

Geometry Seminar  
**Thursday**, May 7, 2009  
Room **102** WWH at 6:00 P.M.

# Topological Tools In The Analysis of Point Cloud Data

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In many parts of science and engineering we have to infer the structure of manifolds and spaces, or of functions defined over such, from sampled data. In this talk we'll survey a number of topological ideas that allow us to recover some of the desired structure from samples in the presence of noise, ambiguities, and other difficulties. We exploit topological persistence to perform reconstruction of a space  $X$ , or study the properties of a function  $f$  defined over  $X$ , based on a sampling of points from  $X$  which are known to us only through their extrinsic or intrinsic inter-point distances. The study of this problem leads us to novel questions on the stability of persistence diagrams and a detour through persistence modules and their geometry and topology. In the end we derive a series of algorithms for manifold reconstruction and the analysis of scalar fields from point cloud data. These algorithms are simple and easy to implement, have reasonable complexities, and come with theoretical guarantees. To illustrate the generality of the approach, we present some experimental results obtained in various applications, ranging from 3D reconstruction, to clustering, to sensor networks.

For more information please visit the seminar website at:  
[http://www.math.nyu.edu/seminars/geometry\\_seminar.html](http://www.math.nyu.edu/seminars/geometry_seminar.html).