Update on (Optimal Transport) Displaced Track Classification

Nathan Suri
SLAC-Yale Weekly Meeting
4/23/24

Phase 0: Track-by-track BDT (XGBoost)

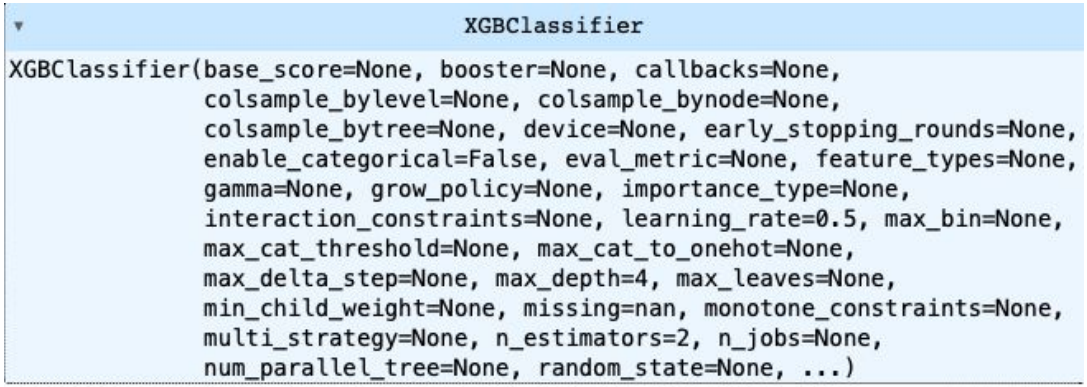
Parameters

