Augmenting Line-Segment Tracking with Graph Neural Network

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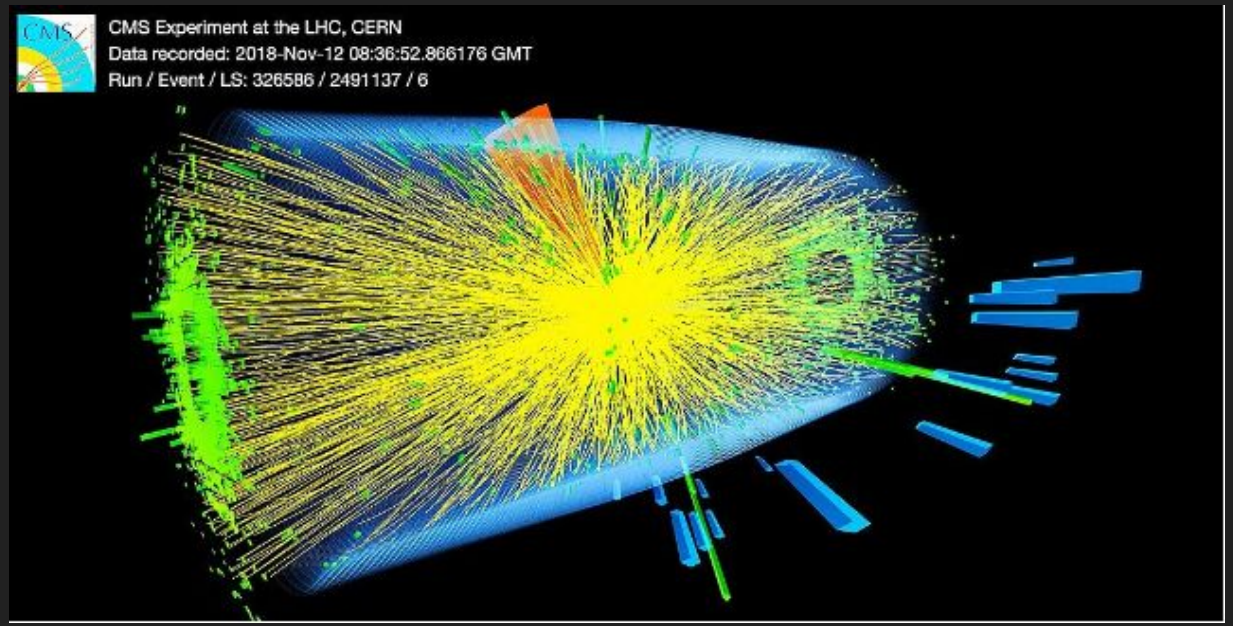
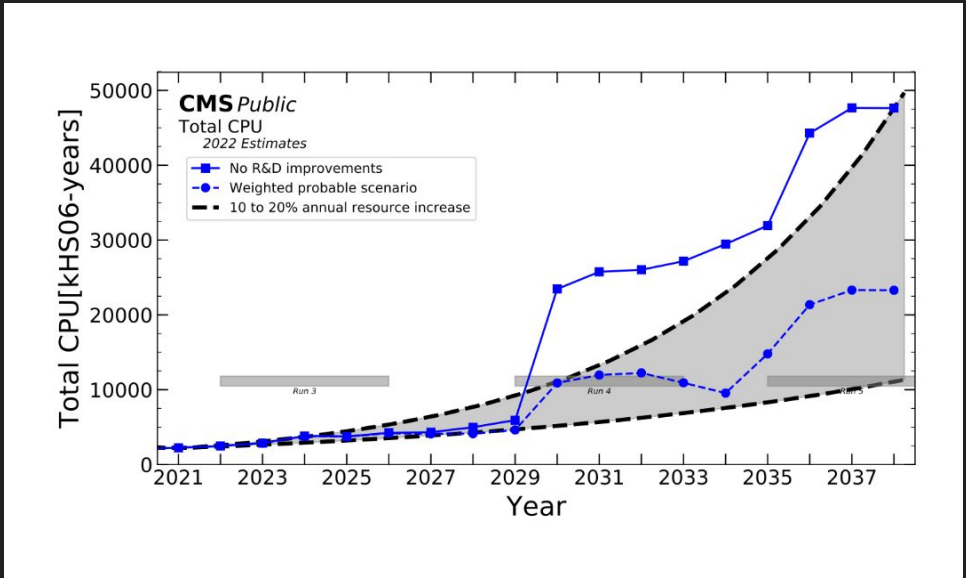
Track Reconstruction

