

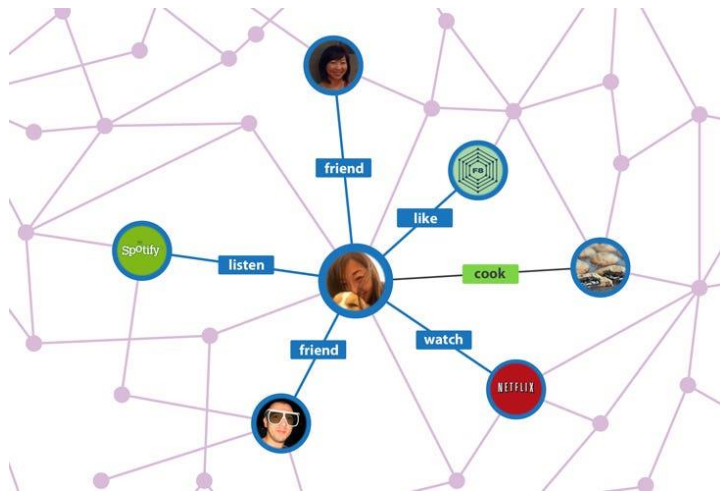
# EvolveGCN: Evolving Graph Convolutional Networks for Dynamic Graphs

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# Graphs from **social networks**

- Dynamic graph - # of users, connections, weights
- Static graph is inefficient with large nodes
- How to consider the dynamics of graph?