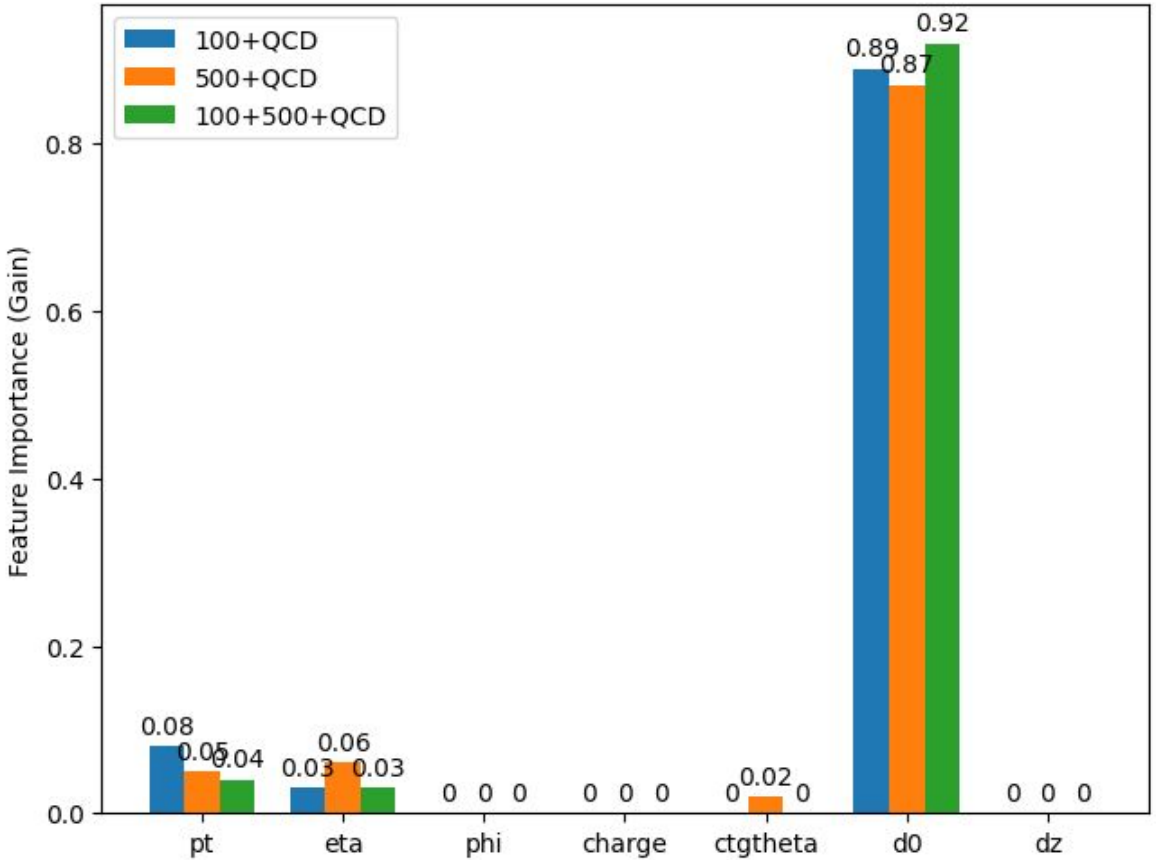
n_estimators=2

max_depth=4

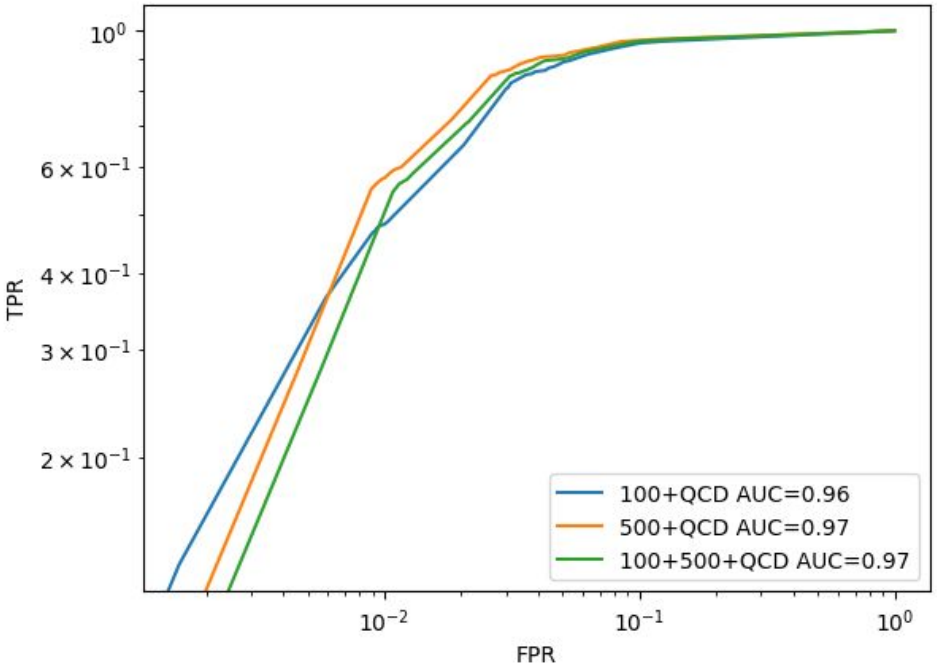
learning_rate=0.5

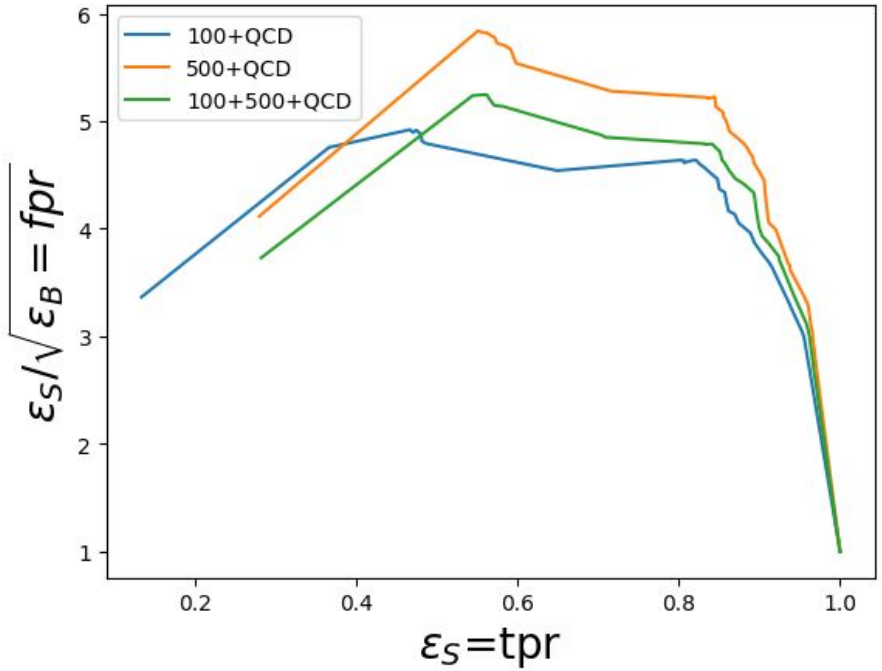
objective='binary:logistic'





