

TESSERA



FotoNation FaceTools Image Enhancement Solutions

Powerful Image Enhancement Solutions for Camera-Enabled Devices

Digital camera technology is evolving rapidly—converging with cell phones and extending into other camera-enabled devices. However, even with this convergence, camera users still have to contend with less than perfect results: subjects with closed eyes, awkward facial expressions or images that are over-exposed. What users want are camera-enabled devices that automatically take portrait-quality images every time, with the push of a button and no need for post processing. That technology is here—and it's key to your competitive advantage.

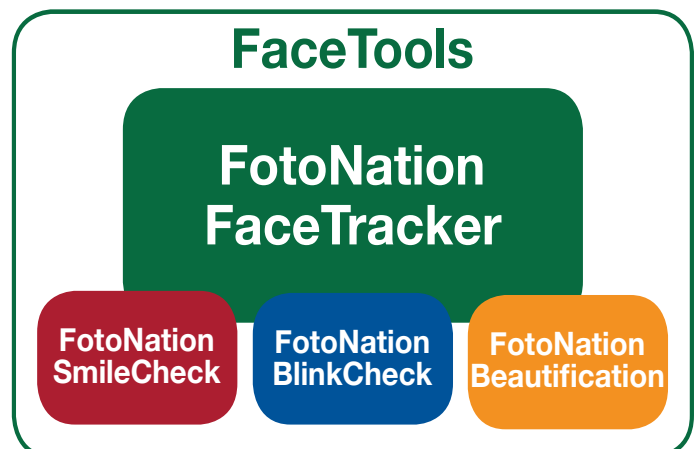
Industry-leading FotoNation® FaceTools image enhancement solutions enable you to deliver advanced imaging features that will improve image quality and simplify picture taking on cameras, cell phones and other digital imaging products.

FaceTools image enhancement technology includes the FotoNation FaceTracker solution with smile, blink and beautification options that provide your camera-enabled products with the following functions:

- Portraits with optimal color balance correction, focus and exposure - automatically
- Automatic face cropping and face zooming
- Smile shutter and blink prevention
- Face beautification
- Professional-quality portraits with no need for post processing

Key features include:

- Face tracking for up to 10 faces, with less than 0.1 seconds lock time
- Real-time face tracking up to 30 frames per second
- Faces detected in a wide range of orientations including rotation-in-plane and out-of-plane
- Smile and blink detection
- Face beautification with subtle image smoothing capabilities
- Available in both embedded and hardware accelerated form



FaceTools family of "smart" image enhancement solutions gives your products a competitive advantage and improves customer satisfaction.

Tessera - Transforming the Future™

FotoNation FaceTracker

Next-generation face detection and tracking

The FotoNation FaceTracker solution provides fast, high-performance face detection and tracking capabilities that enable the camera to select optimal settings automatically for the perfect picture. Having already shipped in tens of millions of digital cameras, the FotoNation FaceTracker solution is a proven technology.



FotoNation FaceTracker enables automatically-optimized image quality, even under poor lighting conditions.

Using innovative face-oriented technology, the FotoNation FaceTracker solution detects up to 10 faces in the camera viewfinder in as little as 0.1 seconds, and tracks them moving through the image if the camera is rotated or subjects shift their poses. It enables a camera to automatically adjust focus, color and exposure settings, optimizing portraits even when subjects are backlit, off-center or over/under exposed. The technology also incorporates advanced tracking algorithms to lock and anticipate the changing position of faces.

Image enhancement technologies transform cell phone cameras, webcams and more

Enhanced FotoNation FaceTracker features allow you to provide a more user-friendly camera product that automatically improves portrait quality. For example, extension modules are available that ensure faces are smiling and eyes are open when the image is captured.

FotoNation SmileCheck

The FotoNation SmileCheck extension module enables a camera viewfinder to indicate when faces are smiling and can ensure the camera shutter is triggered only when one or more faces are smiling.



FotoNation SmileCheck detects smiles in faces as small as 10 pixels between eyes.

