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1 Question 1

To avoid immediately revisiting a node, we need to add a verify that a node hasn't been added to the random walk. In my implementation of the random walk, I add the new chosen node at the end of a list.

At time i, the node v_i is added to the list random_walk and can be accessed by random_walk[-1]. At time i+2, we will choose another node v_{i+2}. To make sure we don't have a noisy random walk, we just need to verify that $v_i \neq v_{i+2}$ or $v_{i+2} \neq random\_walk[-2]$.

2 Question 2

In the node classification architecture, we extract local features at a vertex level. One way of extension into a graph classification architecture could be to sum up these features, producing a graph-level feature used for graph classification.

In [1], they show an architecture called DGCNN (Deep Graph Convolutional Neural Network) capable of performing graph classification in an end to end deep neural network architecture.

DGCNN features a propagation-based graph convolution layer to extract vertex features, as well as a novel SortPooling layer which sorts vertex representations instead of summing them up.
It can be summed up in the following layers :

1. Graph convolution layers : to extract vertices local features
2. SortPooling layer : sorts the vertex features under the previously defined order
3. Traditional convolutional and dense layers : read the graph representations and make predictions.

3 Question 3

The deepWalk + Logistic regression method performs a 0.85 accuracy. For 100 epochs, the GNN has a lower performance with only 0.42 accuracy, when running for 1000 epochs, it achieves a similar accuracy.

However, the main issue with DeepWalk is that it lacks the ability of generalization. Whenever a new node comes in, it has to re-train the model in order to represent this node.

4 Question 4

Changing the features to all ones provides the same accuracy after re-training and re-testing. And that is due to the normalization trick.

References

[1] Muhan Zhang, Zhicheng Cui, Marion Neumann, and Yixin Chen. An end-to-end deep learning architecture for graph classification. In *AAAI*, pages 4438–4445, 2018.