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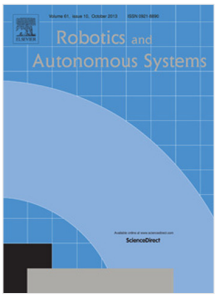

Time-dependent gas distribution modelling

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Time-Dependent Gas Distribution Modelling[☆]

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Abstract

Artificial olfaction can help to address pressing environmental problems due to unwanted gas emissions. Sensor networks and mobile robots equipped with gas sensors can be used for e.g. air pollution monitoring. Key in this context is the ability to derive truthful models of gas distribution from a set of sparse measurements. Most statistical gas distribution modelling methods assume that gas dispersion is a time-constant random process. While this assumption approximately holds in some situations, it is necessary to model variations over time in order to enable applications of gas distribution modelling in a wider range of realistic scenarios. Time-invariant approaches can not model well evolving gas plumes, for example, or major changes in gas dispersion due to a sudden change of the environmental conditions. This paper presents two approaches to gas distribution modelling, which introduce a time-dependency and a relation to a time-scale in generating the gas distribution model either by sub-sampling or by introducing a recency weight that relates measurement and prediction time. We evaluated these approaches in experiments performed in two real environments as well as on several simulated experiments. As expected, the comparison of different sub-sampling strategies revealed that more recent measurements are more informative to derive an estimate of the current gas distribution as long

[☆]This paper is an extended and revised version of the work of Asadi and Lilienthal in [1].

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