FotoNation BlinkCheck

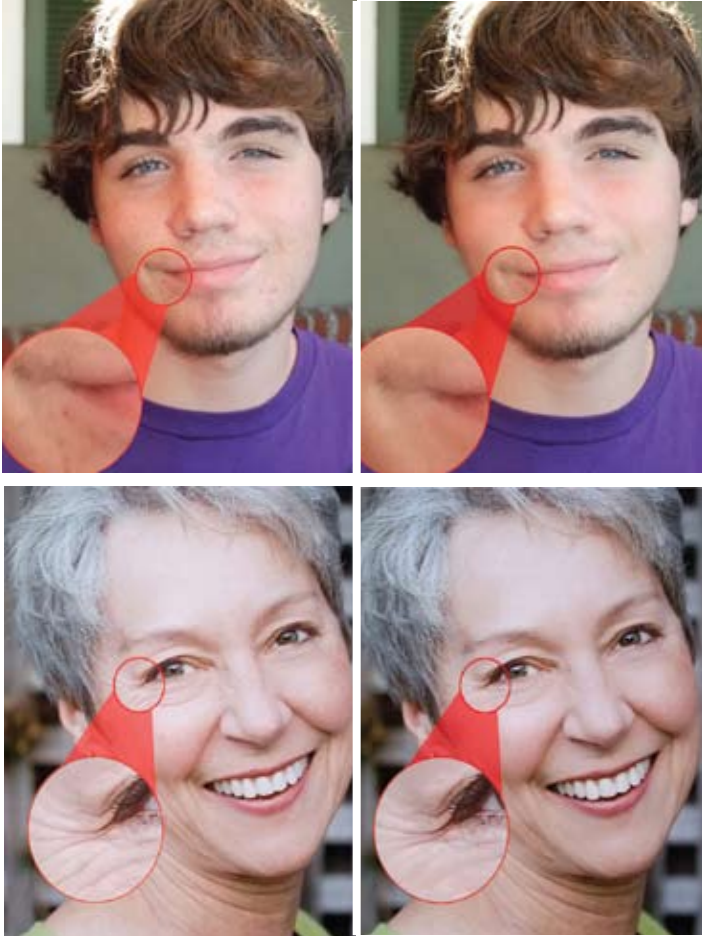
The FotoNation BlinkCheck extension module can be used to warn the photographer when the subjects' eyes are closed.



FotoNation BlinkCheck detects blinks in faces as small as 22 pixels between eyes.

FotoNation Beautification

The FotoNation Beautification extension module brings professional-looking photo capability to image capture devices. It allows camera-enabled products to enhance portraits without requiring separate, post-editing software. The technology automatically reduces the appearance of wrinkles or other skin imperfections. Skin is smoothed while the sharpness of eyes, hair and lips is retained for perfect, lifelike portraits.



FotoNation Beautification auto-corrects imperfections while maintaining natural-looking key facial features.

FaceTools image enhancement technology will enable you to deliver the highest quality photo capability, coupled with practical, intuitive features. As a result, you will enhance and simplify the photo experience for users.

Flexible, Scalable Implementations

FotoNation FaceTools technology is available as an embedded software solution or in a hardware-accelerated version. Both are highly scalable and are based on an adaptive algorithm that accommodates processing power, memory and image quality for a wide range of digital cameras, cell phones and other mobile platforms. The technology allows simultaneous processing of other tasks in the camera by distributing execution on multiple cores.

Technical Features

Embedded Software

- Software solution for face tracking and detection
- Small code size: 240 KB
- Platforms: x86, ARM, MIPS
- Operating Systems: Windows, WinCE, Linux, MacOS X, Symbian, MonteVista, µltron, ThreadX, Nucleus and other custom operating systems
- Easily portable to new platforms
- Simple firmware interface for easy integration into the camera, with only three necessary function calls

Hardware-Accelerated

- FotoNation IP core
- Embedded software plus hardware acceleration
- Requires 4x less processing power than equivalent embedded software implementation
- 100K gates (delivered as encrypted RTL)
- 240 KB embedded code size

FotoNation FaceTracker Specifications

Minimum Face Size Detected/Distance to Subject	14 x 14 pixels (or 7 pixels between the eyes)
Facial Orientation	Detects faces through Rotation-in-plane and Rotation out-of-plane

FotoNation FaceTracker Module Specifications

Minimum Face Size/Distance to Subject	Smile: 10 pixels between the eyes Blink: 22 pixels between the eyes
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FaceTools Specifications

Solution/Module	SW Code Size	Working Memory Req'mts	HW Gate Size	MIPS Requirement (typ)	Initial Face Locking Time (typ)	Comments
FotoNation FaceTracker (Embedded SW)	≈240kB	≈640kB (QVGA input)	N/A	≈63 MIPS (QVGA input)	<0.33 sec	14 x 14 pixel face detected
FotoNation FaceTracker (HW Acceleration IP Core)	≈240kB	≈1.6 MB (QVGA input)	≈100k	≈30 MIPS (QVGA input)	<0.1 sec	Speeds up core FotoNation FaceTracker performance by up to 4x vs. embedded SW version
Optional Extension Modules			N/A		N/A	Works with FotoNation FaceTracker or other face detection technology
- FotoNation SmileCheck	23kB			≈3 MIPS (per face)		
- FotoNation BlinkCheck	50kB			≈10 MIPS (per face)		
- FotoNation Beautification	35kB			≈19 MIPS (per Mp)		

FaceTools family of image enhancement solutions are based on an adaptive algorithm that accommodates processing power, memory and image quality for camera-enabled devices.

Transforming the future with face-based image enhancement solutions

By investing in technologies that drive new levels of innovation in electronics, optics and imaging, and delivering scalable solutions that enable manufacturers to get the right product to market, at the right time, Tessera's transformational technologies are enabling the next generation of advanced electronics products.

**Contact a Tessera sales representative for more information
or to schedule a FaceTools demonstration**



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