Multimodal Next POI Recommendation Based On GNN

Group 16

City University of Hong Kong

Proposal Presentation

Contents

Motivation & Background

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Motivation

- Enhance user experience through personalized POI recommendations.
- Traditional methods fail to capture complex social and content-based relationships.
- Leveraging GNNs and GANs may better model these intricate relationships.

Background

- **Graph Neural Networks (GNNs):** Effective for modeling graph-structured data.
- **Generative Adversarial Networks (GANs):** Used for extracting and utilizing image features.

Task & Challenges

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Task

- Extract business-related image features using GAN and classify them as its visual features.
- Merge the above features with other features for embedding.
- Use GNN to build a Nest POI recommendation system based on the User-User graph and the User-Business graph.

Challenges

- Integrating heterogeneous data sources (social network, textual, visual).
- Handling data sparsity and scalability issues.
- Effectively modeling complex user-business interactions.

Proposed Approach

Proposed Approach

Model Design:

- Use Clustering GAN to classify images and extract visual features for businesses.
- Integrate multimodal embeddings for enhanced recommendation accuracy.
- Employ GNNs (e.g., GAT[3], GraphSAGE [1]) to learn node embeddings capturing graph structures.

Model Architecture

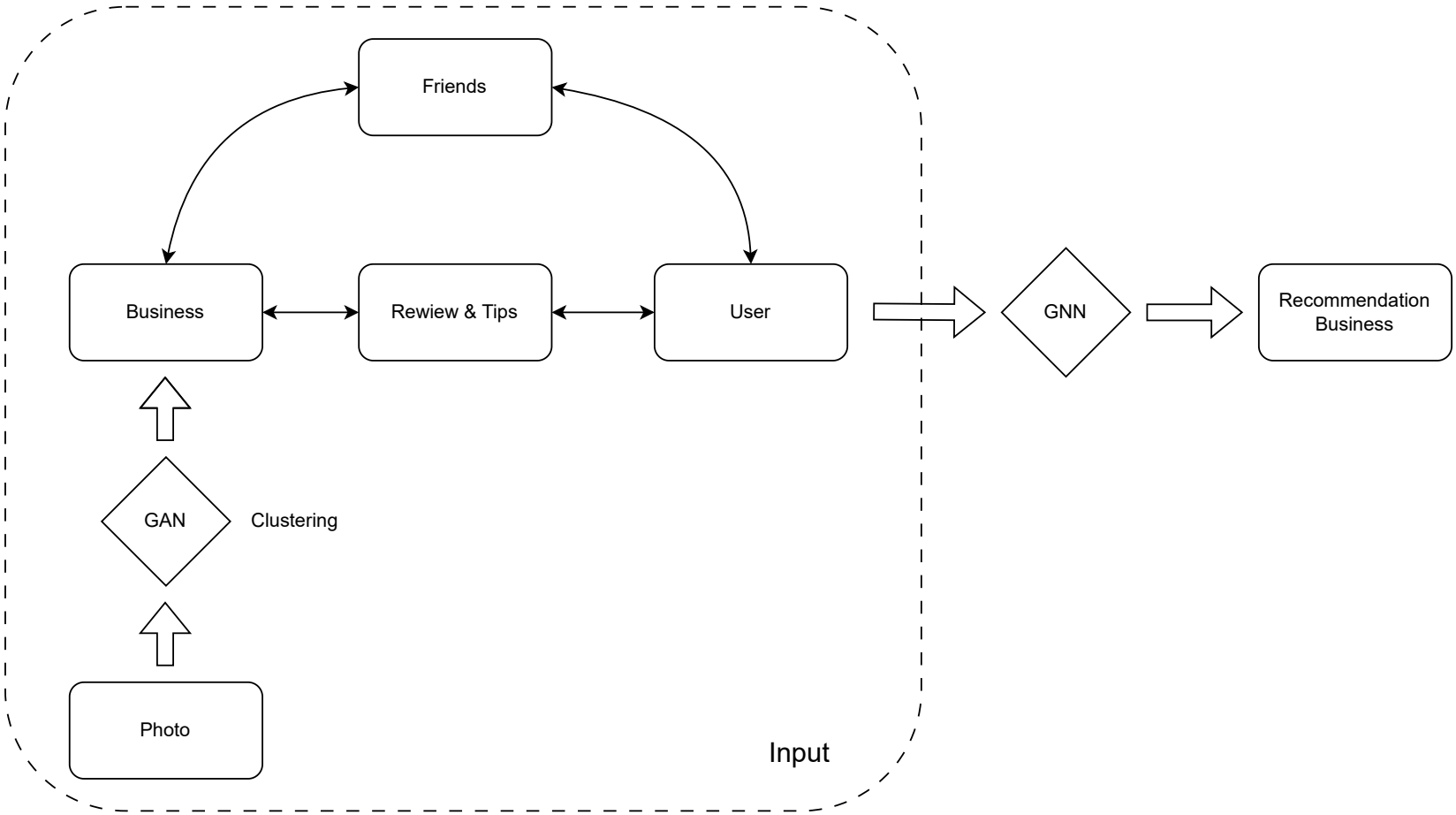

Figure: Model Architecture

Proposed Approach

Graph Construction:

- Build user-user friendship graphs.
- Create user-business interaction graphs.
- Develop business-business similarity graphs based on categories and reviews.

