

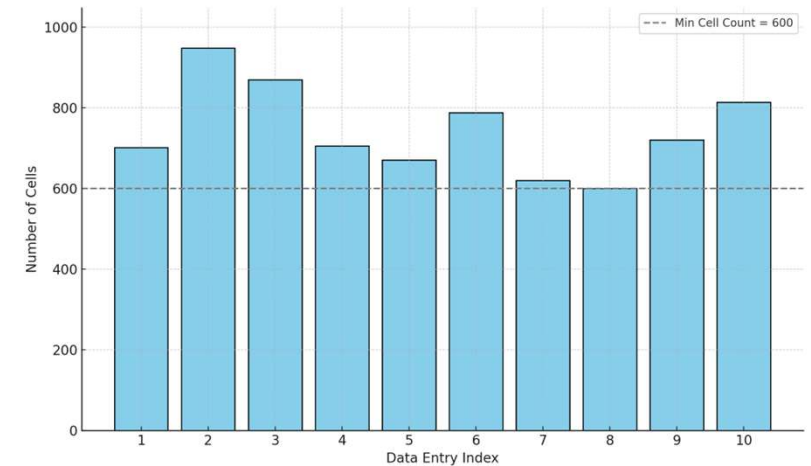
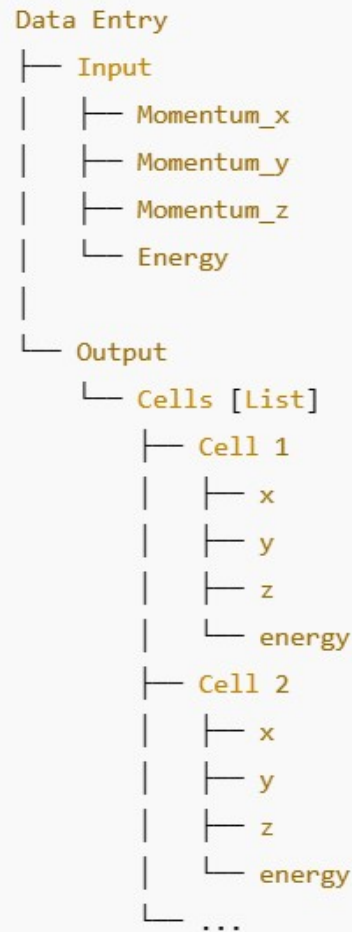
Generative Model for CEPC Detector Simulation

Generative Model for CEPC Detector Simulation

- Data Preprocessing
- Model Construction
- Display of Training Results
- Parameter Setting and Optimization
- Future Work

Data Preprocessing

- Standardize Dataset Format
- Fix the Number of Cells
- Normalize to the Range $[-1, 1]$
- Convert to PyTorch Tensors



