

Elena Burceanu - Research report AUF

PhD student (second year activity)

Research

Object tracking is an essential problem in computer vision that has been researched for several decades. One of the main challenges in tracking is to adapt to object appearance changes over time and avoiding drifting to background clutter. We address this challenge by proposing a deep neural network composed of different parts, which functions as a society of tracking parts. They work in conjunction according to a certain policy and learn from each other in a robust manner, using co-occurrence constraints that ensure robust inference and learning. From a structural point of view, our network is composed of two main pathways. One pathway is more conservative. It carefully monitors a large set of simple tracker parts learned as linear filters over deep feature activation maps. It assigns the parts different roles. It promotes the reliable ones and removes the inconsistent ones. We learn these filters simultaneously in an efficient way, with a single closed-form formulation, for which we propose novel theoretical properties. The second pathway is more progressive. It is learned completely online and thus it is able to better model object appearance changes. In order to adapt in a robust manner, it is learned only on highly confident frames, which are decided using co-occurrences with the first pathway. Thus, our system has the full benefit of two main approaches in tracking. The larger set of simpler filter parts offers robustness, while the full deep network learned online provides adaptability to change. As shown in the experimental section, our approach achieves state of the art performance on the challenging VOT17 benchmark, outperforming the published methods both on the general EAO metric and in the number of fails, by a significant margin.

Publications

1. ECCV Workshop - Visual Object Tracking 2018 [2]

Our paper was published at Visual Object Tracking workshop, in proceedings of ECCV conference (rank A). The workshop was dedicated to the unsupervised tracking problem, of generic objects. The benchmarks on which we were testing our solution (and other current tracking solutions) are released by the organizers of this workshop.

2. Best poster la TMLSS [3]

I obtained the best poster on Computer Vision at Transilvanian Machine Learning Summer School, organized by three Deepmind researchers în Cluj, with a focus on supporting Eastern European research in AI. International participants percent was around 50%.

Events

1. **Organizing and participating at Deep Learning Meetup – FMI and ACS Universities [4]**
 - a. We meet once a month and we present new and impactful papers in Deep Learning (Computer Vision, Reinforcement Learning and NLP), at a great level of details
 - b. This year we had Razvan Pascanu (DeepMind), Viorica Patraucean (DeepMind), Dan Alistarh (IST Austria) and Rudradeb Mitra as special guests
 - c. The participants are students and engineers working in ML at local companies here in Bucharest (several times we had participants from other cities coming here for our presentations: Timisoara, Craiova)

2. **Organizing and participating at Statistics Reading Group – IMAR**
 - a. We have chosen the book: Larry Wasserman, All of Statistics: A Concise Course in Statistical Inference
 - b. We meet once at 2 weeks; Conf. Marius Leordeanu is supervising us, being present at almost all meetings
 - c. I consider this experience very useful in understanding Computer Vision from the statistics perspective
 - d. The participants at the reading group are members of my team at Bitdefender (Theoretical Machine Learning team), and students from IMAR and Politehnica Bucharest

3. **Participating at Computer Vision reading group - IMAR [5]**
 - a. At the group we are presenting our work and recent papers in Computer Vision
 - b. Beside the students, professors from University Bucharest and IMAR are also participating at the meetings

References

- [1] <https://arxiv.org/abs/1804.01771>
- [2] <http://www.votchallenge.net/vot2018/program.html>
- [3] <https://tmlss.ro/>
- [4] <https://www.meetup.com/Bucharest-Deep-Learning/events/past/>
- [5] <https://sites.google.com/site/bucharestcomputervision/>