Adaptive sampling of environmental variables (ASEV) **[1]**

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Abstract:

In environmental surveys a large sampling effort is required to produce accurate geostatistical maps, representing the distribution of environmental variables and the analysis of each sample is often expensive. The standard way to plan a survey is by non-adaptive sampling, whose distribution is usually completely specified prior to data-collection. In general, the sampling points are located on a regular grid, or along directions that are selected following a priori knowledge. However, the contribution of each point to the final prediction accuracy is typically unknown, and it is likely that lesser points distributed in a different manner might reach the same accuracy results eliminating sampling redundancies. Adaptive sampling uses only few initial sampling points and then follows an iterative collection of data, learning and refining the distribution of the variables in order to optimize the uncertainty of the estimates. In this technical report, we describe the design of an adaptive sampling scheme, where a at each sampling step the next optimal point to be sampled is selected based on: i) an uncertainty map of the environmental parameter distribution, which is continuously updated when a new measure is acquired, and ii) the geometric and physics constraints given by the morphology of the surveyed area. The optimality criterion will take into account the trade-off between cost and prediction precision. This research is funded by the INTERREG-MATRAC-ACP project; its strategic objective is to enhance the protection of marine waters by improved real-time driving of ROVs equipped with a series of digital sensors. The project will lead to the definition of protocols for intervention in emergency situations with minimum risks for human operators, and more efficient monitoring procedures in routine conditions. Before starting experimentation on the field, a simulation study was developed to evaluate the effectiveness of this strategy.

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