# Maximum Likelihood Surface Estimation

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## Abstract

A confluence of technologies in 3D sensing, high-performance computing, and interactive graphics is providing new opportunities for generating accurate, 3D models of complex scenes. However, as the variety of applications for this capabilities grows, so do the demands on the quality of the models. In some applications, especially those that place time and space restrictions on the data acquisition, the requirements for model fidelity can exceed the raw capabilities of the sensor. Furthermore, as real-life applications become more prevalent, it becomes infeasible to devote large amounts of time to manually modifying the scene to suit the sensing technology or massaging and aligning data sets so that they can be properly processed.

These developments suggest the need for new methods of processing range data that will automatically combine range images in a robust way while making the best use of all of the available information. This talk describes such a framework. The proposed framework relies on estimation theory and incorporates the statistics of the sensor to produce a best estimate of the surface shape and associated parameters. The framework uses a maximum likelihood formulation, which is known to be unbiased and efficient, and can combine measured data with prior information about the scene or the application. This formulation gives rise to a family of algorithms for registration, calibration, and reconstruction, which are shown to be robust and accurate.