Feature Importance


TPR
FPR
100+QCD AUC=0.96
500+QCD AUC=0.97
100+500+QCD AUC=0.97


100+QCD
500+QCD
100+500+QCD
$\varepsilon_S/\sqrt{\varepsilon_B = fpr}$
ε_S=tpr

Phase 1: Track-by-track Transformer (ABCNet)

Architecture

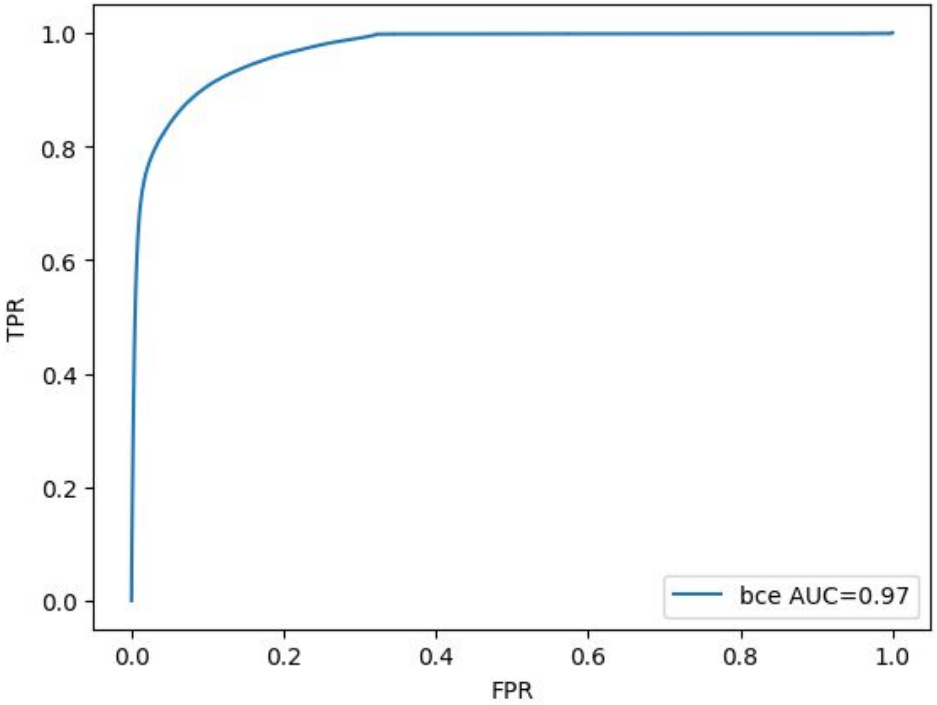
https://github.com/ViniciusMikuni/ABCNet/tree/master

