Personalized Dialogue Generation Based on Contrastive Learning

黄钊恒 2018202064 2021-12-23

Environment

- OS&GPU: Ubuntu 20.04 & Tesla-V100, 16G
- Datasets: PChatbot: A Large-Scale Dataset for Personalized Chatbot
- (https://github.com/qhjqhjoo/SIGIR2021-Pchatbot)

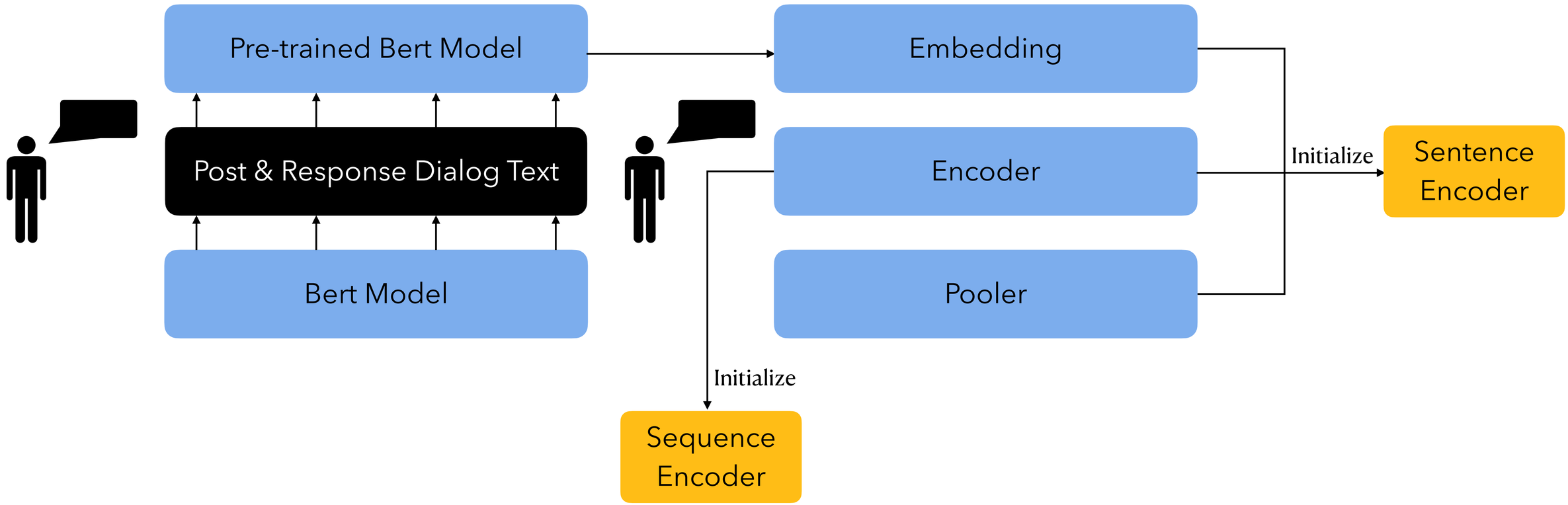
Models

- 4 Phases (overview):
  - Pre-training for BERT
  - Contrastive Learning Pre-train for seq2seq model
  - Fine-tuning for seq2seq model
  - Inference & generation

Phase 1

Pre-training for BERT

- Target: Pre-train a BERT Model with PChatbot (weibo post and response) dataset.
- Auto-encoder: masked language model(mlm)



Phase 2

Contrastive Learning Pre-train for seq2seq model

- Pre-processing: Sampling similar users and responses
- Methodology:
  - 1. Sampling users: apply CBOW models to embed a user into a (vocab_size,) dense vector, measuring with Cosine Similarity
  - 2. Sampling responses: apply word co-occurrence models to embed a sentence into a (vocab_size,) bool vector, measuring with Manhattan Distance

