ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Saliency Based Boosting Laplacian Pyramid Image Fusion for Multi Exposure Photography

Rama Nangavath
ME Student,
Stanely College of Engineering and Technology for Women, Hyderabad, India.

Shatabdi Nandi, M.Tech
Asst Professor,
Stanely College of Engineering and Technology for Women, Hyderabad, India.

Abstract:

THE DYNAMIC range of a natural scene often spans a much larger scope than the capture range of common digital cameras. An exposure image only captures a certain dynamic range of the scene and some regions are invisible due to under-exposure or over-exposure. Variable exposure photography captures multiple images of the same scene with different exposure settings of the camera while maintaining a constant aperture. In order to recover the full dynamic range and make all the details visible in one image, high dynamic range (HDR) imaging techniques are employed to reconstruct one HDR image from an input exposure sequence.

These generated HDR images usually have higher fidelity than convectional low dynamic range (LDR) images, which have been widely applied in many computer vision and image processing applications, such as physically-based realistic images rendering and photography enhancement. On the other hand, the current displays are only capable of handling a very limited dynamic range.

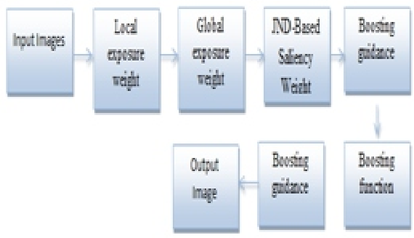
This Project proposes a new exposure fusion approach for producing a high quality image result from multiple exposure images. Based on the local weight and global weight by considering the exposure quality measurement between different exposure images and videos, and the just noticeable distortion-based saliency weight, a novel hybrid exposure weight measurement is developed.

This new hybrid weight is guided not only by a single image's exposure level but also by the relative exposure level between different exposure images. The core of the approach is our novel boosting Laplacian pyramid, which is based on the structure of boosting the detail and base signal, respectively, and the boosting process is guided by the proposed exposure weight.

Our approach can effectively blend the multiple exposure images for static scenes while preserving both color appearance and texture structure. Our experimental results demonstrate that the proposed approach successfully produces visually pleasing exposure fusion images and videos with better color appearance and more texture details than the existing exposure fusion techniques and tone mapping operators.

Proposed Method Block diagram:

Block Diagram:



Introduction:

In computer vision, Multisensor Image fusion is the process of combining relevant information from two or more images into a single image. The resulting image will be more informative than any of the input images.In remote sensing applications, the increasing availability of space borne sensors gives a motivation for different image fusion algorithms. Several situations in image processing require high spatial and high spectral resolution in a single image. Most of the available equipment is not capable of providing such data convincingly. Image fusion techniques allow the integration of different information sources. The fused image can have complementary spatial and spectral resolution characteristics.

However, the standard image fusion techniques can distort the spectral information of the multispectral data while merging.In satellite imaging, two types of images are available. The panchromatic image acquired by satellites is transmitted with the maximum resolution available and the multispectral data are transmitted with coarser resolution. This will usually be two or four times lower. At the receiver station, the panchromatic image is merged with the multispectral data to convey more information.

Many methods exist to perform image fusion. The very basic one is the high pass filtering technique. Later techniques are based on Discrete Wavelet Transform, uniform rational filter bank, and Laplacian pyramid.Image fusion methods can be broadly classified into two groups - spatial domain fusion and transform domain fusion.The fusion methods such as averaging, Brovey method, principal component analysis (PCA) and IHS based methods fall under spatial domain approaches. Another important spatial domain fusion method is the high pass filtering based technique.

Here the high frequency details are injected into upsampled version of MS images.. Spatial distortion can be very well handled by frequency domain approaches on image fusion. The multiresolution analysis has become a very useful tool for analysing remote sensing images. The discrete wavelet transform has become a very useful tool for fusion. Some other fusion methods are also there, such as Laplacian pyramid based, curvelet transform based etc.

These methods show a better performance in spatial and spectral quality of the fused image compared to other spatial methods of fusion. The images used in image fusion should already be registered. Misregistration is a major source of error in image fusion. Some well-known image fusion methods are:

- High pass filtering technique
- IHS transform based image fusion
- PCA based image fusion
- Wavelet transform image fusion
- Pair-wise spatial frequency matching

Image fusion in remote sensing has several application domains. An important domain is the multi-resolution image fusion (commonly referred to pan-sharpening). In satellite imagery we can have two types of images.

