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My PhD research subject involves unsupervised understanding of videos at a semantic level. More specific, my first research direction is to track objects in videos, in an unsupervised manner. Given the video and one bounding box from the first frame, the tracker should follow the object until the end of the video. Being able to follow objects that undergo different transformations in the video sequence, including changes in scale, illumination, shape and occlusions, makes the problem extremely difficult. Object tracking is an essential task in computer vision that has been studied since the early days of the field.

Our first approach describes a tracker system that functions as a society of parts, each having its own role and level of credibility. Reliable classifiers decide the tracker's next move, while newcomers are first monitored before gaining the necessary level of reliability to participate in the decision process. Some parts that loose their consistency are rejected, while others that show consistency for a sufficiently long time are promoted to permanent roles. We have improved our first robust solution with a neural network component that adapts easily to a faster and work as a reliable part, trained online on highly confident frames from video. We have one theoretical contribution based on the observation that for our linear classifiers formulation, the balanced case solution has the same direction as the unbalanced one, but with a different magnitude.

### **PhD activity in 2017** (first PhD year)

- We have published "Learning a Robust Society of Tracking Parts" with competitive results on OTB100 [1] article on arxiv.org [2]
- I have presented our arxiv paper at RAAI 2017 workshop [3]
- I had two presentations at Scientific Seminar for Computer Vision, IMAR [4, 5]: "Struck: Structured Output Tracking with Kernels", (S. Hare et al, PAMI 2015) and "High-Speed Tracking with Kernelized Correlation Filters", (J. F. Henriques et al, PAMI 2015), both describing state of the art results and original approaches for OTB100 [1]
- I have organized and participated at Linear Algebra Seminar, IMAR (once 2 weeks)
- I have organized and participated at Deep Learning Bucharest Meetups, where we present new papers in Deep Learning from theoretical perspective [6] (once 2 weeks)
- We have submitted our improved tracking approach with state of the art results on VOT benchmark [7] at ECCV 2018 Computer Vision Conference [8]

- [1] <https://sites.google.com/site/benchmarkpami/>
- [2] <https://arxiv.org/abs/1705.09602>
- [3] <http://old.unibuc.ro/~conference/raai2017/>
- [4] <https://sites.google.com/site/bucharestcomputervision/>
- [5] <http://www.imar.ro/organization/activities/seminars.php>
- [6] <https://www.meetup.com/Bucharest-Deep-Learning/events/past/>
- [7] <http://www.votchallenge.net/vot2017/>
- [8] <http://www.eccv2018.org/>