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P2.68: Improvement of phoswich detector-based β+/γ-ray discrimination algorithm with deep learning

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Positron probes are widely used to accurately localize malignant tumors by directly detecting positrons emitted by positron-emitting radiopharmaceuticals that accumulate in malignant tumors. However, the conventional method of direct positron detection cannot distinguish some γ-rays, resulting in misidentification of γ-rays as positrons and increasing the error rate of positron detection. In this study, an Autoencoder-based positron detection algorithm is proposed to improve the accuracy of positron detection by analyzing the energy distribution in each scintillator of the multilayer scintillator detector for discriminating between true and false positrons. The Autoencoder was trained to separate the combined signals generated by the multilayer scintillator detector into two signals from each scintillator. An energy window was then applied to the energy distribution obtained using the trained Autoencoder to distinguish true positrons from false positrons. The proposed method was evaluated and compared with the conventional method in terms of performance, sensitivity and error rate for positron detection. The results showed that the proposed method can increase the sensitivity of positron detection while maintaining a low error rate compared to the conventional method. Specifically, the proposed method had a higher sensitivity than the conventional method when both methods had the same error rate. In addition, the proposed method had a lower error rate than the conventional method when both methods had the same sensitivity.

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