Applied Topology from the point of view of Probability

Robert J Adler

Andrew and Erna Viterbi Faculty of Electrical Engineering,
Technion - Israel Institute of Technology

It is an undeniable fact that the moment any area of Pure Science, including Mathematics, meets data, randomness comes into play, whether it be as a result of sampling variance, measurement error, background noise, or any of a multitude of stochastic phenomena. Topology is no exception, but stands out from many other examples in that Topology and Randomness are two topics that have rarely appeared together, making the integration of statistical approaches into Applied Topology singularly challenging.

Driven, in a large part, by issues arising in Applied Topology, the past few years have seen considerable activity at the Topology/Probability and Topology/Statistics interfaces. I will describe a number of the results of this activity, mainly looking at them from the perspective of Probability, but also illustrating their potential importance to Applied Topology.

Among others, the (to some extent eclectic) results I hope to cover will come from the theory of random surfaces, mappings and embeddings; from problems related to learning the homology of manifolds when sampling from them in the presence of noise; and from the crucial problem of understanding randomness in persistence diagrams.

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