Posudek závěrečné práce Filipa Naisera: Tracking, Learning and Detection of Multiple Objects in Video Sequences

oponent: Ing. Karel Zimmermann, Ph.D. (ČVUT-FEL K13133)

24. ledna 2017

Filipe Naiser has proposed and implemented the application for animal surveillance in biology experiments (e.g. tracking of ants in a controlled environment). Problem is defined as a search for K-(almost)-disjoint paths in a bipartite oriented graph, where verticies corresponds to presegmented regions (e.g. ants) and edges corresponds to the likelihood that two regions in consecutive frames obtain the same object. The solution is a kind of well engineered greedy heuristics, which seems to be working well on provided datasets. The proposed pipeline is experimentally evaluated on several problems (ants, zebrafishes, sowbug, etc.) and the fair comparison with the state-of-the-art solution (idTracker) is provided (chapter 7).

I appreciate the number of considered and evaluated solutions to each particular step of the pipeline and the fair extensive comparison with the idTracker. Even though the formulation of the tracking as a graph labelling (assigment point 3) is missing, I believe that the core of the thesis assignment was satisfied. The overall work is above standard, therefore I suggest **grade A**.

Question for the discussion:

1. Could you formulate the multiple object tracking as an optimization problem?
2. It looks that edges are created only between regions in consecutive frames, which cause that the graph is bipartite. Does your algorithm require that the graph is bipartite? Could you also create edges for more distant regions? Is the proposed algorithm going to work for such graph?
3. Do you tune parameters (e.g. of RFC tuned in Table 7.1) on an independent validation set or do you use the testing set?
4. You suggest (page 23) that in the future a semisupervised learning should replace fully supervised learning on 50 annotated samples. How should the semisupervised pipeline look like?

Minor comments (mostly to the author):

- It seems to me that anomaly score (page 17) produces negative values for shorter paths and positive values for longer paths, however author mentions that shorter paths indicate anomaly.
- Page 11, k objects should be **K** objects.