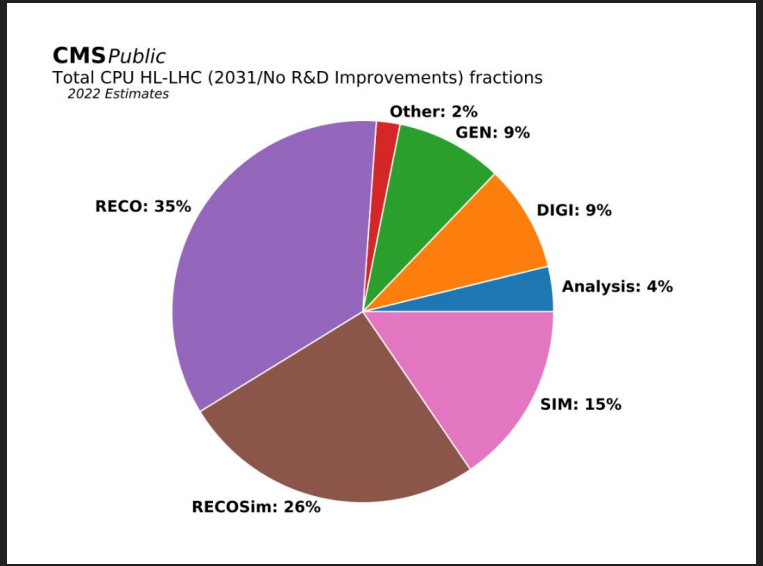


https://www.science-photo.de/bilder/12971111-Lead-ion-collision-event-in-CERN-s-CMS-detector

Resource Cost



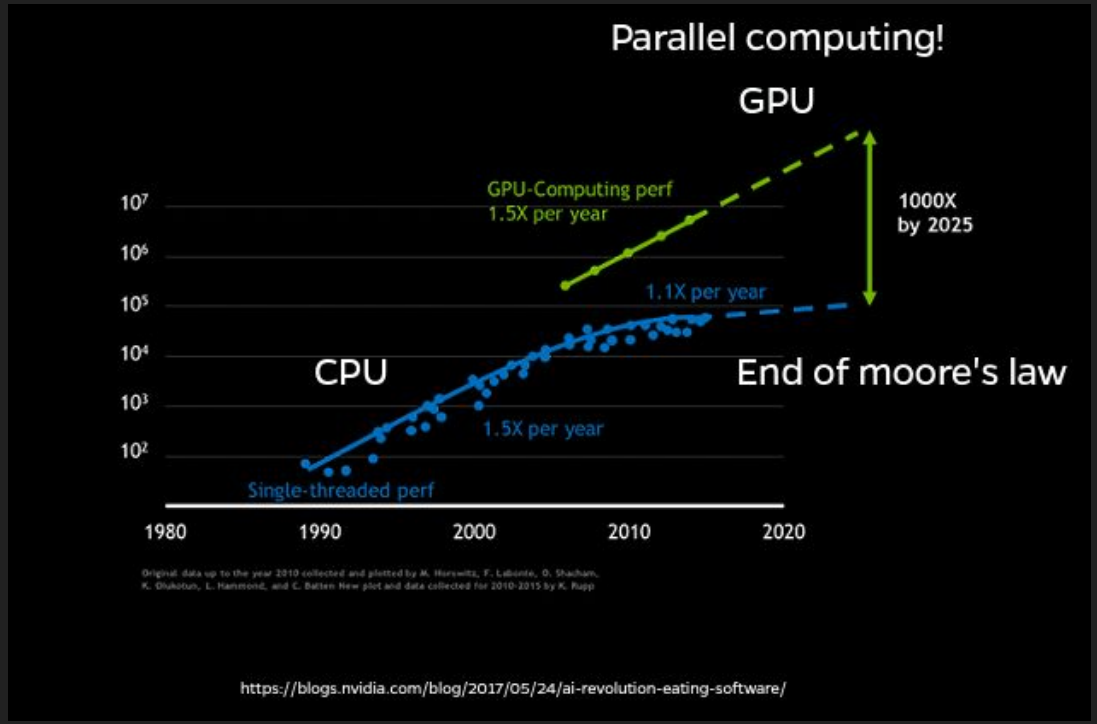
https://twiki.cern.ch/twiki/pub/CMSPublic/CMSOfflineComputingResults/cpu_cms2022.png



https://twiki.cern.ch/twiki/pub/CMSPublic/CMSOfflineComputingResults/cpu_pie_cms2022.png

