Response to Reviewers' Comments amt-2017-152 High-Dynamic-Range Imaging for Cloud Segmentation

Soumyabrata Dev, Florian M. Savoy, Yee Hui Lee, Stefan Winkler

February 14, 2018

We would like to thank the Associate Editor Prof. Szymon Malinowski and the anonymous referees for your valuable comments and suggestions.

Based on your inputs, we have thoroughly revised the manuscript. All the comments and suggestions have been addressed. Responses to the individual comments can be found below. Unless otherwise specified, the references, equations, figures and tables cited in the answers are numbered as per the revised manuscript.

We are releasing the first HDR dataset of sky/cloud images, along with its manually annotated ground-truth images.

The source code of all simulations in this paper is also released, and is now available online at `https://github.com/Soumyabrata/HDR-cloud-segmentation`.

```
>> ANONYMOUS REFEREE #3<<
In the manuscript a simple yet efficient method of improving a dynamic range of sky
    camera is described and discussed. The authors use standard bracketing to capture
    three consequent images at three various exposures and proces them by contrast-
    limited adaptive histogram equalization algorithm and further fuzzy logic and
    probabilistic image segmentation, improving quality of the final image. In particular
     the method substantially reduces number of saturated pixels and benchmark tests show
     its advantage over other post-processing methods described in the literature. The
    text is clearly written and contains all the necessary information, however in the
    presentation there are some elements which should be improved. Thus, the paper can be
     accepted to AMT after minor revisions.
```

Thank you for your positive feedback on the manuscript.

```
Specific comments.
1) Figures shall be page wide in the final version of the manuscript.
```

Thank you for the suggestion. In this revised version, we ensured that all figures contain the entire width of the page.

```
2) Figure 5: any ideas why such a range of segmentation errors in various colour
    channels? A short explanation is necessary, the reviewer has some ideas why C15 is
    the best choice, but this should be explained in more detail.
```

The existing approaches in the literature, uses a combination of *red* and *blue* color channels for cloud segmentation. It is due to a physical phenomenon called Rayleigh scattering. The small particles in the atmosphere scatter light at varying degree. The component of white light having the least wavelength (blue component) gets scattered the most. This renders a bluish color to the sky. The c_{15} color channel is the normalized ratio of *red* and *blue* color channels; and is the most *discriminatory* feature for cloud detection. This is a sensible choice, because the sky is predominantly blue in color.

In an earlier publication [S. Dev, Y. H. Lee, S. Winkler, Systematic Study of Color Spaces and Components for the segmentation of sky/cloud images, *Proc. IEEE International Conference*

on Image Processing (ICIP), 2014], we have provided a systematic analysis of the various color channels for cloud detection. Using a set of statistical tools, and a data-centric approach, we concluded in our earlier publication, that c_{15} is a good color channel for conventional 8-bit low-dynamic-range images too. In this manuscript, we observe this behavior too, and conclude that c_{15} is the best color channel for HDR sky/cloud images too.

We have added a discussion on the same in Section 4.2.1 of the revised manuscript.

`3) Figure 6. Any ideas why there are dips and tops on presented curves? Explain, please.`

Thank you for the feedback. Although the general trend of the curve is consistent w.r.t. the increasing seeding level, there are a few deviation points along the curve. The minor *peaks* and *troughs* in Figure 6 are because of the sensitivity of the considered seeding level. This causes error in the seeding accuracy, that subsequently impacts the final evaluation metric of cloud detection.

We have edited Section 4.2.2 of the revised manuscript, to indicate this change.