Readme File

SWIMSEG: Singapore Whole sky IMaging SEGmentation database

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1 Introduction

The SWIMSEG database is introduced and used in the following paper:

S. Dev, Y. H. Lee, and S. Winkler: "Color-based segmentation of sky/cloud images from ground-based cameras." *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 2016.

If you use or adapt any part of this dataset, please cite the above paper.

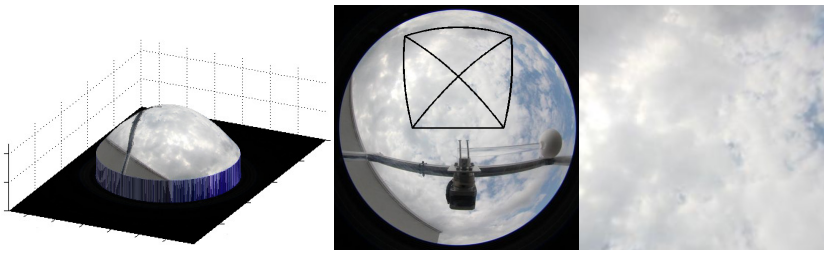
2 Description

The SWIMSEG dataset contains 1013 images of sky/cloud patches along with their corresponding binary ground truth maps, which were generated in consultation with cloud experts.

All images have a dimension 600×600, and were captured using WAHRSIS, a calibrated ground-based whole sky imager. The imager is located at Nanyang Technological University Singapore at the location $(1.34N, 103.68E)$. The images in SWIMSEG were captured over a period of 22 months from October 2013 till July 2015. They were selected based on visual characteristics, by including diverse images with respect to time and date of image capture, percentage of clouds in the image, cloud types etc. The corresponding binary ground truth maps were annotated after consultation with experts from Singapore Meteorological Services. Representative sample images from the SWIMSEG database are shown below in Fig. 1.

Figure 1: Sample images from the SWIMSEG database (top row) along with corresponding sky/cloud segmentation ground truth (bottom row).

The images from the database are undistorted using the geometric calibration function of the lens. This function relates each pixel of the captured image to the azimuth and elevation angle of the corresponding incident light ray. Using that information, we can project the image onto a hemisphere whose center is the focal point, as shown in Fig. 2(a).



(a) (b) (c)

Figure 2: Generation of undistorted images using ray-tracing. (a) Projection of the image on a hemisphere; (b) Input image with borders and diagonals of the output image; (c) Undistorted output image.

We generate undistorted pictures using a ray tracing approach by considering an imaginary camera (with a standard lens) at the center of the hemisphere, which points towards a user defined direction with a given azimuth and elevation angle. In order to simulate this camera, we consider an output image with dimension 600×600. Each output image corresponds to a viewing angle of about $62°$. The rays passing through each pixel will intersect the hemisphere and then converge towards the center. The value of a pixel is equal to the color of the hemisphere at its intersection point. Figure 2 shows the output image as well as the lines corresponding to its borders and diagonals on the original image.

3 Database Content

The database consists of two folders, "images" and "GTmaps", and a tab-delimited .csv file. The "images" folder contains all the image patches, while the folder "GTmaps" contains the corresponding binary ground truth maps. The sky/cloud image files are named <ImageNumber>.png, and the corresponding ground truth maps are named <ImageNumber>_GT.png.

The metadata.csv file contains all the related metadata information pertaining to the individual input image, as follows.

1. **Number**: Number of the sky/cloud image file and corresponding ground truth map.

2. **Date**: Capture date of the image. It is represented in YYYYMMDD format, where YYYY, MM, and DD represent the year, month, and date respectively.

3. **Time**: Capture time of the image. It is represented in hhmmss format, where hh, mm, and ss represent the hour, minute, and second respectively.

4. **Fnumber**: F-number of the camera.

5. **ShutterSpeed**: Shutter speed (in milliseconds) of the camera.
6. **ISO**: ISO setting of the camera.
7. **Elevation**: Elevation angle of the virtual camera direction.
8. **Azimuth**: Azimuth angle of the virtual camera direction.

4 Licensing Information

The dataset is released under a Creative Commons license (`https://creativecommons.org/licenses/by-nc/4.0/`). You are free to:

- Share – copy and redistribute the material in any medium or format
- Adapt – remix, transform, and build upon the material

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Full details can be found in the licensing file.

5 Additional information

- license.html: This is the licensing file that we recommend you read before using or sharing this dataset.
- metadata.csv: Image metadata (see above for details).
- readme.pdf: This file.