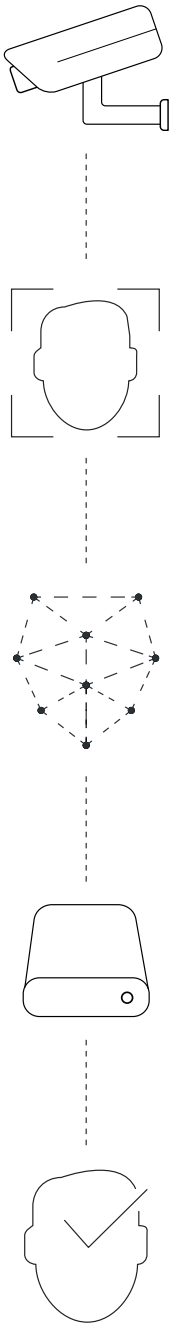
SAFR™

from realnetworks

FACIAL RECOGNITION PLATFORM

OCTOBER 2018



Secure, Accurate Facial Recognition

INTRODUCTION

Increased computing power combined with access to large data sets has accelerated the development of products, systems, and technologies employing artificial intelligence. Machine learning and deep neural networks are driving numerous new innovations.

Despite tremendous progress in both neuroscience and machine learning, computers still fall short of replicating the full complexity of the human brain. Even so, applications of machine learning continue to improve processes and experiences from manufacturing to marketing.

Computer vision and facial recognition platforms leveraging machine learning and deep neural networks are now broadly available for a variety of use cases. As the technology continues to advance, the market is rapidly expanding. The global facial recognition market was USD 3.85 billion in 2017 and is estimated to reach USD 9.78 billion by 2023.[1]

[1]Global Facial Recognition Market, Oristep Consulting report, April 2018

THE CHALLENGES OF FACIAL RECOGNITION

Facial recognition is simultaneously simple and exceedingly complex. The basic requirements of detecting a face in a picture or video, generating a signature, and identifying a match in a database are easy to understand. However, recognizing the subtle but extraordinary variability of the human face under varied conditions of lighting, camera resolution, and focal length can be a challenge. Even more so is achieving near-perfect accuracy with facial recognition in live video where faces are in motion, at different angles, occluded, ageing, and carrying expressions that change over time.

As humans, we take facial recognition for granted with a typical ability to differentiate 10,000 faces. Computer vision – facial recognition – has been a challenging domain for several decades, but only recently, with the availability of economically favorable computing power paired with massive databases and machine learning, has the power of facial recognition become generally accessible.

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RealNetworks® has a legacy of expertise and innovation in digital media, video compression, rich metadata, and solutions that intelligently scale on massive distributed networks across diverse topologies. This deep experience augmented by the latest AI research has enabled the framework for the SAFR facial recognition platform.

THE SAFR FACIAL RECOGNITION PLATFORM

The SAFR Platform is a highly accurate, machine learning facial recognition platform architected to economically scale with high performance and rapid processing to detect and match millions of faces in real time. SAFR is distinguished from other facial recognition platforms by its accuracy and performance with faces in the wild. Unlike other facial recognition systems that are trained on mugshots or visa photos, SAFR was designed to address the more challenging problem of recognizing "faces in the wild" — faces in motion, under poor lighting conditions, misaligned, or partially obscured. The SAFR algorithms achieved exceptional accuracy through training using

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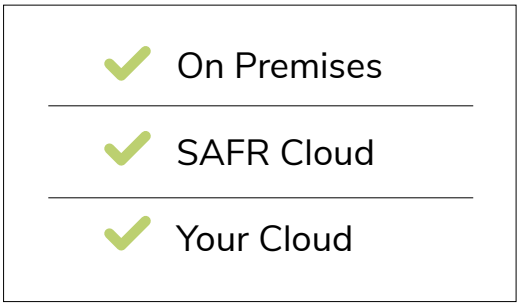
real faces versus simulated faces. This means SAFR is ideally suited for real-world use cases where high performance, dependable, highly accurate industrial-grade facial recognition is required.

SAFR is optimized for end-to-end performance. It is architected to distribute the workload in a cost-efficient way. While most other solutions require full video to be uploaded to the cloud incurring significant bandwidth costs and costly overhead, SAFR employs a hybrid architecture, whereby the detection and tracking in live video happens at the edge, while the database matching and recognition occurs on the server, which can live on premises or in the cloud. Connections to the Server in the cloud can happen over bandwidth as thin as a 3G connection.



