

# Image Processing and Pattern Recognition

## Assignment 4

November 26, 2012

**Submission:** Send report and implementation zipped (*[surname].zip*) to `bvme@icg.tugraz.at`.

**Deadline:** December 10, 2012, 23:59

**Note:** This assignment will be implemented in C++ using OpenCV 2.4. For informations about downloading and installing, as well as a thorough documentation we refer you to the project's homepage at <http://opencv.willowgarage.com>.

Explanations regarding the provided framework can be found at the end of this specification document.

### Mean Shift Tracking (15 points)

For your last assignment you have to implement the mean shift tracker by Comaniciu et al. [1]. The implementation is based on color histograms, but could be extended with gradient orientations and so on. The algorithm maximizes the Bhattacharyya coefficient between a target model, which is only computed in the first frame, and target candidates in every further frame. Look for hints in the framework and also read the paper. State in your report all your implementation details and demonstrate your results.

Hints:

- Use the Epanechnikov profile, because it simplifies the mean shift vector. Describe why!
- The target model  $\hat{q}$  and the target candidates  $\hat{p}$  are just weighted histograms.
- You have to use a RGB-color histogram. This would lead to  $256^3$  bins, where most of the bins would be zero. Therefore you have to quantize the color channels to *QUANT* values instead of 256.

### Bonus: Scale adaption

The tracker in the standard formulation is not able to adapt the scale of the object. Therefore formulate a scale adaption scheme and implement it. Demonstrate your results and discuss your approach in detail.

## Framework Information

We provide a simple framework which can be built using CMake (<http://www.cmake.org/>). The steps to build and run the framework under Unix-based operating systems are

```
> cd /path/to/framework
> cmake .
> make
> ./meanshift path/to/input/video.avi path/to/output/video.avi
```

The framework provides several hints on where to start implementing (watch out for the inline documentation). You may adapt the framework at will (add/remove files/classes/functions/...), however, ensure that your submission can be compiled by invoking `cmake/make` on a system where OpenCV 2.4 is installed.

Using additional libraries is not required/allowed. Please ensure that your submission contains only files needed to build and run your implementation (source files, CMakeLists.txt - no binaries, debug files).

## References

- [1] D. Comaniciu, V. Ramesh, and P. Meer. Real-time tracking of non-rigid objects using mean shift. In *Computer Vision and Pattern Recognition, 2000. Proceedings. IEEE Conference on*, volume 2, pages 142–149. IEEE, 2000.