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Deep Learning Prediction of Residential Radon Health Risk in Canada and Sweden to Prevent Lung Cancer Among Non-Smokers

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Abstract : Indoor air quality, a prime determinant of health, is strongly influenced by the presence of hazardous radon gas within the built environment. As a health issue, dangerously high indoor radon arose within the 20th century to become the 2nd leading cause of lung cancer. While the 21st century building metrics and human behaviors have captured, contained, and concentrated radon to yet higher and more hazardous levels, the issue is rapidly worsening in Canada. It is established that Canadians in the Prairies are the 2nd highest radon-exposed population in the world, with 1 in 6 residences experiencing 0.2-6.5 millisieverts (mSv) radiation per week, whereas the Canadian Nuclear Safety Commission sets maximum 5-year occupational limits for atomic workplace exposure at only 20 mSv. This situation is also deteriorating over time within newer housing stocks containing higher levels of radon. Deep machine learning (LSTM) algorithms were applied to analyze multiple quantitative and qualitative features, determine the most important contributory factors, and predicted radon levels in the known past (1990-2020) and projected future (2021-2050). The findings showed gradual downwards patterns in Sweden, whereas it would continue to go from high to higher levels in Canada over time. The contributory factors found to be the basement porosity, roof insulation depthness, R-factor, and air dynamics of the indoor environment related to human window opening behaviour. Building codes must consider including these factors to ensure adequate indoor ventilation and healthy living that can prevent lung cancer in non-smokers.

Keywords : radon, building metrics, deep learning, LSTM prediction model, lung cancer, canada, sweden
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