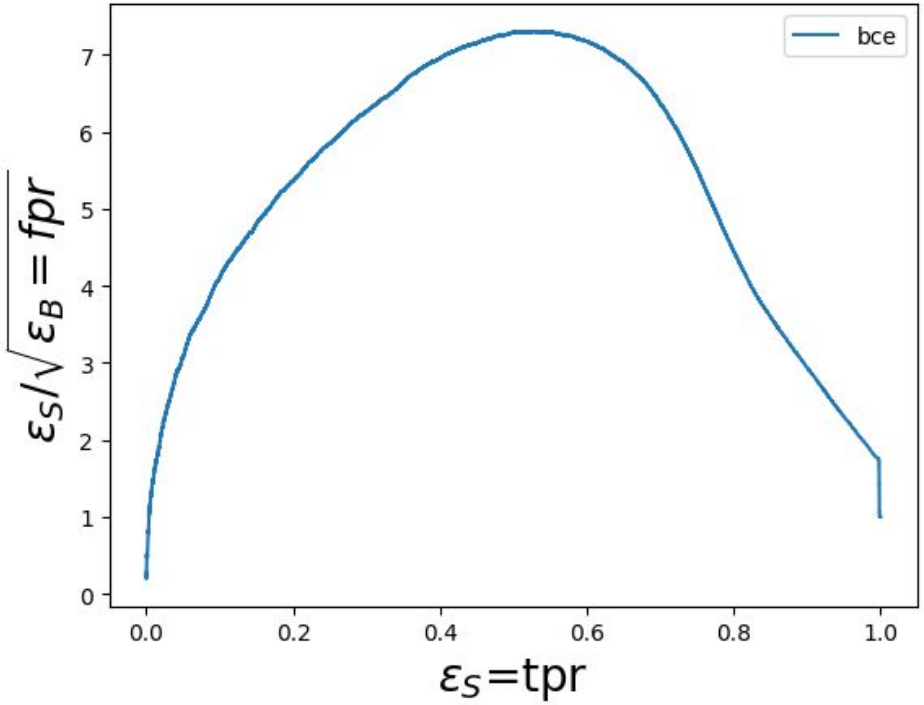
Total params: 160,117

Trainable params: 159,021

Non-trainable params: 1,096

[Trained using full data without pileup]


TPR
FPR
bce AUC=0.97
0.0
0.2
0.4
0.6
0.8
1.0


bce
$\varepsilon_S/\sqrt{\varepsilon_B} = fpr$
ε_S=tpr
0
1
2
3
4
5
6
7
0.0
0.2
0.4
0.6
0.8
1.0