Panchromatic images :

An image collected in the broad visual wavelength range but rendered in black and white.

Multispectral images :

Images optically acquired in more than one spectral or wavelength interval. Each individual image is usually of the same physical area and scale but of a differentThe standard merging methods of image fusion are based on Red-Green-Blue (RGB) to Intensity-Hue-Saturation (IHS) transformation. The usual steps involved in satellite image fusion are as follows:

Resize the low resolution multispectral images to the same size as the panchromatic image.Transform the R, G and B bands of the multispectral image into IHS components.Modify the panchromatic image with respect to the multispectral image. This is usually performed by histogram matching of the panchromatic image with Intensity component of the multispectral images as reference.Image fusion has become a common term used within medical diagnostics and treatment. The term is used when multiple images of a patient are registered and overlaid or merged to provide additional information. Fused images may be created from multiple images from the same imaging modality, or by combining information from multiple modalities,such as magnetic resonance image (MRI), computed tomography (CT), positron emission tomography (PET), and single photon emission computed tomography (SPECT). In radiology and radiation oncology, these images serve different purposes. For example, CT images are used more often to ascertain differences in tissue density while MRI images are typically used to diagnose brain tumors. For accurate diagnoses, radiologists must integrate information from multiple image formats. Fused, anatomically consistent images are especially beneficial in diagnosing and treating cancer. With the advent of these new technologies, radiation oncologists can take full advantage of intensity modulated radiation therapy (IMRT). Being able to overlay diagnostic images onto radiation planning images results in more accurate IMRT target tumor volumes.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Exposer Photography:

In photography, exposure is the amount of light per unit area (the image plane illuminance times the exposure time) reaching a photographic film or an image sensor, as determined by shutter speed, lens aperture and scene luminance. Exposure is measured in lux seconds, and can be computed from exposure value (EV) and scene luminance in a specified region.In photographic jargon, an exposure generally refers to a single shutter cycle .It is defined as:

where $H_v = E_v \cdot t$

- Hv is the luminous exposure (usually in lux seconds)
- Ev is the image-plane illuminance (usually in lux)
- t is the exposure time (in seconds)

The radiometric quantity radiant exposure He is sometimes used instead; it is the product of image-plane irradiance Ee and time, the accumulated amount of incident "light" energy per area:

where $H_e = E_e \cdot t$

- He is the radiant exposure (usually in joules per square metre (J/m2))
- Ee is the irradiance (usually in watts per square metre (W/m2))
- t is the exposure time (in seconds)

If the measurement is adjusted to account only for light that reacts with the photo-sensitive surface, that is, weighted by the appropriate spectral sensitivity, the exposure is still measured in radiometric units (joules per square meter), rather than photometric units (weighted by the nominal sensitivity of the human eye).

Exposer settings
• Manual exposer:

In manual mode, the photographer adjusts the lens aperture and/or shutter speed to achieve the desired exposure.

Many photographers choose to control aperture and shutter independently because opening up the aperture increases exposure, but also decreases the depth of field, and a slower shutter increases exposure but also increases the opportunity for motion blur."Manual" exposure calculations may be based on some method of light metering with a working knowledge of exposure values, the APEX system and/or the Zone System.

• Automatic exposure:

A camera in automatic exposure (abbreviation: AE) mode automatically calculates and adjusts exposure settings to match (as closely as possible) the subject's mid-tone to the mid-tone of the photograph. For most cameras this means using an on-board TTL exposure meter.Aperture priority mode (commonly abbreviated to Av) gives the photographer manual control of the aperture, whilst the camera automatically adjusts the shutter speed to achieve the exposure specified by the TTL meter. Shutter priority mode (commonly abbreviated to TV) gives manual shutter control, with automatic aperture compensation. In each case, the actual exposure level is still determined by the camera's exposure meter.

Exposer compensation:

The purpose of an exposure meter is to estimate the subject's mid-tone luminance and indicate the camera exposure settings required to record this as a midtone. In order to do this it has to make a number of assumptions which, under certain circumstances, will be wrong. Cameras with any kind of internal exposure meter usually feature an exposure compensation setting which is intended to allow the photographer to simply offset the exposure level from the internal meter's estimate of appropriate exposure. On low-end video camcorders, exposure compensation may be the only manual exposure control available.