Graph Architecture

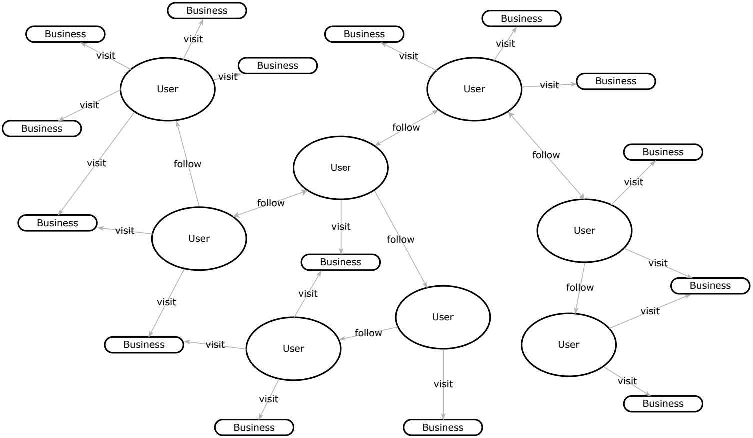

Figure: Graph Architecture

Proposed Approach

Feature Extraction:

- **User Features:** Review counts, ratings, social influence metrics.
- **Business Features:** Longitude, Latitude, Stars, Review_count.
- **Image Features:** Extracted using GAN (e.g., Clustering GAN [2]) from business photos.

Feature Selection

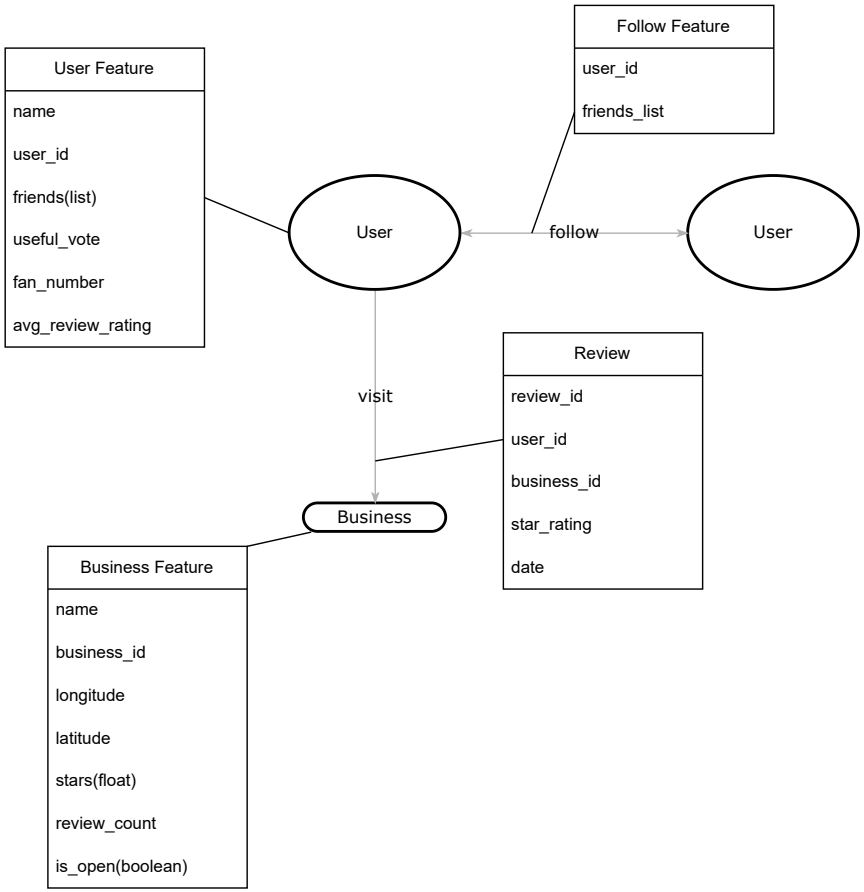

Figure: Feature Selection

Planned Experiments

Planned Experiments

- **Dataset Preparation:**
  - Do training and test set splitting
  - Utilize provided data to construct graphs and extract features.
  - Preprocess images for feature extraction.
- **Evaluation Metrics:**
  - Precision@K, Recall@K, F1-score, NDCG, etc.
- **Baseline Comparisons:**
  - Compare with traditional collaborative filtering methods (e.g., Matrix Factorization).
  - Compare with other graph-based recommendation systems (e.g., GCN).
- **Ablation Studies:**
  - Assess the impact of each component (GNN, GAN, image features, etc).
  - Evaluate performance without social network information.
- **Hyperparameter Tuning**

Thank you!

References

[1] Will Hamilton, Zhitao Ying, and Jure Leskovec. Inductive representation learning on large graphs. *Advances in neural information processing systems*, 30, 2017.

[2] Sudipto Mukherjee, Himanshu Asnani, Eugene Lin, and Sreeram Kannan. Clustergan: Latent space clustering in generative adversarial networks. In *Proceedings of the AAAI conference on artificial intelligence*, volume 33, pages 4610–4617, 2019.

[3] Petar Veličković, Guillem Cucurull, Arantxa Casanova, Adriana Romero, Pietro Lio, and Yoshua Bengio. Graph attention networks. *arXiv preprint arXiv:1710.10903*, 2017.