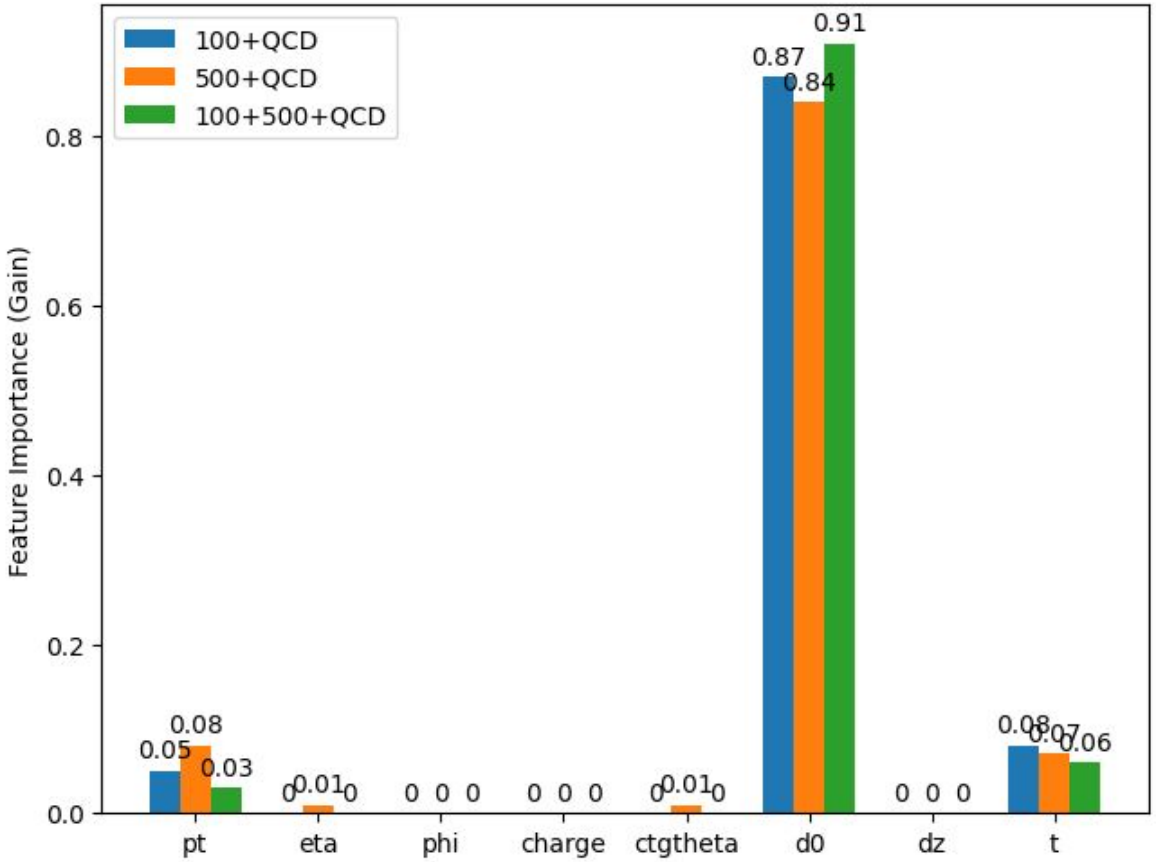
Thoughts

- BDT
  - Overall, task seems (more than) viable
  - Results generalize well for more signals so far
- Supervised Transformer
  - Similar results found to the BDT
  - Are the displaced tracks themselves distinct enough that context is unnecessary for discrimination?
  - Is the current signal too easy to perform track-by-track classification?

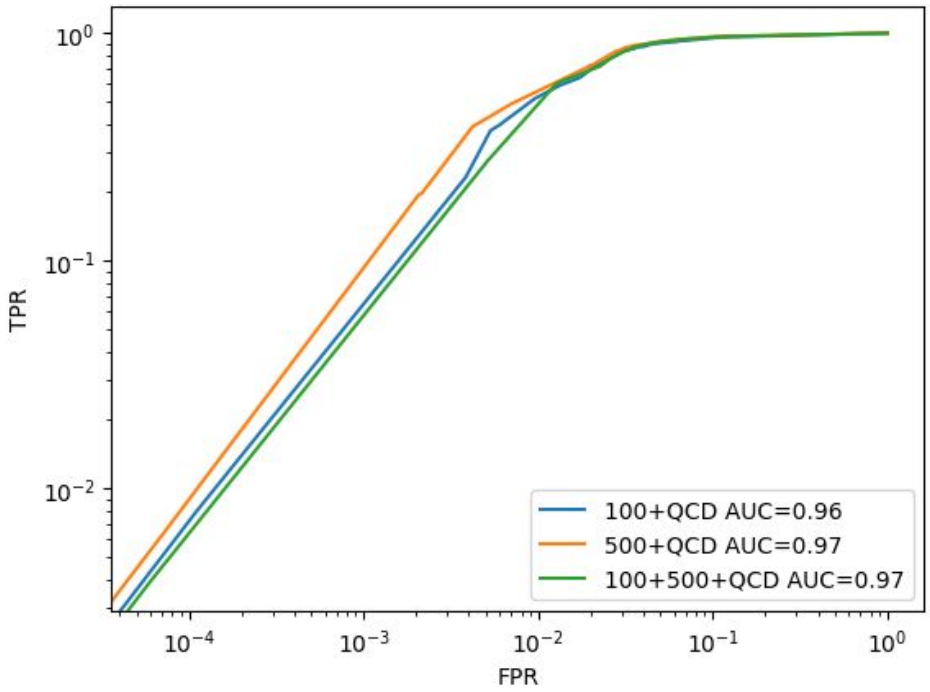
Tasks

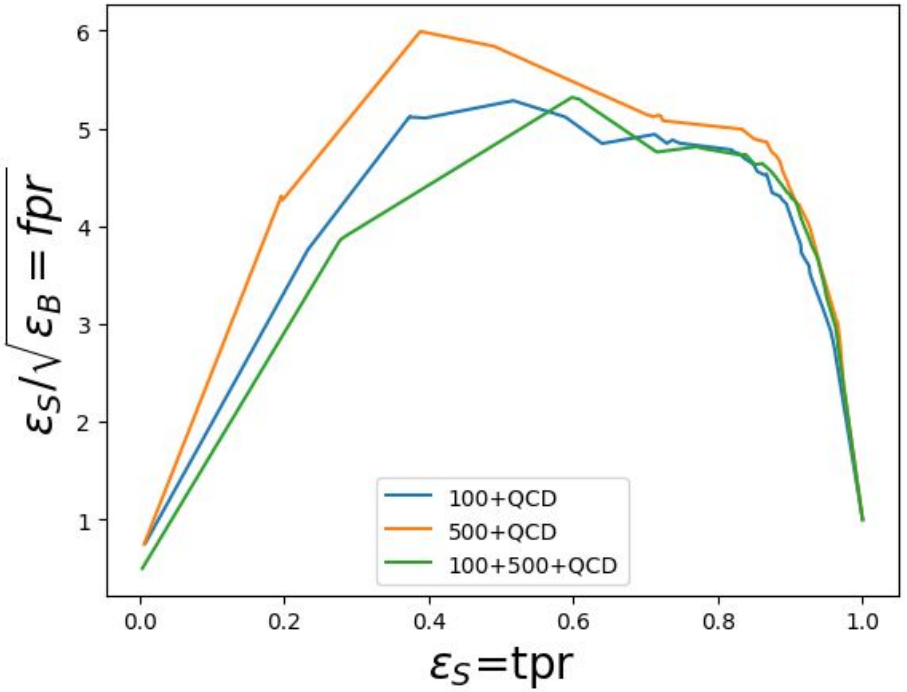
- Data
  - Finish adjusting root->h5 pipeline
  - Reconfigure saving of truth information for dark photon samples
- Training
  - Autoencoder
    - Recheck autoencoder implementation
  - OT
    - Retrain with normalized inputs
- Logistics
  - Draft abstract for ATLAS ML workshop?

