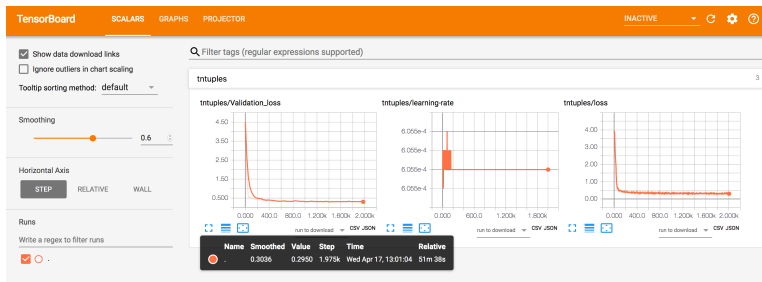


# GPU enabled Particle Reconstruction using Graph Neural Networks

April 17, 2019

# DAY 3: PROGRESS

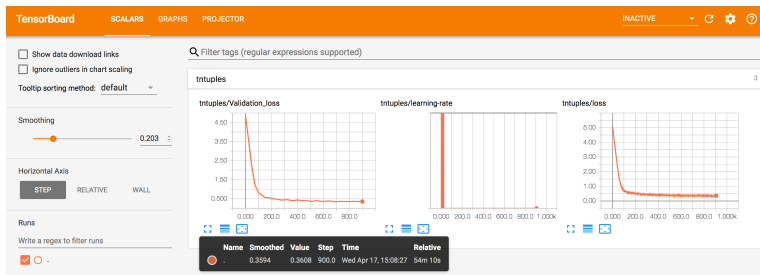
## ► Initial training results



- This shows the training loss going down to 0.29 (not great but it's a start; 2000 iterations) for the GNN model with Batch Size 64, Learning Rate 0.0004

# DAY 3: PROGRESS

## ► Initial training results



- This shows the training loss going down to 0.35 (900 iterations) for the model with Batch Size 128, Learning Rate 0.0002

## DAY 3: INSIGHTS

- ▶ Principled exploration into hyperparameter tuning: there are different ways of doing this although they require significant time and effort. These range from brute-force or grid search to Bayesian optimization.
- ▶ We need to evaluate what properties we can introduce to make it more interpretable. For example, the idea of tracks as centroids in the rechart space is one.
- ▶ Faster training for the models would be nicer. Could be interesting to compare GTX 1080Ti performance versus the V100s for this use-case.

## DAY 3: FUTURE WORK

- ▶ Project the tracks and seeds to a common space and improve the clustering by using the tracks as centroids for the clusters. This is a more intuitive way of looking at the problem.
- ▶ MOAR DATA! Since data is generated from simulations, it would be interesting to see how the same model performs (and at what point it overfits) with increasing data.

# SLIDES ALREADY PRESENTED

# DAY 2: PROGRESS

## ► Initial training results



- (this is a sample image from one of the trainings because the one I actually wanted to show crashed before I could take save it)

## DAY 2: PROGRESS

- ▶ What does the image mean?
- ▶ Represents the loss for the GNN training on Tracking Data
- ▶ Exponential decay causes the variation in learning rate
- ▶ The lighter lines above/below represent the change of the minima/maxima with time.



## PROBLEMS FACED IN CURRENT APPROACH

- ▶ Training GraphNets is computationally expensive
- ▶ Graph based data structures which are optimized for GPUs

# DAY 1 : PROGRESS

- ▶ Discussion with the NVIDIA team to explain our project and issues regarding training/code optimization
- ▶ Initial training results

