COMPACT SINGLE-SHOT HYPERSPECTRAL IMAGING USING A PRISM

Primary Paper

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The approach presented in this paper is a novel one for compact single shot imaging. It will allow the user to take hyperspectral images with a conventional DSLR camera. This method enables in an imaging method which reconstructs the full spectral information of a scene. For a traditional hyperspectral imaging what happens is you will want the whole information from all the angles which are computed internally which is offered by this method. The available spectral cues are sparse which are present only around the object so is done is that a formulation of an image formation model that can predict the perspective projection of dispersion, and a reconstruction method that can estimate the full spectral information.

This novel method has wide range of applications over many fields in the real world for example physically accurate material appearance, automatic segmentation and etc. though, it has these many applications the negative point in the approach which is proposed is that it is very costly which ranges from $25k to $100. The equipment which is required to get hyperspectral imaging using a prism is a specialized one such as collimating optics and a lithographic coded aperture with a small-scale type and diffraction grating. The scanning system which is used in the history like the traditional ones isolate the calculation of some basic dimensions of an object for every wave-length using some filters, which will make the process so slow, furthermore, the spectral pixels is bounded by the type and number of filters used. The consecutive spectral reconstruction of the image relies on a spatially-invariant dispersion model, for which aggregating optical scenes. To solve this issues which are bounding from not going further with the process this approach which is proposed in the paper is a single-shot technique for hyperspectral imaging, which requires just a conventional dslr camera and a simple prism made of glass which will be in the position in such a way that it is directly mirrored in the front of the lens.

We have two main challenges with respect to the technical side, which arises because of using a basic prism, first is existing spatially-invariant dispersion models cannot be used in the system which we proposed while using a basic prism lenses we might overcome this issue using a complicated lens with advance computational capacity indulged within it. so, the just mentioned issue is because of the absence of collimating optics and the resulting wavelength-dependent, non-linear refractive distortion which is made by the prism. So, the solution for the above mentioned are done by making the following changes and contributions, first we introduce a information model for the images that can forecast the view projection of dispersion getting the dispersion direction and its scalar value of each wavelength at every pixel. The second one is a novel calibration method to find out the spatially-changing dispersion of the prism, in the absence of aggregating optics in the setup. And the third one is a developed vital reconstruction algorithm consists of three main steps edge restoration, gradient estimation and spectral reconstruction. Lastly the final proposal is that single-shot hyperspectral imaging method using only a solo prism in the front of a conventional cameras view.

If we evaluate the model in question furthermore after the points mentioned above, in the presence of suboptimal input we can find limitations in edge frequency, edge blurriness. The former can be explained as follows: our reconstruction quality depends on the edge frequency of an image captured. If the image or the scene which we are capturing does not have enough edge information in it the quality of re-construction will be so low, or it degrades from the image which is taken with more edge information. We can also see that additionally examining the concentration of increasingly bigger frequency edges we can understand the effect with more efficiency.

Coming to the latter one it can be explained as follow: a synthetic blurred color checker to examine the level of concentration. The confidence we get for the reconstructed spectrum is compared to the original one, and after the comparison we can see that the one picture with mire information of the edges has good efficiency than the one with less information.

BIREFRACTIVE STEREO IMAGING FOR SINGLE-SHOT DEPTH ACQUSITION

Secondary Paper

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Estimating the depth in an image is very vital not only in computer graphics but in many different field, for example if you are creating a self-driving car you have to see what is the dispersion between your car and the car coming in front of you to estimate and for safe driving we have to estimate the depth or dispersion between them. So, depth capturing is an important element in many fields and it can be calculated using two cameras. we can also capture the depth with a single camera but there may be many limitations and bounding or trade-off in many things. So he proposed object comes now to solve these limitations as if you use a single camera there might be different tradeoffs and if you use two camera it might be too costly so the proposed of bi-prism stereo reduces the effective sensor resolution by half; this trade off between spatial resolution and the number of captured images is also one of the main limitations of light field depth imaging. Reflection based stereo requires that the scenes images should be through a double-sided half mirror plate with an angle of 90 degrees perpendicular to it.

In this paper to solve the limitations mentioned above a new model is proposed which is refractive stereo, a novel technique for single-shot depth estimation from double refraction. This is achieved by simply placing a birefringent material in front of the lens of any camera let it be traditional conventional camera or a more sophisticated one which you get these days. It is cheaper then the other proposed methods as it has a minimal impact on the form factor of the setup, does not sacrifice spatial resolution, introduces no visible image degradation and is readily useful for personal photography, which allows users to take images without the burden of careful setups or complex with more hardware. However even if the proposed model has minimal setup in it there are many technical challenges that need to be over-come, to get the work of estimating depth from double refraction done. Our goal is to solve these technical issues and leverage the displacement between the o-ray and the e-ray, to estimate depth z. this will allow us to enable single-shot refractive stereo, with out needing to capture an additional direct image. Our refractive stereo method consists of a formal description of our image formation model, which allows us user to establish the relationship between-ra and e-ray disparity and depth in-formation from a single image, where ordinary and extraordinary information appear superimposed, based on our gradient-domain search and dual derivation of matching cost volumes and a novel calibration method for the refractive material and our imaging setup to obtain the parameters of our correspondence model.

Other than this other approach was made by other researches some of the are: simulating birefringence, capture and display, reflective stereo and refractive stereo. Simulating of birefringent materials proposed a matrix-based formulation for uniaxial crystals, deriving formulas for the propagation of the extraordinary ray. Capture and display can be explained with some practical imaging applications of birefringent crystals have been proposed in literature. Reflective stereo is the setup for acquisition which requires the scene being captured be observed through a double sided half-mirror plate. And finally coming to refractive stereo which uses a pair of direct refracted images or a pair of refractive images using different media.

The applications of single-shot depth acquisition are refocusing anaglyph generation, object segmentation and dept-aware image compositing. Explaining all of them one by one will be as follows: refocusing is after estimating the depth from the approach proposed the image formation allows to build a set of deconvolution kernels for each depth, secondly anaglyph generation are the stereo pairs from single image by using the death captured using the approach to render novel views. Object segmentation is segmenting the objects using the estimated depth and the underlying color information. Finally, depth-aware image composting is occlusions are directly handled by our estimated depth without user intervention.

There are many interesting avenues for this approach to be improvised to have many more applications, As many other algorithms for depth-acquisition. Handling transparency and specular reflections are very hard because more often than not they lead to wrong depth estimations. The image formation model which is proposed in this paper that the refractive medium consists of two planar parallel faces. Finally, what we could say is that the approach for single-shot acquisition of depth using bi-refractive lens is that it is better than other approaches in terms of cost and we can also say that it has many applications and many fields to be improvised for future enhancements.

CONCLUSION

So from both the papers one can conclude that, Both of the proposed methods are for getting the full depth of a an image which will be used in many applications, what is being achieved is same in both the papers but the difference is how those methods are achieving it, in the first paper the single-shot depth acquisition is done using a prism and in the second paper it is done using a birefractive object. Both the proposed method have their future scope and both have their advantages and limitations.