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Next Generation Radiation Risk Assessment and Prediction Tools Generation Applying AI-Machine (Deep) Learning Algorithms

Authors : Selim M. Khan

Abstract : Indoor air quality is strongly influenced by the presence of radioactive radon (222Rn) gas. Indeed, exposure to high 222Rn concentrations is unequivocally linked to DNA damage and lung cancer and is a worsening issue in North American and European built environments, having increased over time within newer housing stocks as a function of as yet unclear variables. Indoor air radon concentration can be influenced by a wide range of environmental, structural, and behavioral factors. As some of these factors are quantitative while others are qualitative, no single statistical model can determine indoor radon level precisely while simultaneously considering all these variables across a complex and highly diverse dataset. The ability of AI-machine (deep) learning to simultaneously analyze multiple quantitative and qualitative features makes it suitable to predict radon with a high degree of precision. Using Canadian and Swedish long-term indoor air radon exposure data, we are using artificial deep neural network models with random weights and polynomial statistical models in MATLAB to assess and predict radon health risk to human as a function of geospatial, human behavioral, and built environmental metrics. Our initial artificial neural network with random weights model run by sigmoid activation tested different combinations of variables and showed the highest prediction accuracy (>96%) within the reasonable iterations. Here, we present details of these emerging methods and discuss strengths and weaknesses compared to the traditional artificial neural network and statistical methods commonly used to predict indoor air quality in different countries. We propose an artificial deep neural network with random weights as a highly effective method for assessing and predicting indoor radon.

Keywords : radon, radiation protection, lung cancer, aI-machine deep learnng, risk assessment, risk prediction, Europe, North America
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