Publicacions més rellevants de la línia de recerca:
Geometria algebraica filogenètica

Referència: Casanellas, M. and Fernández-Sánchez, J. The geometry of the Kimura 3-parameter model. *Advances in Applied Mathematics*, **41** (2008), pp. 265–292.

Abstract: The Kimura 3-parameter model on a tree of n leaves is one of the most used in phylogenetics. The affine algebraic variety W associated to it is a toric variety. We study its geometry and we prove that it is isomorphic to a geometric quotient of the affine space by a finite group, which is completely described. As a consequence, we are able to study the singularities of W and prove that the biologically meaningful points are smooth points. Then we give an algorithm for constructing a set of minimal generators of the localized ideal at these points, for an arbitrary number of leaves n. This leads to a major improvement of phylogenetic reconstruction methods based on algebraic geometry.

Referència: Casanellas, M. and Fernández-Sánchez, J. Performance of a new invariants method on homogeneous and non-homogeneous quartet trees.. *Molecular Biology and Evolution*, **24(1)** (2007), pp. 288–293.

Abstract: An attempt to use phylogenetic invariants for tree reconstruction was made at the end of the 80s and the beginning of the 90s by several authors (the initial idea due to Lake and Cavender and Felsenstein). However, the effciency of methods based on invariants is still in doubt, probably because these methods only used few generators of the set of phylogenetic invariants. The method studied in this paper was first introduced by Casanellas, Garcia and Sullivant and it is the first method based on invariants that uses the *whole* set of generators for DNA data. The simulation studies performed in this paper prove that it is a very competitive and highly efficient phylogenetic reconstruction method, especially for non-homogeneous phylogenetic trees.

Referència: Casanellas, M. and Sullivant, S. The strand symmetric model, in "Algebraic statistics for computational biology", ed. L. Pachter and B. Sturmfels, Cambridge University Press 2005.

Abstract: This chapter is devoted to the study of strand symmetric Markov models on trees from

the standpoint of algebraic statistics.