• Exposer control:

An appropriate exposure for a photograph is determined by the sensitivity of the medium used. For photographic film, sensitivity is referred to as film speed and is measured on a scale published by the International Organization for Standardization (ISO).

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Faster film, that is, film with a higher ISO rating, requires less exposure to make a good image. Digital cameras usually have variable ISO settings that provide additional flexibility. Exposure is a combination of the length of time and the illuminance at the photosensitive material. An approximately correct exposure will be obtained on a sunny day using ISO 100 film, an aperture of f/16 and a shutter speed of 1/100 of a second.

Determining exposer:

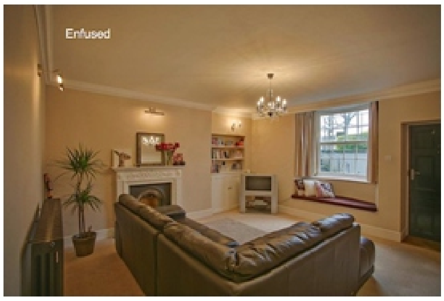
The Zone System is another method of determining exposure and development combinations to achieve a greater tonality range over conventional methods by varying the contrast of the film to fit the print contrast capability. Digital cameras can achieve similar results (high dynamic range) by combining several different exposures (varying shutter or diaphram) made in quick succession.Today, most cameras automatically determine the correct exposure at the time of taking a photograph by using a built-in light meter, or multiple point meters interpreted by a built-in computer, see metering mode.Negative/Print film tends to bias for exposing for the shadow areas (film dislikes being starved of light), with digital favouring exposure for highlights. See latitude below.

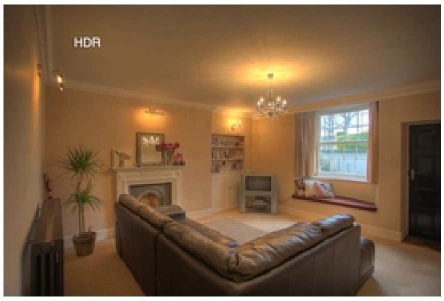
What is Exposure Fusion?

Lets set things straight from the start, Exposure Fusion is not a kind of HDR.Exposure Fusion is a fairly new concept that is the process of creating a low dynamic range (LDR) image from a series of bracketed exposures.In short, EF takes the best bits from each image in the sequence and seamlessly combines them to create a final 'Fused' image. Or more technically, the fusing process assigns weights to the pixels of each image in the sequence according to luminosity, saturation and contrast, then depending on these weights includes or excludes them from the final image. And because Exposure Fusion relies on these qualities, no exif data is required, and indeed, if you wanted to, you could include an image with flash to bring darker areas to life.

Exposure Fusion Advantages over HDR

For one, no intermediate HDR image needs to be created, and therefore no tone mapping step is required either, making Exposure Fusion a far more efficient and quicker process. Not only that, but due to the algorithm used in Exposure Fusion, halos around objects that would otherwise ruin a nice HDR image have been completely eliminated, resulting in a more natural looking final image.Exposure Fusion also has one other trick up its virtual sleeve. It can also create extended Depth Of Field images by fusing together a sequence of images with different DOFs. This could actually be quite handy, say if lighting conditions at the time don't allow the full DOF to be captured in one shot, or if you're just limited by the DOF of your lens. This process could also be used creatively to get different DOFs in one image.Here are some examples of both methods – click to enlarge.





Exposure Fusion Software:

At this stage Exposure Fusion is still in its infancy, so there's only a handful of programs to choose from.Enfuse is the primary tool for Exposure Fusion at the moment, and although it is a command line utility, there are "droplets" (batch files) available that you can drag and drop a series of images onto to create a fused image. However, the plugin is donation-ware so its limited to 500px final images until you donate to get the full version. There is currently no plugin for Photoshop. If you're into photo stitching then PTgui and Hugin may be of interest to you. These programs utilise Exposure Fusion by stitching and fusing bracketed sequences together, with some pretty nice results.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Advantage of Exposer fusion:

Exposure Fusion is not HDR but is a new concept of processing a series of bracketed images, which result in a low dynamic range image. To summarize it takes the best tonalities from each image in the sequence and combines them to create a single image. To be more specific what is actually happening is that the fusing process assigns weights to the pixels of image in the sequence according to luminosity, saturation, and contrast, and then carefully balances the three to make a single image. In layman's terms what is happening that the best part of each image gets recorded and fused together to combine all of the best elements in final image.