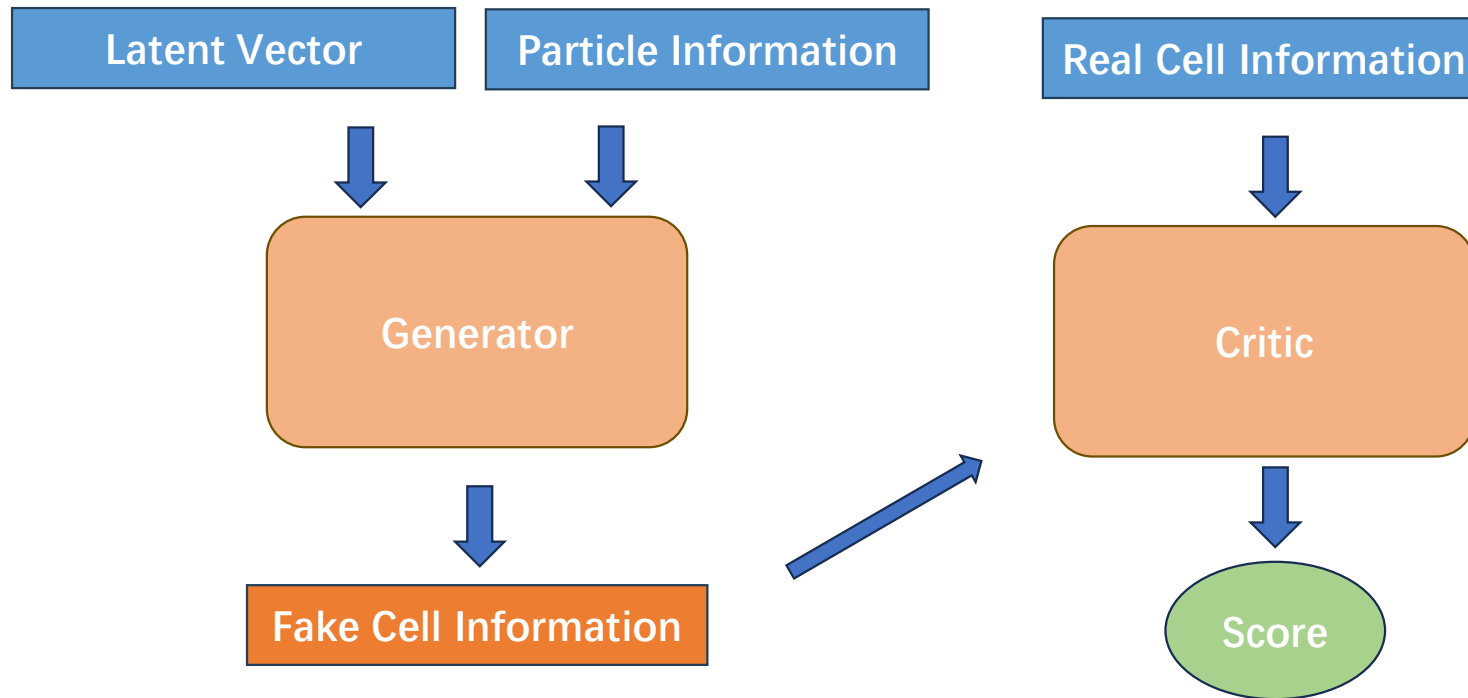
high energy

low energy

Min Cell Count

Model Construction

- WGAN-GP

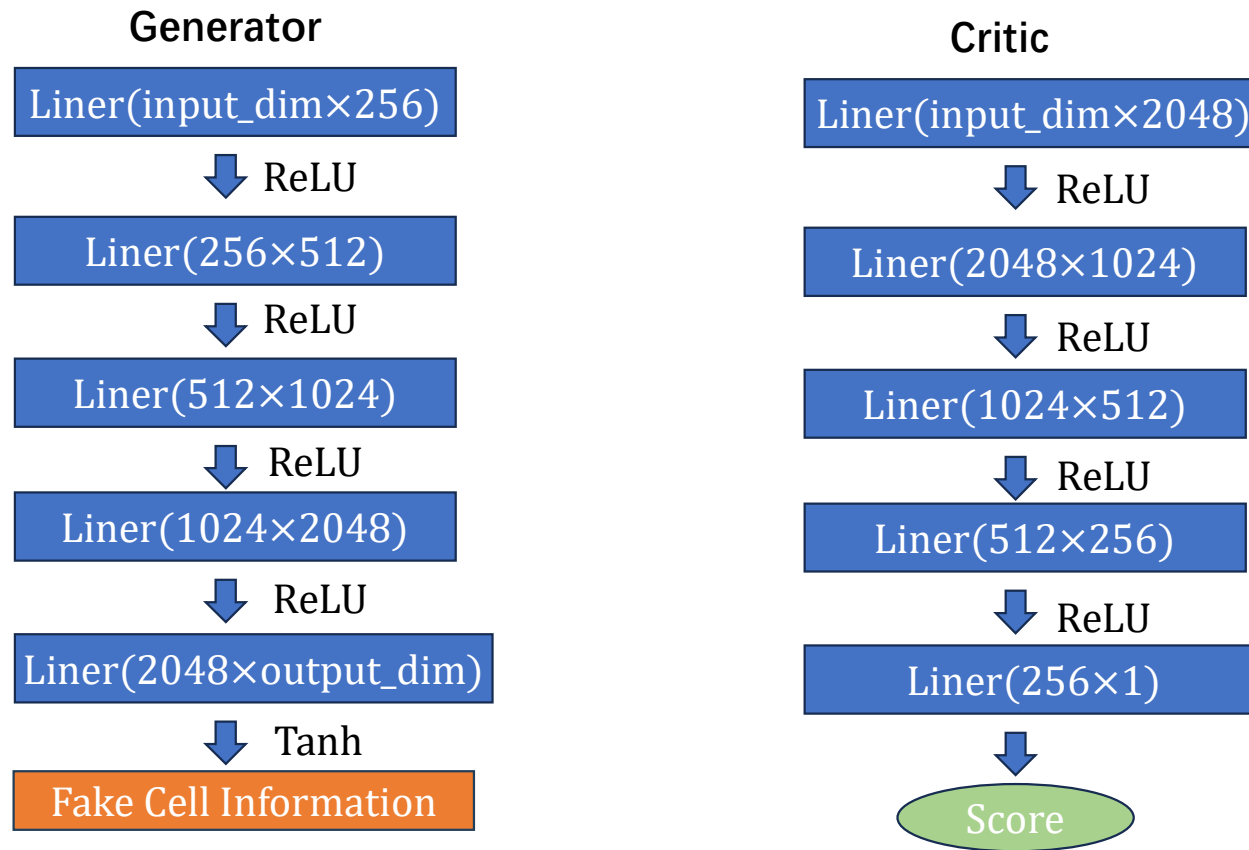


$$L_G = -\mathbb{E}_{\tilde{x} \sim P_g} [D(\tilde{x})]$$

$$L_D = \mathbb{E}_{\tilde{x} \sim P_g} [D(\tilde{x})] - \mathbb{E}_{x \sim