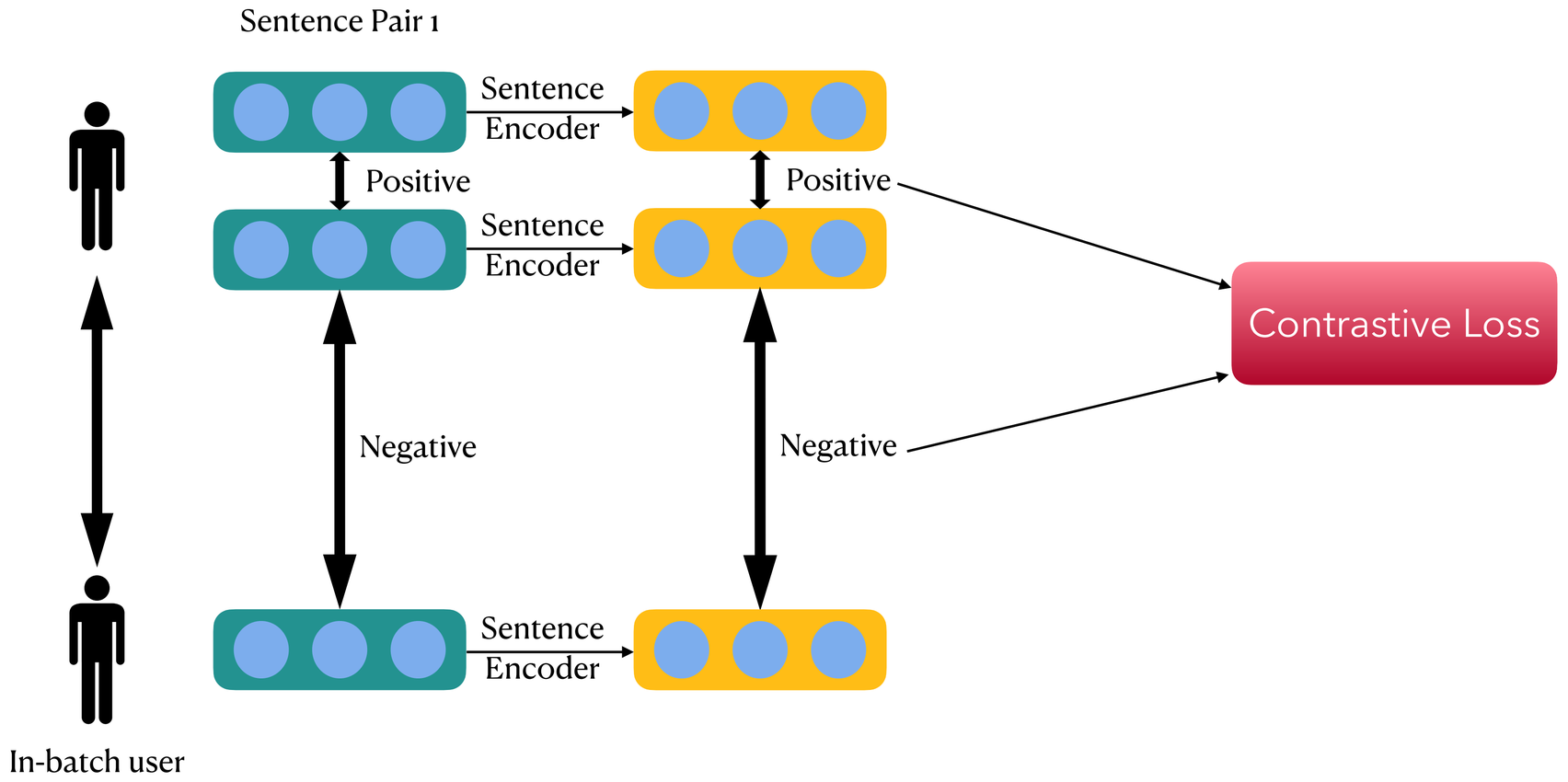
Phase 2

Contrastive Learning Pre-train for seq2seq model

- Components of training loss:
  - 1. Sentence Contrastive Loss
  - 2. Sequence Contrastive Loss
  - 3. User Contrastive Loss

