Using neural network techniques in environmental sensing and measurement systems to compensate for the effects of influence quantities

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Abstract:
Multiple influence quantities affect environmental sensing and measurement (ESM) systems. Accounting for their variations over time promotes metrological comparability and traceability of measurement results. Using suitable data processing techniques allows identification of the main influence quantities that affect the measurement result of a given quantity and allows evaluation of the associated compensation coefficients. This paper presents several concerns related to implementation of ESM systems, paying particular attention to the impact of the multiple of measuring and influence quantities on system performance. A review of different data processing techniques to compensate for the effects of influence quantities is presented. A case study based on water conductivity measurements is used to illustrate the capability of artificial neural network (ANN) based techniques and to cope with errors due to a low number of measurement values and due to collinear effects between influence quantities.

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Introduction

A topic of major importance in environmental quality is how to preserve ecosystems and quality of human life [1]. In measurement issues, whenever high accuracy is a concern, certified laboratories using specific techniques and suitable analytical instrumentation perform the measurements [2], [3]. However, laboratory measurements are not performed in real time, nor in online conditions, do require expensive instrumentation devices, and the measuring results that are provided, even if accurate, only give static information of a particular measurement sample that is collected in a specific location on a given date. Thus, the dynamic behavior of measurement data is lost between sampling dates, as well as the dynamic variations of the influence quantities.

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