# Application of artificial intelligence in the hazard indexes of recycled agricultural waste materials


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## Abstract


Radioactive substances are emitted during the recycling of agricultural waste materials, putting both the environment and people at risk. Thus, the research forecasts the risks from these materials, using deep neural networks (DNN) with a variety of network architectures. Levenberg–Marquardt backpropagation was used as a training algorithm and the neural network was built using just one target variable, the hazard index, together with three input variables consisting of $^{226}$Ra, $^{232}$Th, and $^{40}$ K. The model was trained using 3–5-5–5-1, 3–10-10–10-1, and 3–15-15–15-1 network architectures. Additional datasets were used to validate the developed model. The results showed that every agricultural byproduct evaluated provides no potential indoor and outdoor risks. All network structures yielded strong precision for predicting the hazard indexes of agricultural byproducts. However, when compared to alternative network topologies, a 3–10-10–10-1 network architecture showed the best performance metrics for training, validation, and testing. In addition, the confirmation of the model with untrained data yielded a strong correlation with 98.68% and 99.76% $R^2$ for indoor and outdoor hazards.

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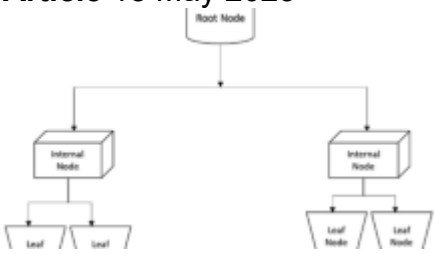


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# Availability of data and materials

All data generated or analyzed during this study are included in this manuscript.

### Statement of code availability

The statement of code availability is available at https://github.com/Sotech281/Data-trained.

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## Contributions

S.O. conceptualized and designed the study, S.O. collected the data, S.O., T.I., F.O. and A.N. analysed and interpreted the results, S.O. analysed the data with software, and S.O. wrote the manuscript in consultation with T.I., F.O. and A.N. All authors reviewed the manuscript.

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# Ethics declarations

### Conflict of interest

The author declares that he has no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

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- Waste recycling

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