P_r} [D(x)] + \lambda \mathbb{E}_{\hat{x} \sim P_{\hat{x}}} \left[(\|\nabla_{\hat{x}} D(\hat{x})\|_2 - 1)^2 \right]$$

Model Construction

- Model Architecture Details

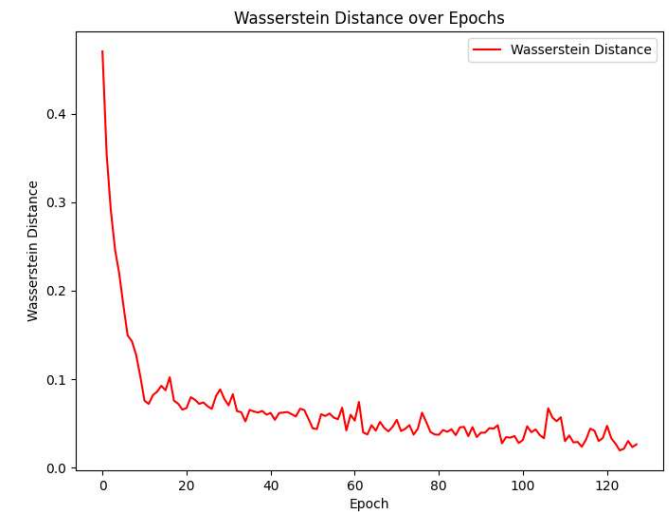
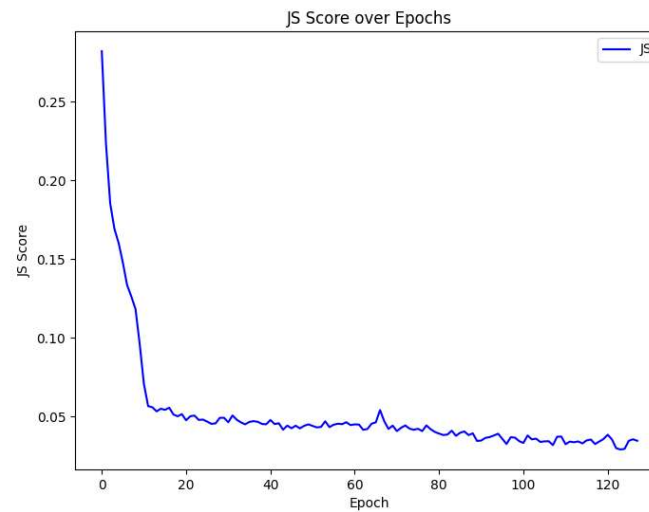
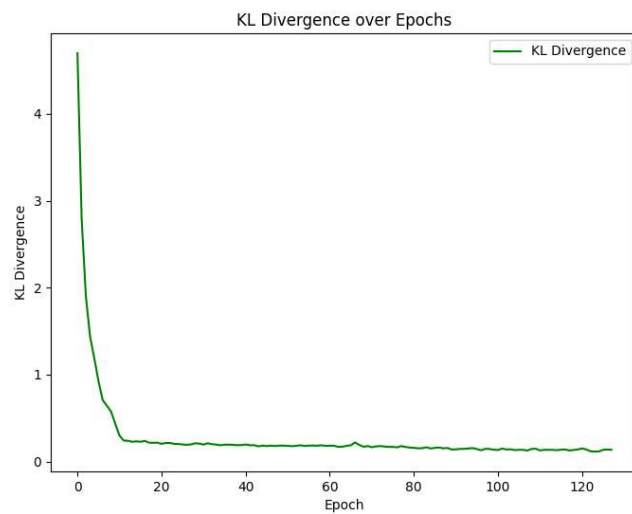