Backup Slides

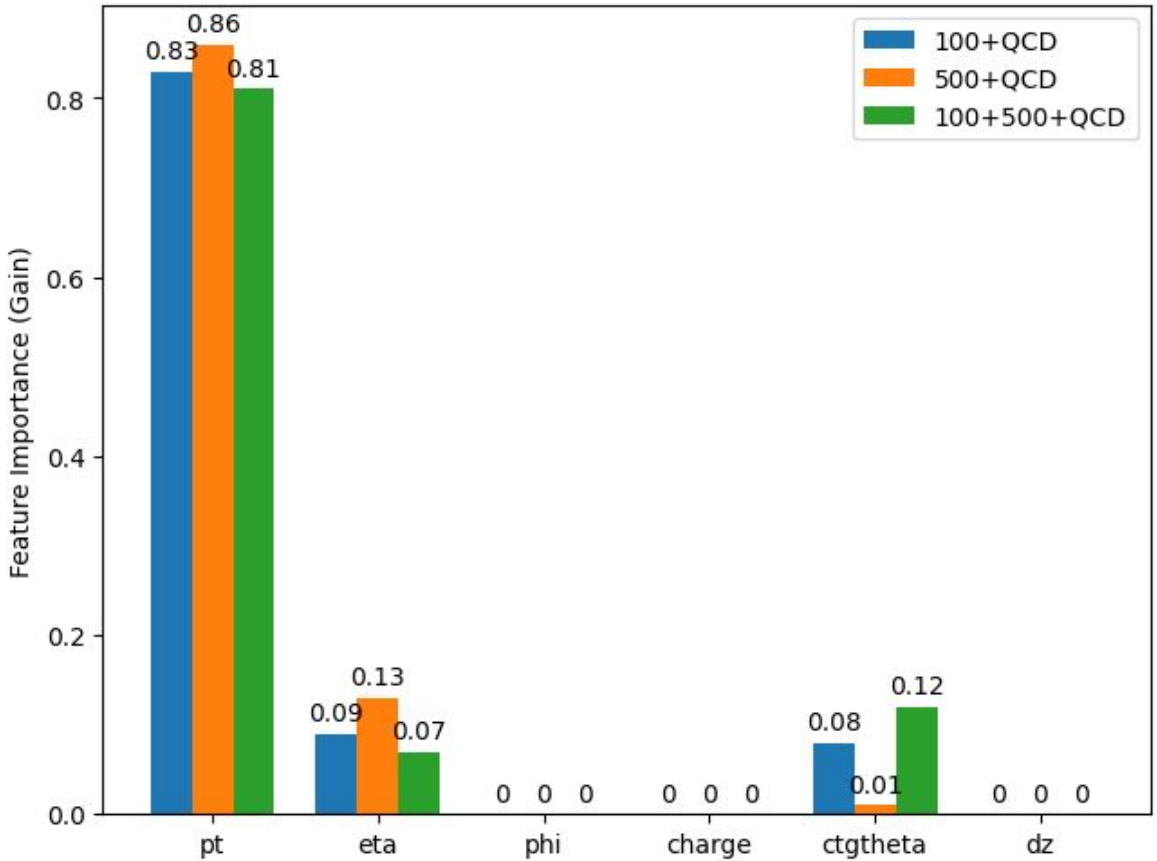


Feature Importance (with t)