The SAFR platform is flexible. SAFR supports multiple OS and hardware platforms, and can be adapted for different environments, applications, and use cases. For example, SAFR supports numerous secure access applications where facial recognition can replace the use of an ID badge, securely automate entry to facilities, trigger notifications, log events, and generate analytics. SAFR can detect and track many faces in a single camera feed and scale to manage any number of readily available IP cameras.

ACCURACY AND PERFORMANCE CONFIRMED BY THE NATIONAL INSTITUTES OF SCIENCE AND TECHNOLOGY (NIST)

Dependable accuracy and performance are central to any viable recognition solution. Latency, false positives, and questionable results render a system unusable. The algorithms powering the SAFR platform were tested by NIST and contrasted with

99.8%
LFW Faces
University of MA 2017

0.048
Wild Faces FNMR*
National Institute of Standards and Technology 2018

*The NIST Wild Faces FNMR (False Non Match Rate) score of 0.048 found that the SAFR algorithm correctly recognized a camera unaware individual from an imperfect image in 95.2% of cases while perfectly differentiating a population of 10,000 people.

over eighty other algorithms submitted by companies and institutions from around the world. SAFR achieved an enviable level of accuracy and performance that squarely established its position in a best-in-class category. The tests conducted in June of 2018 examined multiple aspects of the algorithms. The key results are highlighted below. The complete test results can be found online at https://www.nist.gov/sites/default/files/documents/2018/06/21/frvt_report_2018_06_21.pdf.

SAFR is distinguished from other facial recognition platforms by its accuracy and performance with faces in the wild.

Template Extraction

Template extraction is the process of creating a facial signature. NIST ranked the SAFR template extraction algorithm the fastest among the top seven algorithms in the world. A face image undergoes a multi-pass process that converts facial features into vectors expressed in a string of numerical values. It's critical that a signature is robust and unique since it will be compared against a large database of signatures in order to identify a match. The process of comparing and matching signatures in the database is measured in nanoseconds.

Template extraction happens after a face has been detected in an image or video stream. Detecting a face and differentiating it from a background in a live video stream is by far the most CPU-intensive task a system must accomplish. A high resolution 4K camera presents a large amount of data with each video frame. SAFR efficiently

handles detection by optimizing performance at each step. This results in fast detection (measured in several hundred milliseconds), which is perceptually real time.

Wild Faces False Non-Match Rate (FNMR)

"Wild faces" are faces that are camera unaware. This test looks at performance under real world conditions. The face may be tilted, occluded, moving through a frame, or under low light. A false non-match rate (FNMR) is the rate at which the algorithm mis-categorizes two captured images from the same individual as being from different individuals.

The NIST Wild Faces FNMR (false non-match rate) score of 0.048 indicates that the SAFR algorithm correctly recognizes a camera unaware individual from an imperfect image in 95.2% of cases while perfectly differentiating a population of 10,000 people. This score ranked SAFR 7th out of 82 tested algorithms, and 6th out of the 47 companies who submitted. In addition to the NIST results, SAFR demonstrated a 99.8 percent accuracy for Labeled Faces in the Wild (LFW), based on a University of Massachusetts benchmark database.

Gender and Skin Tone

All facial recognition algorithms have issues with regard to skin tones and gender. However, the SAFR algorithm was developed with a data set and training methodology aimed at solving inherent problems that could lead to bias. As a result of this focus, NIST ranked SAFR as the 4th best in achieving consistent results regardless of skin tone or gender.

FLEXIBLE ARCHITECTURE

SAFR is not a one-size-fits-all solution. It's built for real world conditions. Different environments, policies, hardware systems, and applications necessitate different requirements. SAFR is architected to be flexible. SAFR can be deployed on premises or in the cloud. It can be installed on Mac, Windows, or Linux machines. It supports iOS and Android. It can scale to support larger locations with more cameras by installing additional nodes that interface with the main host and central database. The additional nodes connect automatically and also serve to load balance detection and recognition tasks.

