Overview

This work is focused on proposal and implementation of a software for detecting and analyzing pedestrian trajectories, moving in a predefined area, which is recorded by surveillance cameras. Created software can be useful in many ways, for example, to analyze customer behavior or support of managerial decision.

Data sources

We created four datasets in four different resolutions, containing 5028 positive frames of pedestrians and 3128 negative frames. These datasets were used for training, optimizing and testing selected methods of Supervised Machine Learning.

Object tracking

Main goal of this step is to detect dynamic objects from a video source or a set of images mainly by using Optical Flow and Background Subtractors methods.

These found dynamic objects are paired into trajectories of movement by using Hungarian method. Extended Kalman filter was used for predicting current position of undetected objects.

Pedestrian verification

Verification is a process, which is focused on detecting pedestrians in each trajectory of movement. The result of this step is a set of probable trajectories of movement.

In this step, We examined selected methods from Supervised Machine Learning (Artificial Neural Network, Linear SVM, Adaptive Boosting) and selected Pedestrian Detectors (VJ, Histogram of Oriented Gradients) to verify found trajectories.

The best result in the test was achieved by a Multilayer Neural Artificial Network with accuracy of 92%.

Presentation layer

Software is able to present obtained results in many interesting forms such as heatmaps, charts, statistical variables and others. These tools provide sophisticated view on the found pedestrian trajectories in a predefined area.

Conclusion

The accuracy of the algorithm is 83.25% for the selected data sets.

The created application is able to process any video source in various resolution and provides complex view on a predefined area.