Contribution ID : **94** Type : **Talk**

Machine Learning for Event-Level Background Rejection in LAFOV PET

Wednesday, 9 September 2026 11:40 (30)

Long axial field-of-view PET scanners provide a significant gain in sensitivity, but also bring a substantially higher background of scattered and accidental coincidences. We investigate machine-learning classification of individual coincidence events using GATE Monte Carlo simulations of the Siemens Quadra scanner with NEMA IEC and anthropomorphic XCAT phantoms, where every event has a ground-truth label.

We evaluate XGBoost, AdaBoost, and neural network classifiers with two feature sets, and show that phantom-wise metrics give a misleading picture of classifier performance. In a cross-phantom test, a small decrease in accuracy corresponds to regionally concentrated degradation that only per-voxel quality maps reveal, while geometry-dependent features overfit the phantom geometry.

In our initial approach, we kept events predicted as true and rejected all others. We present two extensions in which the per-event probabilities influence the reconstructed image and its uncertainty. First, using soft probability weighting, in which each event contributes to reconstruction according to its estimated true-coincidence probability, we reduced the image-wise reconstruction error compared to hard filtering. Second, we apply split conformal prediction, which replaces a single predicted class with a set of classes carrying a finite-sample coverage guarantee. Aggregated per voxel, these sets produce ambiguity maps that identify unreliable image regions without ground-truth labels.

Primary author(s) : OBARA, Michał (NCBJ)

Presenter(s) : OBARA, Michał (NCBJ)

Session Classification : Machine Learning in Medical Applications