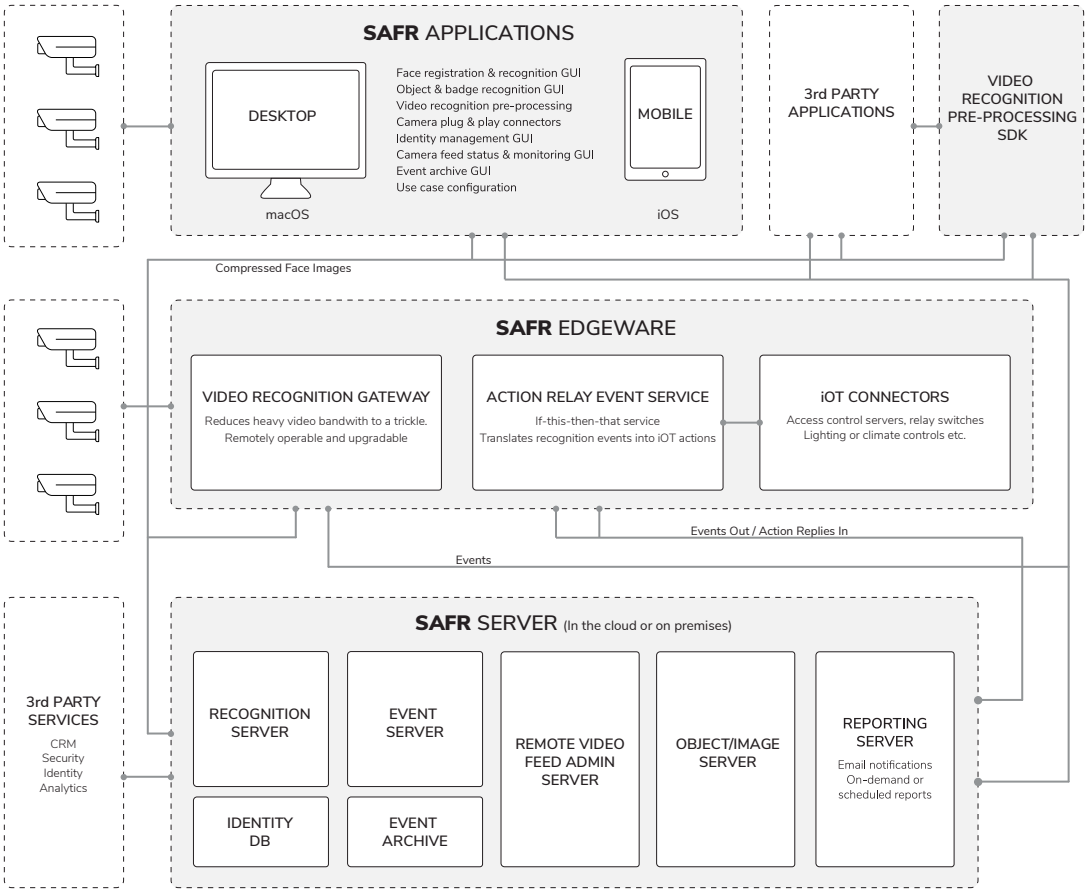
Developers and system integrators can build custom solutions with the SAFR RESTful API's.

Developers and system integrators can build custom solutions with the SAFR RESTful API's which provide access to an array of functions, events, metadata, and configuration settings. The full range of SAFR capabilities are available to build custom applications, integrate into existing systems, connect hardware and iOT devices, create custom actions based on recognition events, and to export data for insights and reports.

The platform can extend to mobile devices via the SAFR mobile app running on macOS or Android. These mobile devices can be configured as kiosks for people to register into the system for a specific use case. They can also be configured as a secure access point which can recognize a registered individual and unlock a door.

All remote devices which connect to the primary SAFR Server must connect via SSL to ensure secure transmission of data and images. When SAFR is deployed as a closed system, no face data or imagery is every transmitted over the internet.

SAFR system architecture



SAFR PLATFORM COMPONENTS

The SAFR Platform includes three primary parts; the SAFR Application, the SAFR Server, and SAFR Actions Application.

SAFR APPLICATION

The SAFR Application is used to add and configure cameras, monitor feeds, get alerts, and view activity. It is also used to update and manage the identity database.

The SAFR Application can be installed on additional laptops or desktops to allow administration and monitoring anywhere, anytime.

