Graph Neural Network Tutorial

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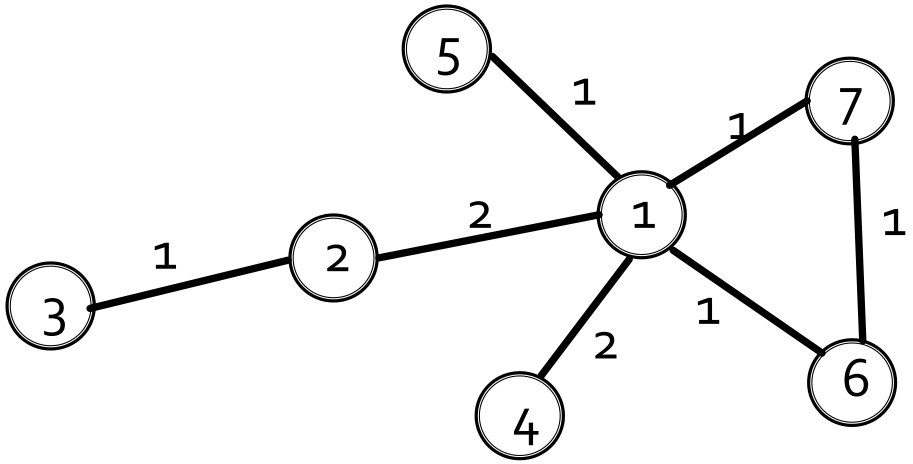
Question:

Given a graph below (next page), the task is to do node-wise classification using a 2-layer graph convolutional network (GCN) and a cross-entropy loss.

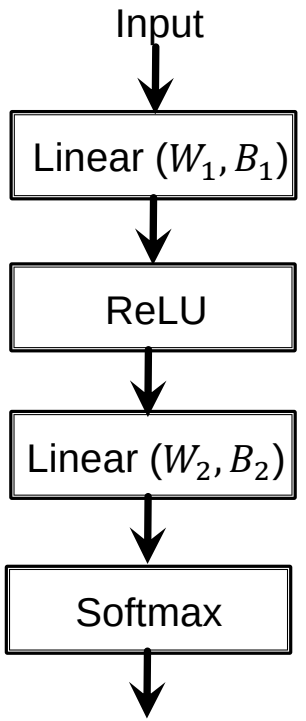


Input graph

(continued from last page)

The initial node features and the GCN network architecture are given below:

$$x_1 = [0, -1]^T,$$
$$x_2 = [0, 1]^T,$$
$$x_3 = [-1, 0]^T,$$
$$x_4 = [1, \ 0]^T,$$
$$x_5 = [-1, -1]^T,$$
$$x_6 = [2, 1]^T,$$
$$x_7 = [-1, 1]^T.$$



GCN architecture

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The initial GCN weight parameters given below (W_k and B_k are the weight matrices for neighborhood aggregation and self transformation, respectively, for the k-th layer).

Calculate the prediction of **node 3** by performing one forward pass.

$$W_1 = \begin{bmatrix} 0 & -0.1 \\ 0.1 & 0 \end{bmatrix} \quad B_1 = \begin{bmatrix} 0.1 & 0 \\ 0 & -0.1 \end{bmatrix}$$

$$W_2 = \begin{bmatrix} -0.1 & 0 \\ 0 & 0.1 \end{bmatrix} \quad B_2 = \begin{bmatrix} 0 & 0.1 \\ -0.1 & 0 \end{bmatrix}$$