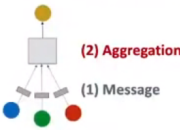



10.1 Heterogeneous & Knowledge Graph Embedding


Recap: A Single GNN Layer

Recap: A Single GNN Layer

- **A single GNN layer:**
 - **(1) Message:** each node computes a message
$$\mathbf{m}_u^{(l)} = \text{MSG}^{(l)}(\mathbf{h}_u^{(l-1)}), u \in \{N(v) \cup v\}$$
 - **(2) Aggregation:** aggregate messages from neighbors
$$\mathbf{h}_v^{(l)} = \text{AGG}^{(l)}(\{\mathbf{m}_u^{(l)}, u \in N(v)\}, \mathbf{m}_v^{(l)})$$
 - **Nonlinearity (activation):** Adds expressiveness
 - Often written as $\sigma(\cdot)$: $\text{ReLU}(\cdot)$, $\text{Sigmoid}(\cdot)$, ...
 - Can be added to **message or aggregation**






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Stanford CS224W:
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Lecture 10.1
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回顾GNN

一个单层 GNN 层应该包括:

(1) Message

$$\mathbf{m}_u^{(l)} = \text{MSG}^{(l)}(\mathbf{h}_u^{(l-1)}), u \in \{N(v) \cup v\}$$

每个节点计算一个消息

(2) Aggregation

$$\mathbf{h}_v^{(l)} = \text{AGG}^{(l)}(\{\mathbf{m}_u^{(l)}, u \in N(v)\}, \mathbf{m}_v^{(l)})$$

从邻居节点聚合消息

Recap: Classical GNN Layers: GCN(1)

Kipf and Welling. [Semi-Supervised Classification with Graph Convolutional Networks](#), ICLR 2017

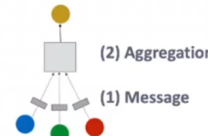
Recap: Classical GNN Layers: GCN (1)

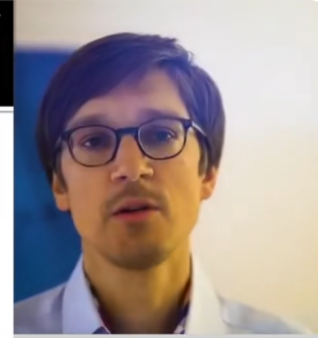
- (1) Graph Convolutional Networks (GCN)


$$\mathbf{h}_v^{(l)} = \sigma \left(\mathbf{W}^{(l)} \sum_{u \in N(v)} \frac{\mathbf{h}_u^{(l-1)}}{|N(v)|} \right)$$

- How to write this as Message + Aggregation?

$$\mathbf{h}_v^{(l)} = \sigma \left(\underbrace{\sum_{u \in N(v)} \mathbf{W}^{(l)} \frac{\mathbf{h}_u^{(l-1)}}{|N(v)|}}_{\text{Aggregation}} \right)$$







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先回顾一下简单的 GCN

- Message: 通过 $\mathbf{W}^{(l)}$ 进行线性变化
- Aggregation: 简单求和后平均