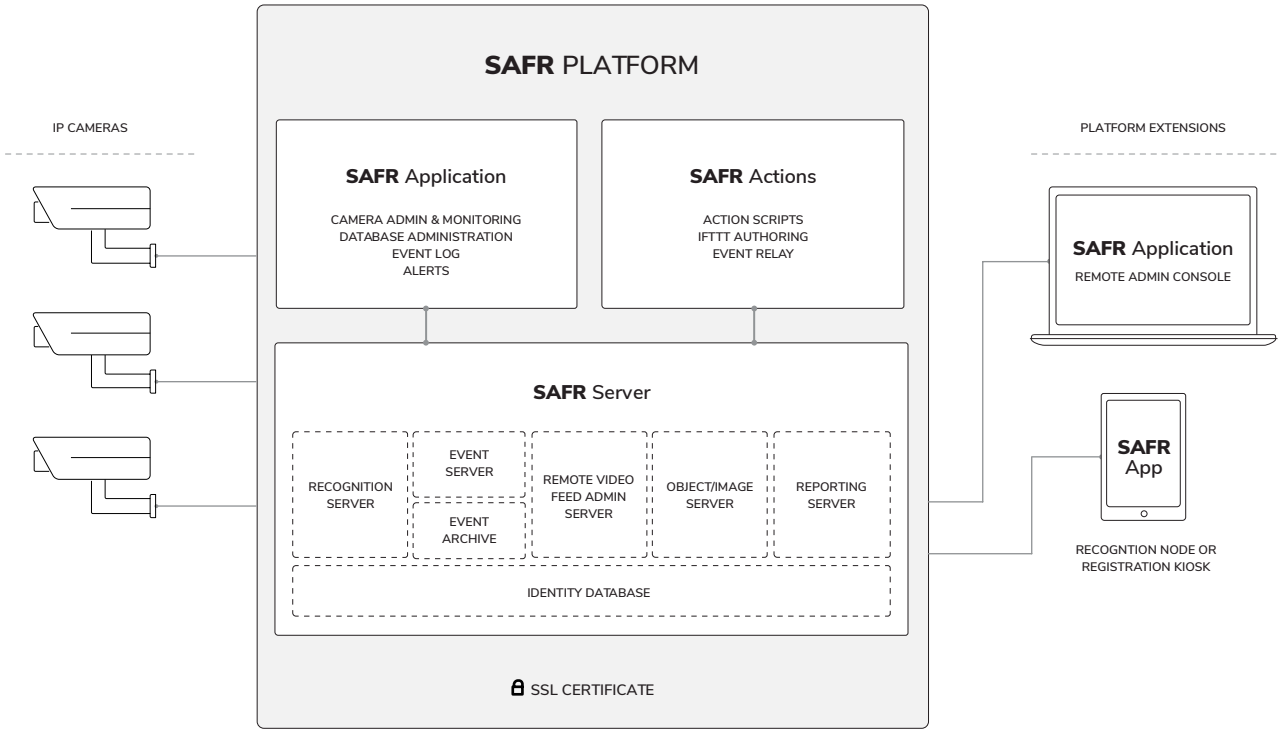
SAFR SERVER

The SAFR Server, comprised of multiple components, includes the facial recognition server, identity database, recognition event server, event archive, remote video feed administration server, and object server.

SAFR ACTIONS APPLICATION

The SAFR Actions Application is used to create and manage actions based on event triggers. Actions are written in Python and can be deployed for wide range of IFTTT (If this, then that) scenarios. For example, you can unlock a door, turn on a warning light, send an SMS message or email, record data for reporting, or any number of actions depending on the use case.

SAFR Platform basic configuration



SAFR IN USE

SAFR was designed to connect, adapt, and extend to different environments, specialized applications, existing hardware, or custom integrations. A wide range of use cases can benefit from SAFR facial recognition. Secure access, door lock activation, biometric entry control, event and venue monitoring, school safety, digital signage, camera integration, retail insights, and physical space analytics are just some of the areas where SAFR can add real value.

SECURE ACCESS

- Smile to unlock
- Multi-factor authentication
- Notifications
- Building system integration
- Lighting & environment controls

VIP LOYALTY

- Digital signage
- Retail kiosk
- Personalization
- Merchandising
- Rewards
- Concierge services

VENUE MONITORING

- Identify unwelcome guests
- Locate lost children
- Theft and loss prevention
- Secure area access
- Concession staffing
- Traffic flows
- Sentiment

SCHOOL SAFETY

- Threat detection
- Attendance
- Guest check in
- Convenience
- Common area monitoring
- Alerts & notifications
- Entry control

ANALYTICS

- Live data collection
- Traffic analysis
- Dwell time
- Heat maps
- Demographics
- Sentiment
- Notifications
- Reporting

The SAFR Platform includes integrated technologies that combine best-in-class performance, a flexible architecture, and support for a wide range of real-world use cases. RealNetworks is a global company with a near 25-year legacy of technology innovation and expertise.

FOR MORE INFORMATION

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