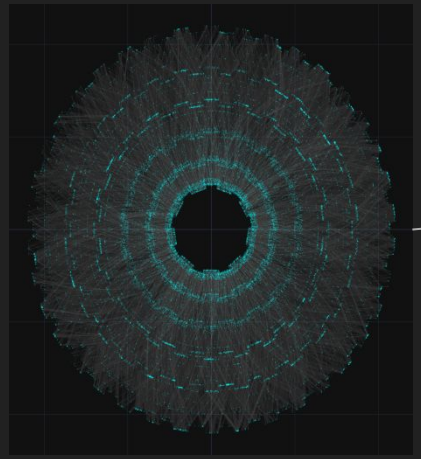
Parallelizable Solution

- Combinatorics increasing exponentially
- CPU computing power plateauing



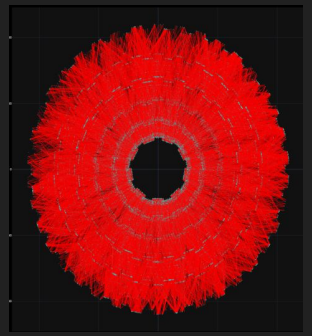
ML Parallelized Line-Segment Tracking

Possible Line Segments

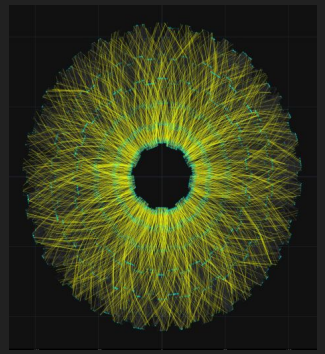


Graph Neural Network

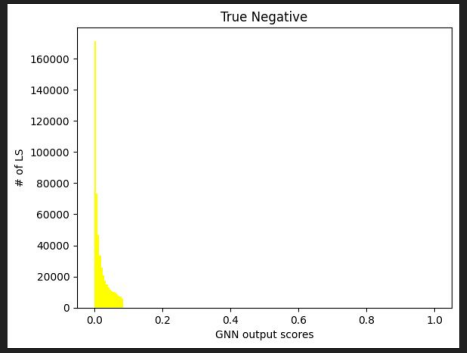
Fake Segments

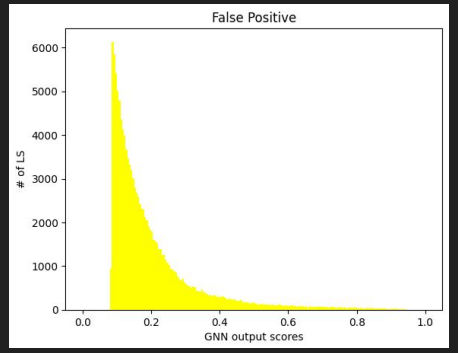


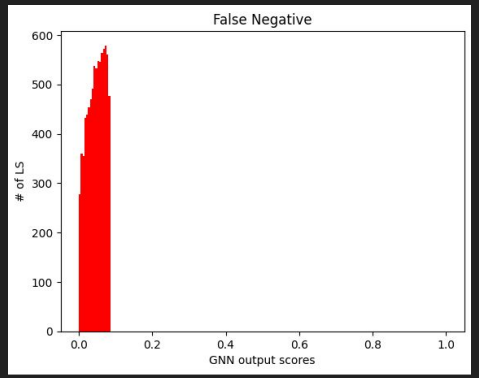
Real Segments

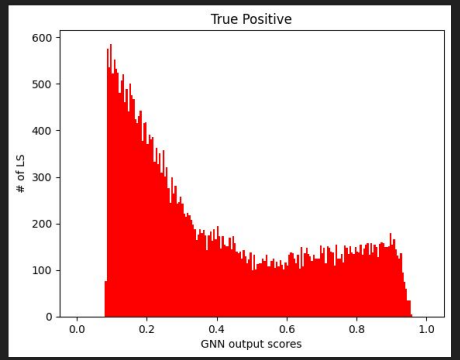


Project Progress





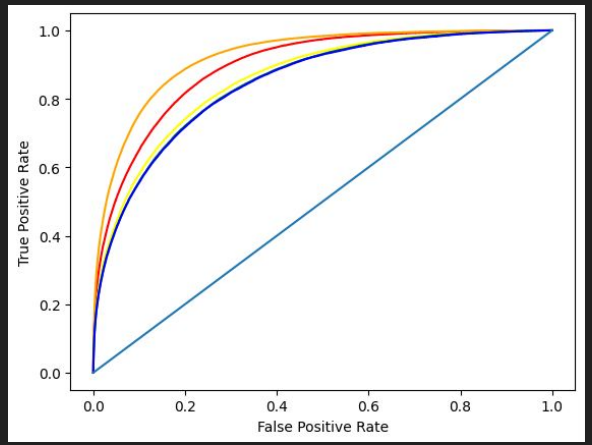




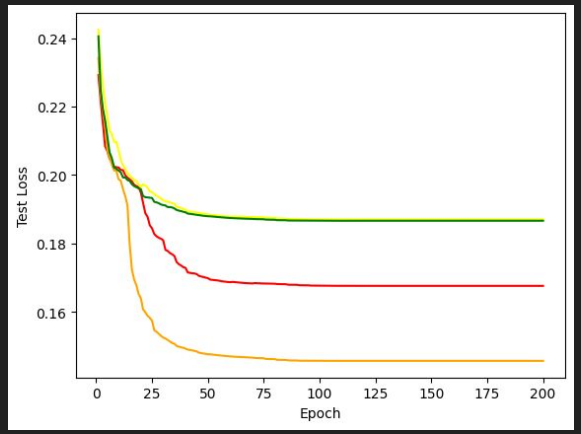
GNN Performance Testing

Project Progress

ROC Curves



Message Passing Rounds Optimization



- Hyperparameter Optimization
- Future Objectives
  - Normalization of parameters
  - Further optimization (learning rate, hidden layers, etc.)