

1041-52-193

**Conor Fahey**, Department of Mathematics, 1600 Holloway Avenue, San Francisco, CA 94132, **Serkan Hosten\*** ([serkan@math.sfsu.edu](mailto:serkan@math.sfsu.edu)), Department of Mathematics, 1600 Holloway Avenue, San Francisco, CA 94132, **Nathan Krieger**, Department of Mathematics, 1600 Holloway Avenue, San Francisco, CA 94132, and **Leslie Timpe**, Department of Mathematics, 1600 Holloway Avenue, San Francisco, CA 94132. *Least Squares Methods for Equidistant Tree Reconstruction.*

UPGMA is a heuristic method for identifying the least squares equidistant phylogenetic tree given empirical distances among  $n$  taxa. We study this classic algorithm using the geometry of the space of all equidistant trees with  $n$  leaves, also known as the Bergman complex of the graphical matroid for the complete graph  $K_n$ . We show that UPGMA performs an orthogonal projection of the data onto a maximal cell of the Bergman complex. We also show that the equidistant tree with the least square (Euclidean) distance from the data is obtained from such an orthogonal projection, but not necessarily given by UPGMA. Using this geometric information we give an extension of the UPGMA algorithm. We also present a branch and bound method for finding the best equidistant tree. (Received August 11, 2008)