Deep learning approaches for pseudo gamma spectroscopy of a plastic scintillation detector

Byoungil Jeon[1*]

[1]Intelligent Computing Laboratory, Korea Atomic Energy Research Institute, Daejeon, Republic of Korea
[*]E-mail: bijeon@kaeri.re.kr

Keywords: pseudo gamma spectroscopy, plastic scintillation detector, deep learning, machine learning

The major objectives of gamma spectroscopy are identification and quantitation of gamma-ray sources by analyzing energy spectra with attention to full energy peaks. In aspect of spectroscopic analysis, plastic scintillators are inadequate because of thier poor energy resolution and absence of full energy peak. However, plastic scintillation detectors have been widely used in radiation monitoring system, e.g. radiation portal monitor (RPM), because they have unique characteristics such as low cost, ease to be made in large volume, etc. For RPM applications, various pseudo gamma spectroscopy methods have been studied. In this presentation, deep learning applications for pseudo gamma spectroscopy of a plastic scintillation detector will be addressed: from simple classification to multi-task model. For eight gamma ray sources, ^{22}Na, ^{54}Mn, ^{57}Co, ^{60}Co, ^{109}Cd, ^{133}Ba, ^{137}Cd and ^{152}Eu, Monte carlo simulations and experiments were conducted to establish dataset of deep learning models. Several types of deep learning applications were implemented, trained using dataset and evaluated by experimental spectra.

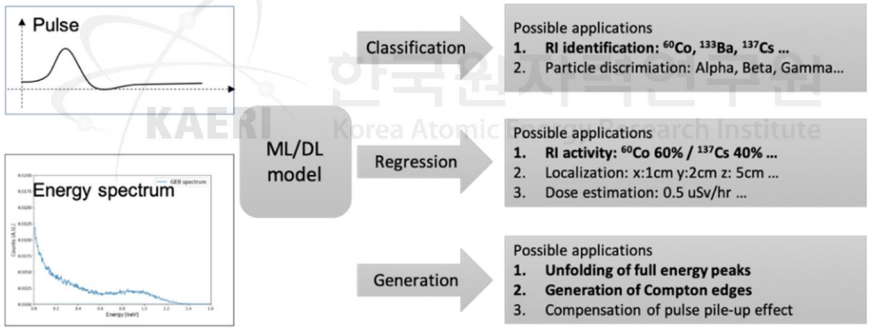

Fig. 1. Possible deep learning applications for a plastic scintillation detector

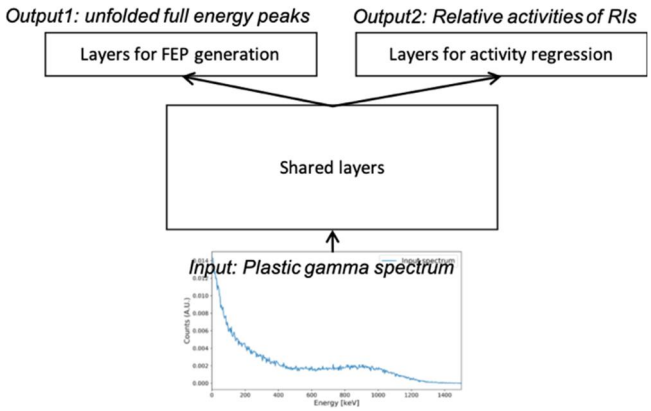

Fig. 2. Concept of multi-task model for pseudo gamma spectroscopy of a plasic scintillation detector

Acknowledgments
This work was supported by the Korea Atomic Energy Research Institute (KAERI project No. 79755-20), the Ministry of Oceans and Fisheries (KIMST project No. 20200611) and the Ministry of Science and ICT (NRF project No. 2020M2C9A1068149).