Here is a list of topics I will aim to cover in the course. This list is incomplete and approximate. Note it is not a syllabus! In particular the order of topics might be different in the course.

- Collider physics basics
  - Detector components
  - Coordinates (pT, eta, phi)
  - Objects (tracks vs towers; electrons, photons, muons, jets, ...)
  - Events

- Some stats basics:
  - Maximum likelihood estimation
  - Likelihood ratio
  - Neyman-Pearson lemma
  - Bayesian statistics

- What is Machine Learning

- What are common problems solved by Machine Learning
  - Classification
  - Regression
  - Generation
  - Anomaly Detection
  - ...

- Why Neural Networks
  - Universal approximation theorem

- What are Neural Networks
  - Hidden layers
  - Activations
  - ...
• How do we train Neural Networks
  – SGD
  – Backprop
  – Differentiable programming
  – GPUs
  – Overfitting
  – Validation
  – ...

• Some popular Neural Network architectures
  – DNN
  – CNN
  – RNN, LSTM, ...
  – GAN
  – Autoencoder, VAE, ...
  – Flows (density estimation)

• Some important applications to HEP:
  – Classification: CNNs, RNNs, ...
  – Decorrelation: Adversarial, DisCo, ...
  – Generation: CaloGAN
  – Anomaly Detection: CWoLa, ANODE, Autoencoders, ...
  – Regression:
  – ...

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