Analysis of a pedestrian trajectories based on Image Processing

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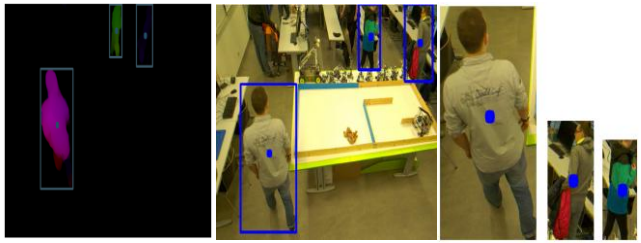
Overview

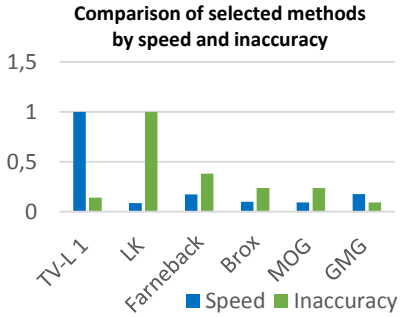
- This work is focused on proposal and implementation of a software for **detecting and analyzing pedestrian trajectories**, moving in a predefined area, which is recorded by surveillance cameras. Created software can be useful in many ways, for example, to **analyze customer behavior** or **support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

Videosource Images



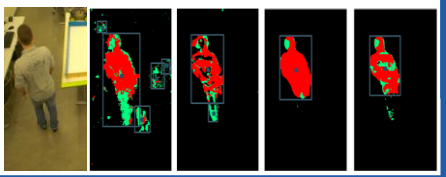
Data sources

- 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.**



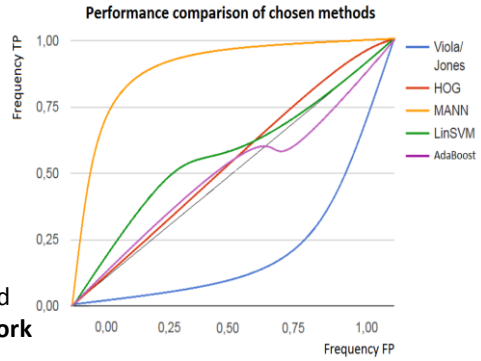
Object tracking

- 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 Substractors** 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.



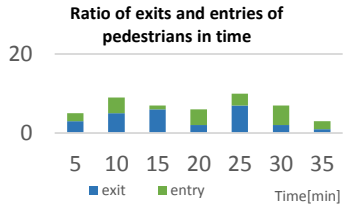
Pedestrian verification

- 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.**