

Mathematical & Computational Biology Seminar

Organizer: Valerie Hower

Wednesday, 2:00–3:00pm, 939 Evans

Oct. 21 **Filip Cools**, K.U.Leuven

Tropical geometry and dissimilarity vectors of trees

I would like to talk about *tropical geometry* and *dissimilarity vectors of trees*. At first sight, these two mathematical topics seem to have no relation. However, nice connections are given by tropical Grassmannians. Indeed, for example, the space of n -trees is equal to the tropical Grassmannian $\mathcal{G}_{2,n}$ (see [2, 4]). In the recent articles [1] and [3] (partially joint work with C. Bocci of U. Siena in Italy), we investigate the relationship between tropical Grassmannians $\mathcal{G}_{m,n}$ and m -dissimilarity vectors of n -trees for the case $m \geq 3$.

The motivation comes from phylogenetics. From an alignment of DNA sequences from the genomes of n species, one wants to construct the suitable phylogenetic tree. The so-called *distance based approach* for doing this, consists of two steps. Firstly, one collapses the data into a dissimilarity matrix and secondly, one searches for the weighted tree which represents this matrix, provided such a tree exists. Therefore, the study of the space of n -trees is of crucial importance.

References

- [1]C. Bocci, F. Cools, *A tropical interpretation of m -dissimilarity maps*, Appl. Math. Comput. 212 (2009), 349-356.
- [2]P. Buneman, *A Note on the Metric Properties of Trees*, J. Combinatorial Theory 17 (1974), 48-50.
- [3]F. Cools, *On the relation between weighted trees and tropical Grassmannians*, J. Symb. Comput. 44 (2009), 1079-1086.
- [4]L. Pachter, B. Sturmfels, *Algebraic statistics for computational biology*, Cambridge University Press, New York 2005.