How is Exposure Fusion Different Then HDR?

Exposure Fusion is quite different in many ways then HDR. The only resemblance the two have are that they combine a sequence of bracketed images together. That is where the similarities end. First of all Exposure Fusion is a low dynamic range result rather then a high dynamic range. This means that the final product looks more realistic to how the scene really would like. HDR takes the sequence of images and blends the images seamlessly but does its best to even the tonalities in the extreme tonalities of shadows and highlights.

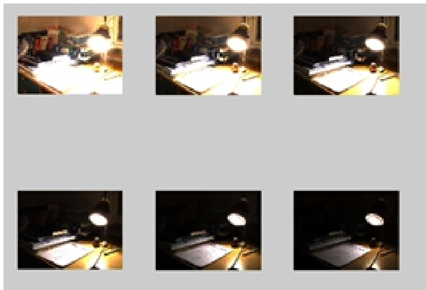
Exposure Fusion Advantages Over HDR

Exposure Fusion processing times takes much less due to a absence of a intermediate HDR image that must be created before one can tone map a HDR image. Thus, processing times are twice as fast when transferring back into Photoshop. The most important advantage in Exposure Fusion is the lack of halos that appear around objects that occur with HDR. Often when combining images HDR produces a very three-dimensional image that looks very impactful but when viewed closer the halos become more evident.

One very important advantage of Exposure Fusion is that it can combine a series of bracketed images with different depths of field that extend the Depth Of Field in an image and give the perception of more three-dimensional qualities in the image. This presents an advantage to many obstacles when it comes to nature photography.

For example, shooting a wide perspective of a scene with wildflowers and a mountain in the distance would normally require a f/16 at least to get everything in focus. The problem arises if there is strong wind or low light and a faster shutter speed is needed to freeze the detail in the foreground wildflowers. It is then necessary to shoot at f/8 for the foreground and combine it with the rest of the images which can be shoot at f/16 to capture the background mountains. Before Exposure Fusion combining a series of images with different Depths Of Fields was limited to only those with the best of Photoshop skills.

RESULT:



ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

VI. Conclusion:

This paper has presented a novel exposure fusion approachusing BLP to produce a high quality image from multipleexposure images. Our novel BLP algorithm is based onboosting the detailand base signal respectively, and caneffectively blend the multiple exposure images and videos for preservingboth color appearance and texture structures. A novel hybridexposure weight is also introduced, which incorporates thelocal weight, global weight and JND-based saliency weight.Thereare many more tone mapping approaches as well as publicresearch data of exposure images that we have not mentioned,and we can implement and compare more tone mapping operatorsin future. However, we believe that the aforementionedexperimental results suffice to validate the effectiveness of theproposed approach. We will investigate further extensions ofthe exposure fusion for detecting the moving objects [22], [35],[36] of the dynamic scenes in the future work.

References:

[1]References[1] P. Burt and E. H. Adelson, "The Laplacian pyramid as a compact imagecode," IEEE Trans. Commun., vol. 31, no. 4, pp. 532–540, Apr. 1983

[2] L. Snidaro, R. Niu, G. L. Foresti, and P. K. Varshney, "Quality-based fusionof multiple video sensors for video surveillance," IEEE Trans. Syst.,Man, Cybern. B, Cybern., vol. 37, no. 4, pp. 1044–1051, Aug. 2007.

[3] P. E. Debevec and J. Malik, "Recovering high dynamic range radiancemaps from photographs," in Proc. SIGGRAPH, 1997, pp. 369–378.

[4] J. Suo, L. Lin, S. Shan, X. Chen, and W. Gao, "High-resolution facefusion for gender conversion," IEEE Trans. Syst., Man, Cybern. A, Syst.Humans, vol. 41, no. 2, pp. 226–237, Mar. 2011.

[5] Y. Zhang and Q. Ji, "Efficient sensor selection for active informationfusion," IEEE Trans. Syst., Man, Cybern. B, Cybern., vol. 40, no. 3,pp. 719–728, Jun. 2010.

[6] S. Mann and R. W. Picard, "On being undigital with digital cameras:Extending dynamic range by combining exposed pictures," in Proc.48th Annu. Conf. IS&T, 1995, pp. 422–428.