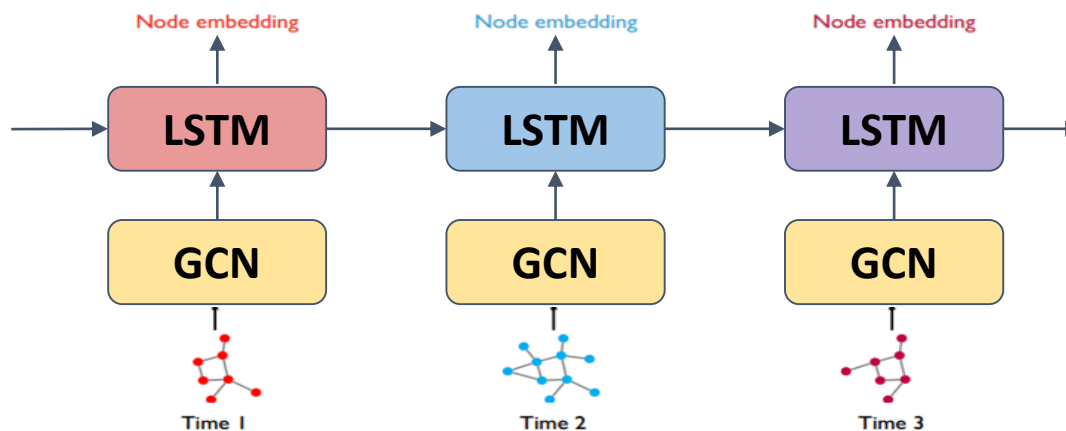
Static Social Graphs



Dynamic Social Graphs

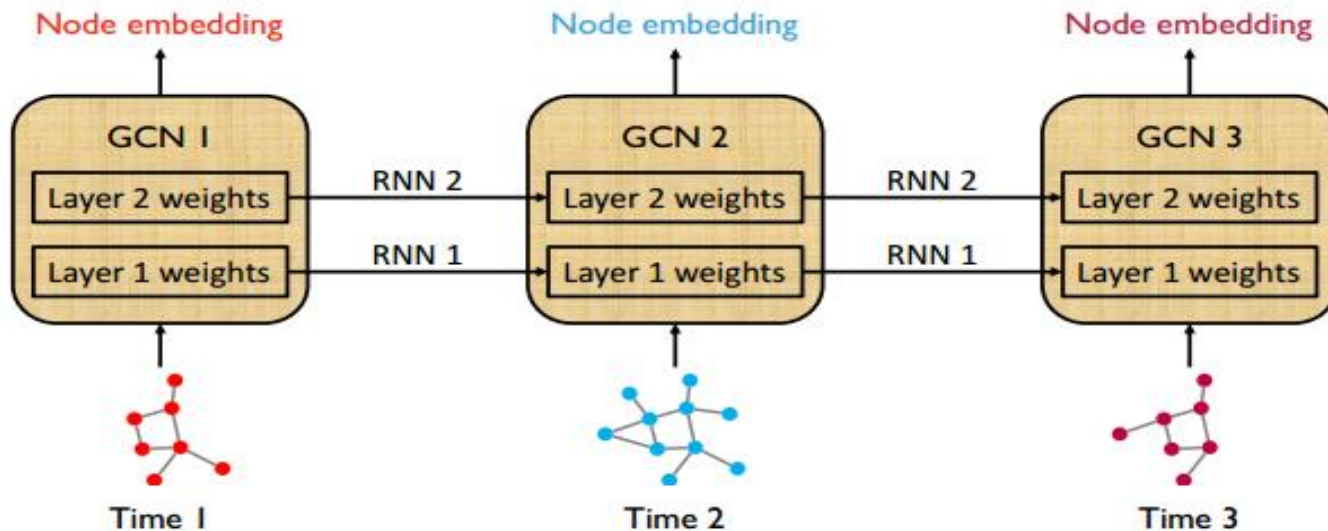
# Dynamic Graphs

- GNN with RNN
  - Introducing the concept of RNN
  - Seo et al. 2016, Manessia et al. 2017, Narayan et al. 2018
- GCN as feature extractor, LSTM as embedding network
- Weakness
  - One single GNN is learned for all graphs on the temporal axis
  - Node embedding is questionable when nodes dis/appear



# IDEAs

- Use the RNN to regulate the GCN model at every step
  - Only **RNN parameters are trained**, not GCN
  - RNN updates the weights  $W_t^{(l)}$  of GCN based on the current information ( $W_{t-1}^{(l)}, H_t^{(l)}$ )
  - Two ways – with GRU, LSTM

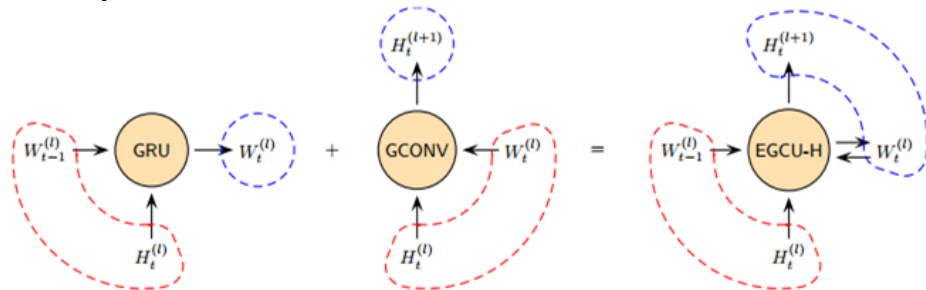


# IDEAs

## Two types of EvolveGCN

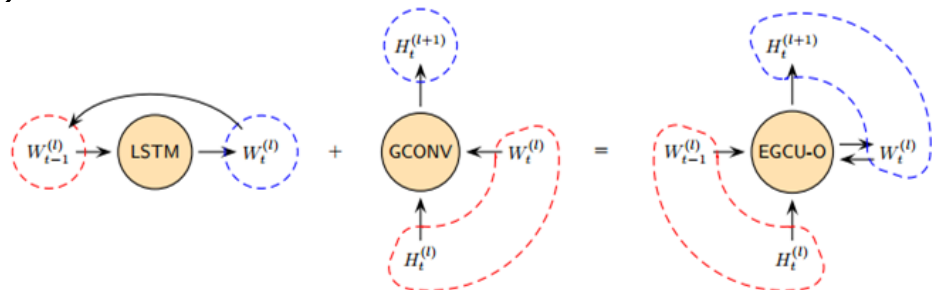
### ■ EvolveGCN-H

- $W_t^{(l)} = GRU(W_{t-1}^{(l)}, H_t^{(l)})$  - when information in  $H_t^{(l)}$  is enough



### ■ EvolveGCN-O

- $W_t^{(l)} = LSTM(W_{t-1}^{(l)})$  - when information in  $H_t^{(l)}$  is **not** enough



# Applications

- Task

- Link prediction
- Edge classification
- Node Classification

- Applications

- Stochastic Block Model
- Bitcoin OTC, Alpha
- Autonomous system
- Reddit Hyperlink Network

**Thank you!**