Phase 2: Contrastive Learning Pre-train for seq2seq model

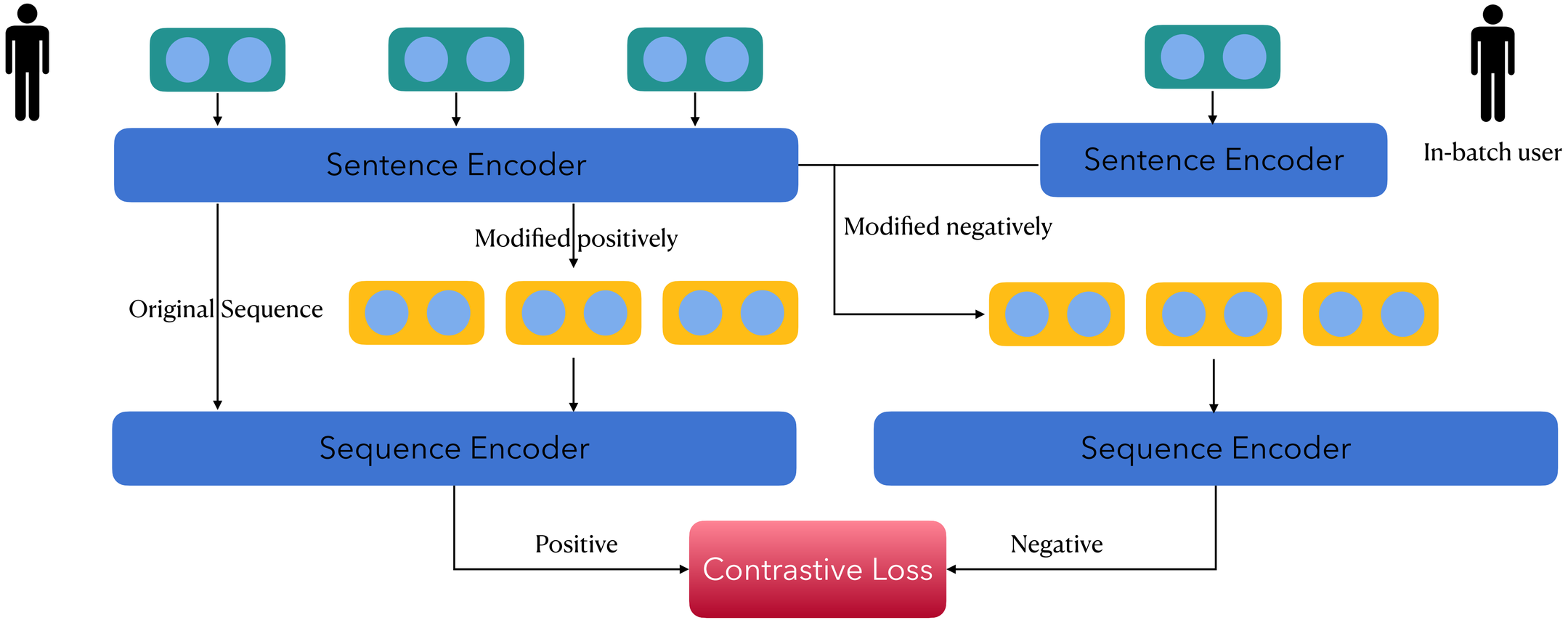
1. Sentence Contrastive Loss



$$loss1 = -log\frac{\Sigma_{s'\in S_{pos}} exp(cos(SenE(s), SenE(s'))}{\Sigma_{s'\in S_{pos}} exp(cos(SenE(s), SenE(s')) + \Sigma_{s'\in S_{neg}} exp(cos(SenE(s), SenE(s'))}$$

Phase 2: Contrastive Learning Pre-train for seq2seq model

2. Sequence Contrastive Loss



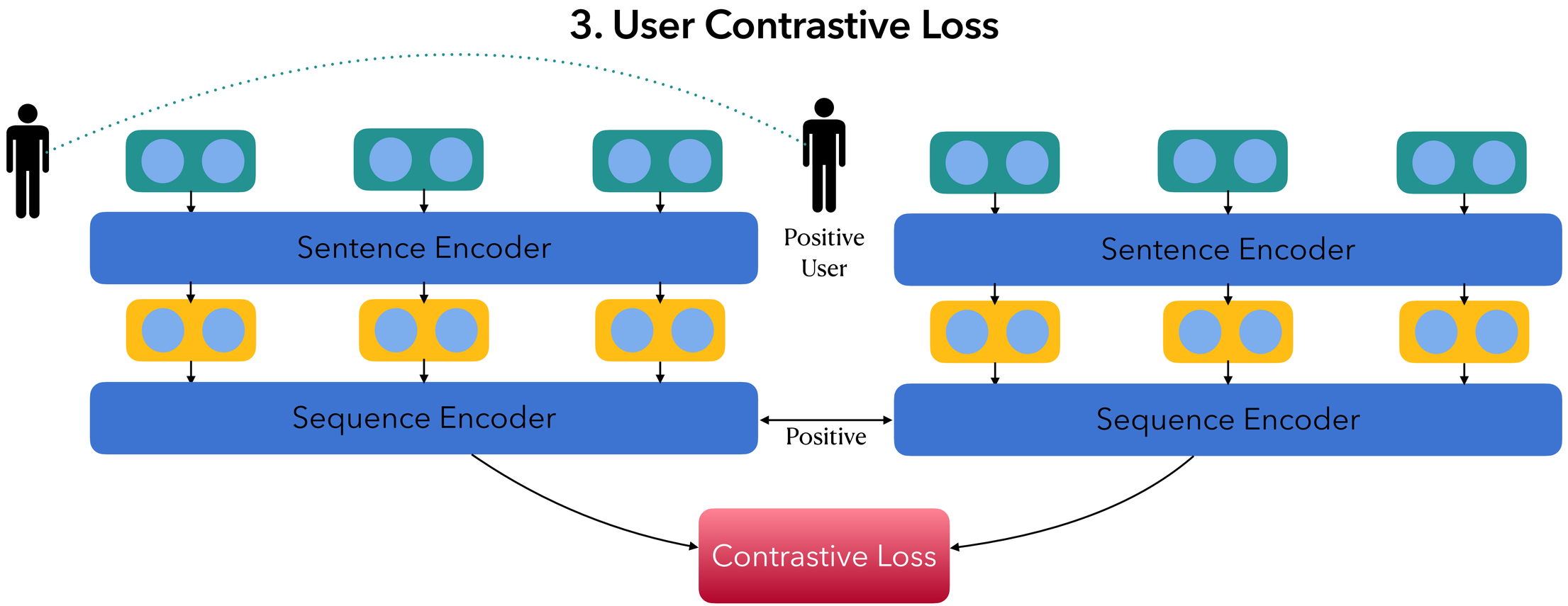
$$loss2 = -\log \frac{\Sigma_{l' \in L_{pos}} exp(cos(SeqE(l), SeqE(l'))}{\Sigma_{l' \in L_{pos}} exp(cos(SeqE(l), SeqE(l')) + \Sigma_{l' \in L_{neg}} exp(cos(SeqE(l), SeqE(l'))}$$

