

Scientific Report

For a period of two weeks (14 Oct – 27 Oct) I was a visitor in the Institute for Mathematics at University of Zürich. The purpose of the visit was to collaborate with Prof. Thomas Kappeler on the subject of random complexes and, more broadly, Stochastic Topology.

The recent theory of random complexes is part of the larger emergent field of Stochastic Topology. This is a recent area of research including/intersecting topics such as topological data analysis, shape analysis, topological robotics, learning theory and others. The increasing number of applications of these topics requires the development of original mathematical tools as well as adapting well established concepts and theories to solve the new problems arising.

During this visit we discussed recent results in the field of random simplicial complexes, including possible improvements on recent results within the Linial-Meshulam model for random simplicial complexes. This builds up on our previous work, see [1].

We also discussed a recent paper in the area of statistical ranking, see [2]. Here the authors develop an approach to statistical ranking based on combinatorial Hodge theory. Statistical Ranking has become increasingly important in the field of Machine Learning. We discussed topological and analytical approaches to this subject. This discussion also involved Prof. Michael Farber, at the time also visiting the Institute. I believe we will be able to contribute with original results to the area in the future.



Dr. Armino Costa
November 4, 2012

[1]- D. Cohen, A. Costa, M. Farber, T. Kappeler. *Topology of random 2-complexes*, at Discrete and Computational Geometry, Volume 47, 1 (2012), pp 117-149.

[2]- Xiaoye Jiang, Lek-Heng Lim, Yuan Yao, Yinyu Ye. *Statistical ranking and combinatorial Hodge theory*, at Mathematical Programming, Volume 127, Issue 1 , pp 203-244.