The Balloon Image Dataset

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A set of 300 images of red and blue balloons was collected and is available to the students. The following subsections offer details on the collected images.

Images

The dataset was collected in such a manner as to simulate what a quad might see as it flies around the arena. As a result, not all images will include a balloon. Students will want to use these images to check that their balloon-detecting algorithms don't provide false positives.

Resolution

Images were taken at 4k resolution.

Image Cropping

There is a narrow green bar at the bottom of each image (see Fig. 1). This is an artifact of the camera API. For our purposes (detecting balloons and measuring their center position), this green bar will present no difficulty, and so need not be cropped.

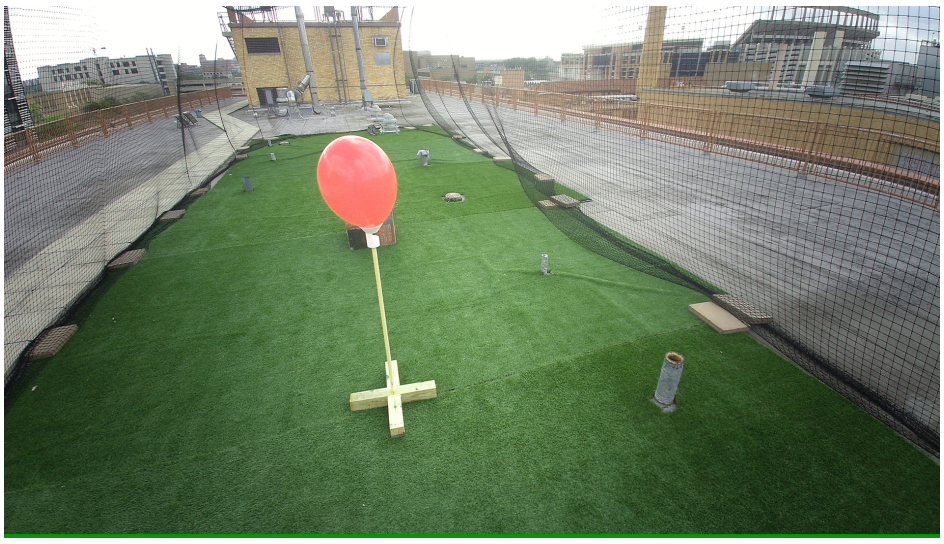

Figure 1: Uncropped image

Camera Parameters

Images from the quad have slight radial distortion. The OpenCV radial distortion model is as follows:

$$\begin{bmatrix} x_{\text{corrected}} \\ y_{\text{corrected}} \end{bmatrix} = (1 + k_1 r^2 + k_2 r^4 + k_3 r^6) \begin{bmatrix} x \\ y \end{bmatrix}$$

You can read more about this distortion model here:

https://docs.opencv.org/2.4/doc/tutorials/calib3d/camera_calibration/camera_calibration.html

The estimated radial distortion parameters are

$$k_1 = -0.0217226$$
$$k_2 = 0$$
$$k_3 = 0$$

The focal length of the camera is

$$f = 1657.72 \text{ pixels}$$

Motion Blur

While collecting data, the quad was flown by hand: a student carried the quad around while it imaged the scene. Disclaimer: images taken by a quad in actual flight may have more motion blur that the images in the dataset. If the quad is relatively stationary, the images will look the same, but if the quad is moving quickly, images may become more blurred.

Lighting

The images in the dataset were taken during partly-cloudy conditions. Lighting can affect the success-rate of computer-vision algorithms. Students may want to take precautions to ensure that their algorithms are robust.

See this blog post for an example of how lighting can affect CV algorithms:

https://www.learnopencv.com/color-spaces-in-opencv-cpp-python/

Measurements

Each dataset directory contains a log of the GPS solution measurements when each image was taken called *image_data_raw.txt*. The structure of this file is as follows:

Image_Name	rpG[3]	RpG[6]	El	Az	σ_{El}	σ_{Az}	RbG[6]

where rpG is a 3-vector with the X, Y, Z locations of the primary antenna in ECEF, RpG are the column-stacked components of the lower half of the 3x3 covariance matrix for rpG, El is the rotation of the quad away from the ground plane (positive is rotating up), Az is the rotation of the quad away from true north (positive is clockwise), σ_{El} and σ_{Az} are the standard deviations of elevation and azimuth, and RbG are the column-stacked components of the lower hald of the 3x3 covariance matrix for the baseline solution (secondary to primary).

Sometimes, the full GPS solution is not available when an image is taken. If this occurs, a full or partial line of zeros is written to the log file. Students may want to filter out lines where there are portions that display 0.000000000.