

### Moving Object Detection Software: SC-SOBS

This page has been created in order to distribute a prototype software implementing the Spatially Coherent Self-Organizing Background Subtraction (SC-SOBS) algorithm presented in

**L. Maddalena, A. Petrosino, The SOBS Algorithm: What Are the Limits?, IEEE Workshop on Change Detection, at CVPR 2012**

If you use the software, please cite the above mentioned paper.

Click [here](#) to download the Windows executable (WinZip compressed) together with the needed OpenCV .dll's.

Basic usage for Change Detection Competition: Unzip the SC-SOBS.exe and the .dll's into the directory holding the "dataset" directory containing the Change Detection Challenge sequences [1]. To obtain all masks for the "baseline/highway" sequence, just type:

```
SC-SOBS dataset/baseline/highway/input/in
```

Click here to download the masks computed by SC-SOBS for the whole dataset.

Usage with generic image sequences:

```
SC-SOBS <SeqName> <#FirstFrame> <#LastFrame> [Parameters]
```

where

- o <SeqName>: sequence name (complete path), not including frame numbers. Image sequences consist of binary .jpg image frames with consecutive 6 digit numbers, named in the following form

```
<SeqName><number>.jpg
```

- o <#FirstFrame>: number of first sequence frame to be considered. Default: 1

- o <#LastFrame>: number of last sequence frame to be considered. Default: toldx (toldx read from file 'temporalROI.txt' as in [1])

- o [parameters]: optional, including:

- n #: (square root of) number of weight vectors for each pixel. Default: 3

- K #: Number of initial frames for training. Default: fromIdx-1 (fromIdx read from file 'temporalROI.txt' as in [1])

- e1 #: Distance threshold  $e_1$  for training phase (Eq. (12)). Default: 1.0
- e2 #: Distance threshold  $e_2$  for testing phase (Eq. (2)). Default: 0.008
- c1 #: Learning rate  $c_1$  for training phase (Eq. (14)). Default: 1.0
- c2 #: Learning rate  $c_2$  for testing phase (Eq. (14)). Default: 0.05
- Cw #: Size of the neighbourhood for Spatial Coherence (Eq. (10)). Default: 5
- s #: To apply shadow removal (as in [2]). Default: 1 (apply)
- g #: Shadow detection value for  $g$  in eqn. (5) in [2]. Default: 0.7
- b #: Shadow detection value for  $b$  in eqn. (5) in [2]. Default: 1.0
- tS #: Shadow detection value for  $t_S$  in eqn. (5) in [2]. Default: 0.1
- tH #: Shadow detection value for  $t_H$  in eqn. (5) in [2]. Default: 10.0
- ROI #: To use ROI.bmp mask as in [1]. Default: 1 (do use)
- Med #: Size of the neighbourhood for Median Filtering Post-Processing. Default: 0 (no Post-Processing)
- m #: To save background model images. Default: 0 (do not save; only models for frames  $K-1$  and  $\#LastFrame$  are saved)
- l #: To save only last detection mask. Default 0 (save all in the temporal ROI)

Examples of use with generic image sequences:

### 1) SC-SOBS

Provides the above information on usage.

2) SC-SOBS `c:/Sequences/WavingTrees/WavingTrees 1000 1247 -K 200 -e1 0.1 -e2 0.03 -c1 1.0 -c2 0.05 -l 1 -ROI 0`

where sequence WavingTrees, coming from sequences adopted in K. Toyama, J. Krumm, B. Brumitt, and B. Meyers, "Wallflower: principles and practice of background maintenance," in Proc. 7th IEEE Conf. Computer Vision, 1999, vol. 1, pp. 255–261, has been saved in binary .jpg image files named:

WavingTrees001000.jpg, ..., WavingTrees001247.jpg

and stored in directory `c:/Sequences/WavingTrees`.

This gives the moving object detection mask for last frame (named `bin001247.png`) as well the background model (named `Model001199.ppm`) achieved by training on the first 200 frames and the updated background model (named `Model001247.ppm`) for the last frame.

3) SC-SOBS `c:/Sequences/WavingTrees/WavingTrees 1000 1247 -K 200 -e1 0.1 -e2 0.03 -c1 1.0 -c2 0.05 -l 1 -ROI 0 -Med 3`

same as before, but applying median filtering post-processing in a 3x3 neighbourhood to masks (through OpenCV function `cvSmooth`).