In comparison with the human eye, the image sensors used in digital cameras have a limited dynamic range, not being able to capture all the details in scenes with difficult illumination. When taking a photo, the user is faced with the choice of either rendering details in shadow areas and overexposing the highlights, or exposing for highlights but losing details in darker zones.

DigitalOptics enables natural looking high dynamic range pictures by taking multiple acquisitions of the same scene at different exposures and merging them into one single HDR photo. The result is a natural image that extends well beyond the dynamic range limitations of the sensor.

One of the features that make DOC’s HDR unique is the ability to analyze the live view video stream before the actual image acquisition, in order to determine the most appropriate settings for the HDR process.

The two most common problems in today’s HDR algorithms are image registration and ghosting suppression. Image registration is the process of aligning the images in order to compensate for camera movement between the shots. This is a very costly operation both computationally and memory-wise. HDR from DigitalOptics is designed to make use of the hardware Frame Registration Engine (FRE) included in the proprietary Advanced Hardware for Image Processing (AHIP) hardware IP core to perform this step which ensures industry-leading performance and reduced system load.
Ghosting is a negative outcome that appears in the case of images with moving subjects, or more generally, when the content of the frames that are used in generating the HDR image is different. HDR from DigitalOptics addresses this issue by a highly intelligent ghosting detection and suppression technique that remains effective even in the case of large movements.

Two processing modes are available: ‘Natural Look’ and ‘Eye Catchy’.

Based on DOC’s Face Tools, the HDR solution from DigitalOptics improves upon conventional algorithms by accounting for facial information. When human faces are detected in the image, their corresponding areas are specially treated so that an optimal exposure is achieved without ghosting artifacts.

**HDR Technology Highlights**

- **Extensive IP protection**
- Enables **HDR imaging with a dynamic range improvement** of up to 4 EV
- Can produce HDR images that are **natural** in appearance, but also features an **eye-catchy** surrealist mode
- **High performance registration process** enables handheld image acquisition, without the use of a tripod
- **Ability to analyze the live preview stream** in order to optimize the HDR process
- Features an **intelligent ghosting reduction** technique for improved results in the case of moving subjects
- Based on face detection, accounts for facial information for **improved rendering of faces in HDR images**
- Available as both software only and also hardware acceleration with proprietary IP core; up to 4X reduction in execution time is achieved with hardware acceleration
An important challenge in shooting video is to achieve steady footage without using tripods or stabilization rigs. This is even more difficult when using lightweight hand-held devices such as camera phones, which by their nature are less steady and need to be held at arm’s length.

Video Image Stabilization from DigitalOptics renders smooth video in virtually any image acquisition device ranging from camera phones to DSCs and camcorders. This is made possible by a highly intelligent algorithm that is able to identify and isolate camera shake from any intentional panning or tilting motion. This way, the image can be stabilized effectively without affecting the intentional camera movement or the natural motion of objects. VIS also increases the quality of up-loadable video content while at the same time reducing data size due to improved compression.

By relying on DOC’s FRE IP core, full HD video up to 60 fps can be stabilized in real time without reduced CPU load and memory bandwidth.

**Video Image Stabilization Technology Highlights**

- Extensive IP protection
- Real time stabilization of Full HD 1080p up to 60 fps
- Ability to distinguish between handshake and intentional camera movement for effective stabilization while maintaining smooth panning and tilting camera motion
- Allows zooming during video capture with no impact on the performance of the stabilization process
- Can be used with gyroscope based motion detection to further improve image stabilization performance
- Lightweight software layer and compact IP core of only 110 kGates logic and 27 kB of memory
Panoramas - images composed from multiple photos stitched together in software for extending the angle of view – have grown in popularity with the advent of digital cameras and camera phones. DOC’s Panorama is a state-of-the-art technology that allows the creation of panoramic photos right upon image acquisition, in real time. This is made possible with DOC’s powerful FRE hardware IP core that is able to perform image registration in real time with sub-pixel accuracy.

DOC’s Panorama works with high resolution images acquired from the video stream or burst mode. The user only needs to sweep the camera without any complicated stop-and-go steps, and the library automatically generates a natural shake-free panoramic image. Moreover, the algorithm can even determine whether the direction of the panoramic sweep is either horizontal (left, right) or vertical (up, down), which makes the acquisition completely hassle-free.

A common challenge when creating panoramic images is performing image registration in the case of uniform surfaces (such as gray skies). To address this problem, DOC’s Panorama features gyroscope support for the sensors incorporated into mobile phones. When combining image data with angular velocity information, even the toughest scenes can now be turned into panoramic images.

The DOC Panorama Engine unleashes its true processing potential when using high resolution images. For example, with 5 MP portrait-oriented images, a highly detailed 180° panorama of 10800x2592 can be obtained.

Dramatic panorama images can be captured in real time with the embedded DigitalOptics solution
Moving subjects in panoramic images can render the seams between adjacent images visible. DOC Panorama is now able to detect objects moving in the scene and can adjust the stitching and blending process to avoid this negative outcome.
Panorama Imaging (CONTINUED)

Without any additional information, Panorama from DigitalOptics can even produce 3D panoramic images to be viewed on 3D widescreen displays for a completely immersive experience.

Panorama Imaging Technology Highlights

- Extensive IP protection
- Available both as standalone software library and hardware accelerated with proprietary IP core
- Support for high resolution images
- Capable of producing 3D panoramic images without any additional inputs
- Automatic detection of sweep direction
- Support for gyroscopic data input for improved accuracy in the case of uniform areas
- Detection of moving objects for elimination of image stitching artifacts
- Extremely low execution times: 30 ms/frame + 700 ms for 5 MP images, 15 ms/frame + 250 ms for HD resolution (as measured on a typical camera phone platform)

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