

# Undergraduate Internship Program Report Fall 2017

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From September 18th to December 8th, 2017 I had the opportunity to conduct research at Carnegie Mellon University with Professor Bruno Sinopoli and Professor João Xavier, my CMU host and IST sponsor respectively. The work developed focused on multi-agent and multi-target tracking, where the goal is to have agents move in a manner that allows all targets to be followed closely, whilst at the same time minimizing the collective effort of tracking. Finding a globally optimal solution that encodes this behaviour is very difficult since the mathematical formulation is non-convex. Furthermore, the intrinsic assignment problem of agents to targets grows exponentially in complexity with the number of targets and time horizon, rendering brute-force approaches infeasible even for relatively small problems. From the work conducted at CMU an iterative majorization algorithm and two solvers have been proposed, where the best one attained a speed increase of two orders of magnitude over CVX, a standard optimization tool.

During my stay, I had the privilege to attend both Prof. Bruno Sinopoli and Prof. José Moura group meetings, and on a weekly basis attend the Machine Learning and Artificial Intelligence Seminars. This allowed me to experience the vibrant research community at CMU, to be exposed to state of the art research and new topics. It was incredibly stimulating to be with like-minded people, to see firsthand their research and be able to discuss it with them. It was also very important to assess what a PhD entails and if in the future I would pursue one, namely at CMU.

On a more personal level, this opportunity allowed me to experience an American culture and campus life. At CMU students are incredibly committed to their studies but also have a tremendous drive for engaging in activities. This is backed up with resources and facilities which result in engineering, sports and arts student groups which make for a very well rounded university not only suited for studying and developing personal projects but also everyday life. During my stay, I also got to know foreign students from around the world and American culture outside the campus.

I would like to thank the CMU-Portugal program for this invaluable experience, to my advisers' Professors Bruno Sinopoli and João Xavier for their expertise, support and time and to Professor José Moura for his invitation to attend his group meetings.