Display of Training Results

Example of $\gamma, \theta \in [73.6, 106.4], E \in [30, 50]$

batch_size = 16 epoch = 128

min_cell = 600

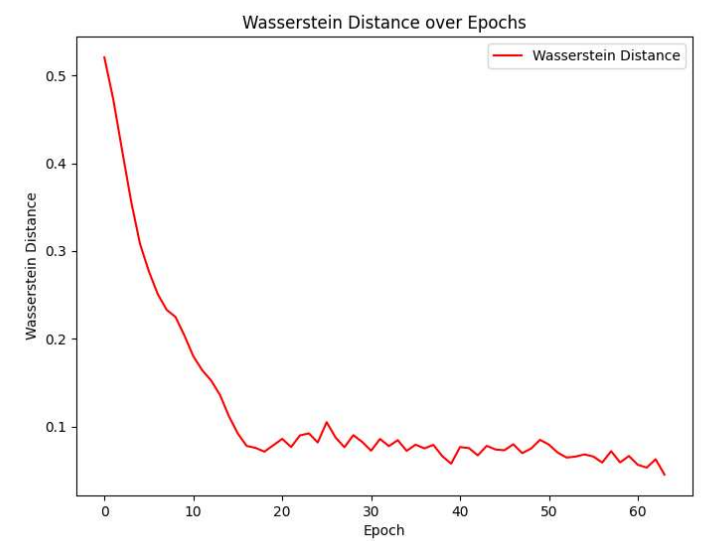
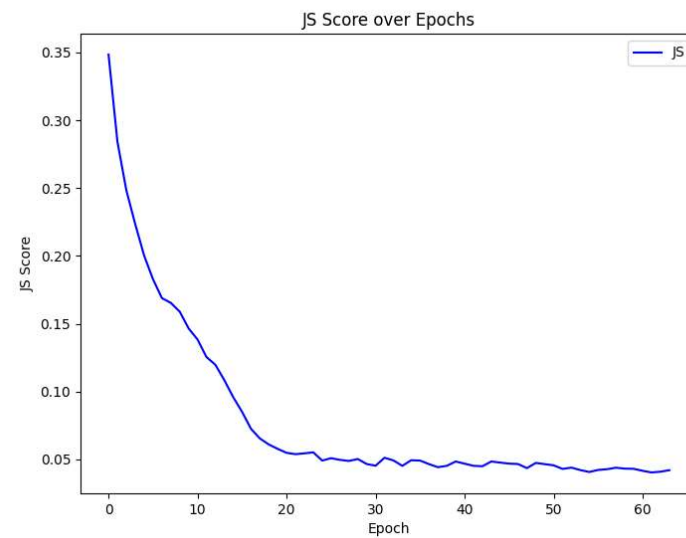
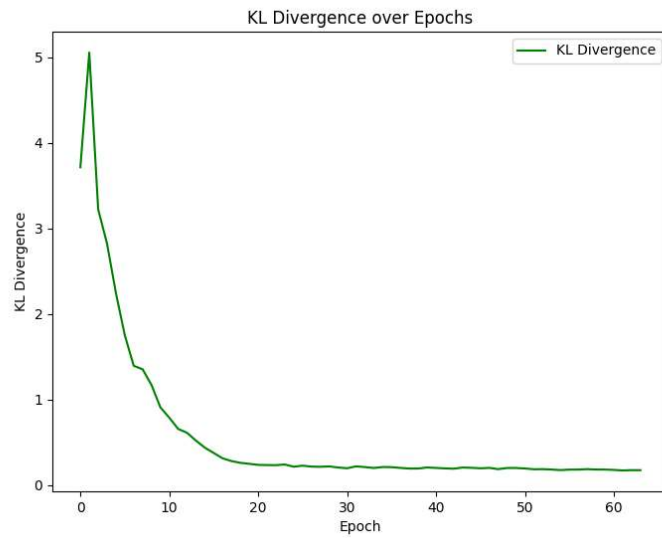


Display of Training Results

Example of $\gamma, \theta \in [73.6, 106.4], E \in [30, 50]$

batch_size = 32 epoch = 64

min_cell = 600



Parameter Setting and Optimization

- Epoch and Batch_size(16&128 32&64)
- Dimension of the Latent Vector ($\alpha = 100$)
- Gradient Penalty Coefficient ($\lambda = 10$)
- N_critic (Number of Critic Iterations per Generator Update)(N_critic = 10)

Future Work

- How to evaluate the model more specifically?
- Does the distribution of noise affect generation?
- Consider a model with variable number of cells (Transformer)
- How are particle and cells information fed into the model?
- Should we set an energy threshold (such as 0.5 MeV)?

Thank you for listening