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Adaptive approach to spatial interpolation and visualization of scattered monitoring data at CERN

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In order to ensure safe operations, CERN leverages an extensive SCADA system to monitor radiation levels and collect environmental measurements across its premises. The Health & Safety and Environmental Protection (HSE) Unit addressed the challenge of visualizing radiation fields from non-uniformly distributed sensors across large areas. This paper presents the approach and implementation of a 2D interpolation and visualization system for such measurements. The system implements two algorithms for two complementary monitoring scenarios. The Inverse Distance Weighting (IDW) interpolation addresses cases where radiation sources are located near sensor locations, assuming maximum values occur at measurement points. The Radial Basis Function (RBF) method handles scenarios with potential radiation peaks between sensors. A region network approach divides large areas into independent regions for optimized performance. Accuracy is evaluated using leave-one-out cross-validation.The architecture relies on TypeScript, React and WebSockets. The system processes measurements across CERN's premises and provides operators with a real-time or historical spatial visualization of radiation levels.

Footnotes

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