Learning Latent Process from High-Dimensional Event Sequences via Efficient Sampling

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Motivation & Background

High-dimensional event sequences are ubiquitous:
- Information cascade in large-scale social networks
- Point-of-interest visiting route in a large city
- Markers contain plenty of combinational features

Main challenges for high-dimensional event sequence modeling:
- Unknown networks among high-dimension markers
- Multiply subsequences of interdependent events
- Hard to measure the discrepancy

Problem Formulation

Methodology

- hidden relation network $\rightarrow$ graph attention network
  \[ p(m_j \in N_i) = \frac{\exp(w_i^T [d_j])}{\sum_{j=1}^{N} \exp(w_i^T [d_j])} \]
- temporal point process $\rightarrow$ attentive intensity model
  \[ h_n = \text{MultiHeadAttn}(e_0, e_1, \ldots, e_n), n = 0, 1, \ldots, k_i \]
- Random walk approach for marker generation
  \[ p(m_j \in N_i | m_j \in N_i) = \frac{\exp(w_i^T [h_n] + b_i)}{\sum_{j=1}^{N} \exp(w_i^T [h_n] + b_i)} \]
- Adversarial generative imitation learning
  \[ \min -H(\pi) + \max \mathbb{E}_{r \sim S} [r(S^*)] - \mathbb{E}_{s \sim S} [r(S)] \]

Experiments

- Sampling for the marker and time of new event
- Prediction of next event’s time and marker
- Reconstruction of marker relation network
- Scalerability to million-level markers