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READING ASSIGNMENT - 5

Topic : Semi Supervised learning

Reference paper :

GCN : Kipf and Welling, SEMI-SUPERVISED CLASSIFICATION WITH GRAPH CONVOLUTIONAL NETWORKS.

Summary:

- The paper proposes a Graph Convolutional Network (GCN) model for semi-supervised classification on graph-structured data.
- The model operates by propagating node feature information across neighbors using a neural network framework.
- A localized first-order approximation of spectral graph convolutions is used as the layer-wise propagation rule.
- This allows the model to scale linearly in the number of graph edges while encoding both structure and features.
- Experiments on citation networks and a knowledge graph dataset show GCN outperforms related methods like graph embeddings.
- Analysis demonstrates the advantages of the proposed propagation model over alternatives.

Pros:

- Achieves state-of-the-art results on benchmark graph classification tasks.
- The Propagation mechanism allows encoding both graph structure and node features.
- Computationally efficient and scalable compared to prior graph CNN methods.
- End-to-end learning approach avoids the need for a pipeline of steps like in graph embeddings.
- Model has strong theoretical grounding from links to spectral graph theory and WL algorithm.

Cons:

- Model is restricted to undirected graphs - it does not natively support directed graphs or graphs with asymmetric relationships. Adjacency matrix needs to be symmetric.
- Memory usage may still be high for very large graphs that don't fit in memory.
- Number of layers is limited for deeper models without residual connections.
- Restricted to transductive learning settings, can't generalize to unseen graphs.
- Learned representations may be harder to interpret than some unsupervised embeddings.
- Depth of model is limited without residual connections - stacking many layers lead to over smoothing and degraded performance.