Phase 2: Contrastive Learning Pre-train for seq2seq model

2. Sequence Contrastive Loss

- Modified methods
- 1. Remove a sentence (label = pos)
- 2. Re-order two sentences (label = pos)
- 3. Replace a sentence with another sentence from in-batch user (label = neg)
- 4. Replace and Re-order (label = neg)

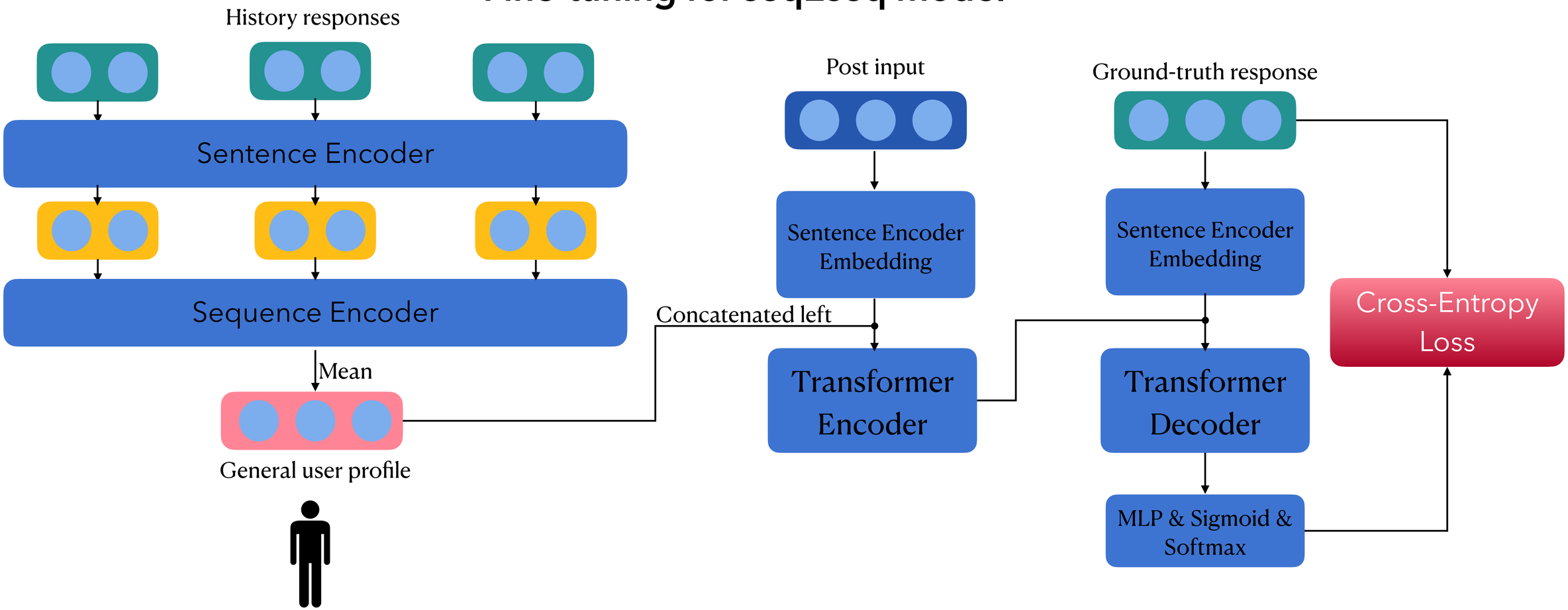
Phase 2: Contrastive Learning Pre-train for seq2seq model



$$loss3 = -\log \frac{\Sigma_{u' \in U_{pos}} exp(cos(SeqnE(u)), cos(SeqnE(u')))}{\Sigma_{u' \in U_{pos}} exp(cos(SeqnE(u)), cos(SeqnE(u'))) + \Sigma_{u' \in U_{neg}} exp(cos(SeqnE(u)), cos(SeqnE(u')))}$$

Phase 3

Fine-tuning for seq2seq model



Phase 4

Inference & generation