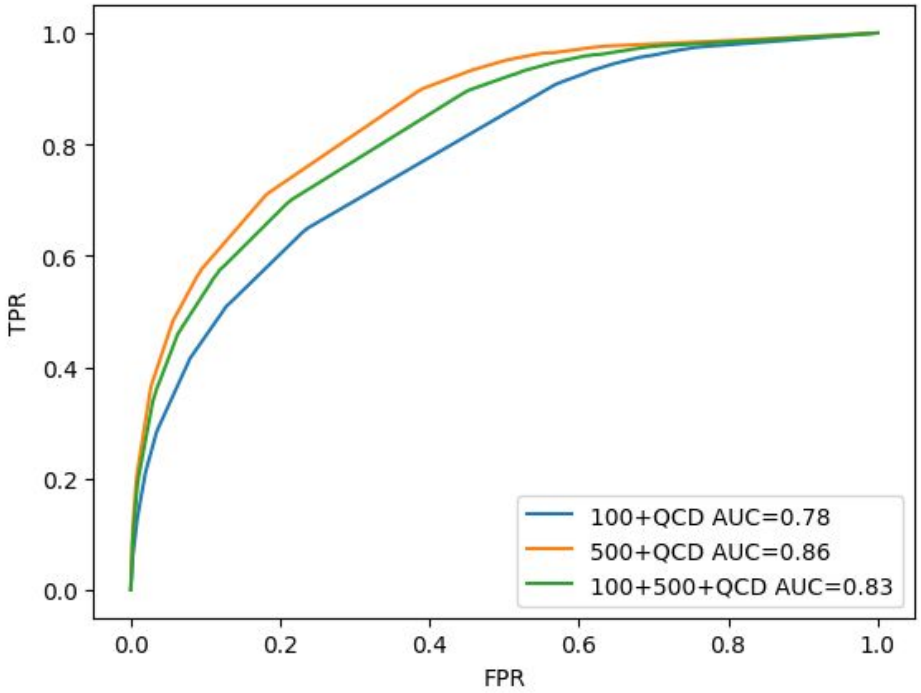


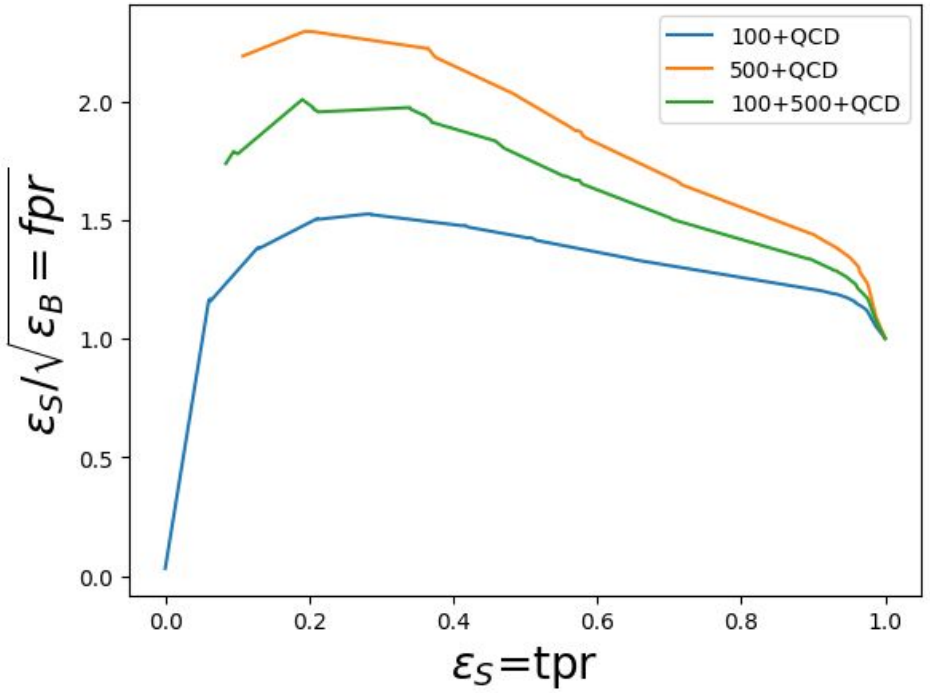


Inclusion of Timing Feature



Feature Importance (without D0)





Removal of D0 Feature