responsibly it is protected, placing a great responsibility on the healthcare system to securely store it and adhere to privacy protection rules.

Do you know how to validate and harness this technology?

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