1017-52-228 **Konstantin Rybnikov*** (krybniko@cs.uml.edu), One University Ave., Mathematical Sciences, UMASS Lowell, Lowell, MA 01854. *Statistical Estimation of Topological and Integral-Geometric Invariants of Non-Convex Bodies in 3D: Mathematical Challenges.* Preliminary report.

Suppose a highly non-convex body or surface in $\mathbb{E}^d$ ($d = 2, 3$) is given by a dense point sampling. It turns out that some integral characteristics of this shape, such as, e.g., the Euler characteristic, the surface area, etc. can be estimated by using methods of integral geometry without explicit reconstruction of the unknown body (surface). My colleagues in UMASS Lowell (D. Klain, K. Daniels), students (B. Jones, C. Neacsu), and I carried out a program on design and implementation of methods of integral geometry for statistical estimation of geometric and topological properties of bodies given by lattice, uniform, and Poisson point samplings. While the resulting software is very efficient in estimation of Euler characteristic, the surface area algortihms require more insights – now they work reasonably well only for bodies with smooth boundaries.

This work in computational geometry and topology brought up a number of interesting mathematical problems. The first type of problems is related to the optimal choice of parameters for the algorithms. For example, when sample points lie on a lattice, the optimal choice of parameters reduces to questions in geometry of numbers about the lattice width. The second, perhaps more difficult, challenge is in proving any kind of convergence and obtaining error estimates. (Received February 24, 2006)