Appendix A

Data-set format

Directory Structure

The data-sets distributed with this package have been converted to the format used by Oxford's Vision and Geometry Group (http://www.robots.ox.ac.uk/~vgg/data/data-various.html). Each data-set has the following directory structure:

```
data_set/
data_set/png
data_set/png/data_set.000.png
data_set/png/data_set.001.png
data_set/H/data_set.000.001.H
```

The images are stored in the directory "data_set/format" where "format" is one of png, jpg or pgm. For each sequential image pair, a homography is provided in the "data_set/H" directory. For example, data_set.000.001.H is a text file containing 3 lines with 3 coefficients each, forming the 3×3 transformation matrix, $H_{0,1}$, which transforms a coordinate \mathbf{c}_0 from image 0 to a coordinate \mathbf{c}_1 in image 1:

$$\mathbf{c}_1 = H_{0,1}\mathbf{c}_0$$

Prefixing image and homography names with the data-set name is optional (i.e., a homography file may be named either data_set.000.001.H or 000.001.H).

Converting relative to absolute homographies

Given the relative homographies $H_{0,1}$, $H_{1,2}$, $H_{2,3}$, etc., we can relate all these transformations to a fixed reference. Such a reference is needed, for example, when we stack images (i.e., transform them to the same reference frame and add them together). Noting that $H_{0,1} = H_{1,0}^{-1}$,

$$H_{K,0} = H_{0,K}^{-1} = (H_{K-1,K} \dots H_{2,3} H_{1,2} H_{0,1})^{-1}.$$
 (A.1)

While this could be written as

$$H_{K,0} = H_{0,1}^{-1} H_{0,2}^{-1} H_{0,3}^{-1} \dots H_{k-1,K}^{-1}$$

it is numerically more accurate to avoid the multiplication of multiple inverses by using (A.1).

In a similar fashion, given the transformation $H_{K,0}$ and $H_{k,0} \forall k < K$ (or, equivalently, $H_{K-1,0}$), we can compute the relative transformation, $H_{K-1,K}$:

$$H_{0,K} = H_{K-1,K} \dots H_{2,3} H_{1,2} H_{0,1}$$

$$\Longrightarrow H_{K-1,K} = H_{0,K} (H_{K-2,K-1} \dots H_{2,3} H_{1,2} H_{0,1})^{-1}$$

$$= H_{K,0}^{-1} (H_{K-2,K-1} \dots H_{2,3} H_{1,2} H_{0,1})^{-1}$$

$$= H_{K,0}^{-1} H_{K-1,0}.$$

Software

Loading VGG data-sets

```
>>> from supreme.io import load_vgg
>>> data = load_vgg('path/to/vgg/data_set')
```

The resulting data is an ImageCollection, which can be accessed like any container or iterator. The first image is data[0], the second data[1] and so forth. Each image has an information dictionary, which contains two associated homographies:

```
data[i].info['H']
```

A 3×3 transformation matrix that maps image i onto image 0.

```
data[i].info['H_rel']
```

A 3×3 transformation matrix that maps image i onto image i+1.