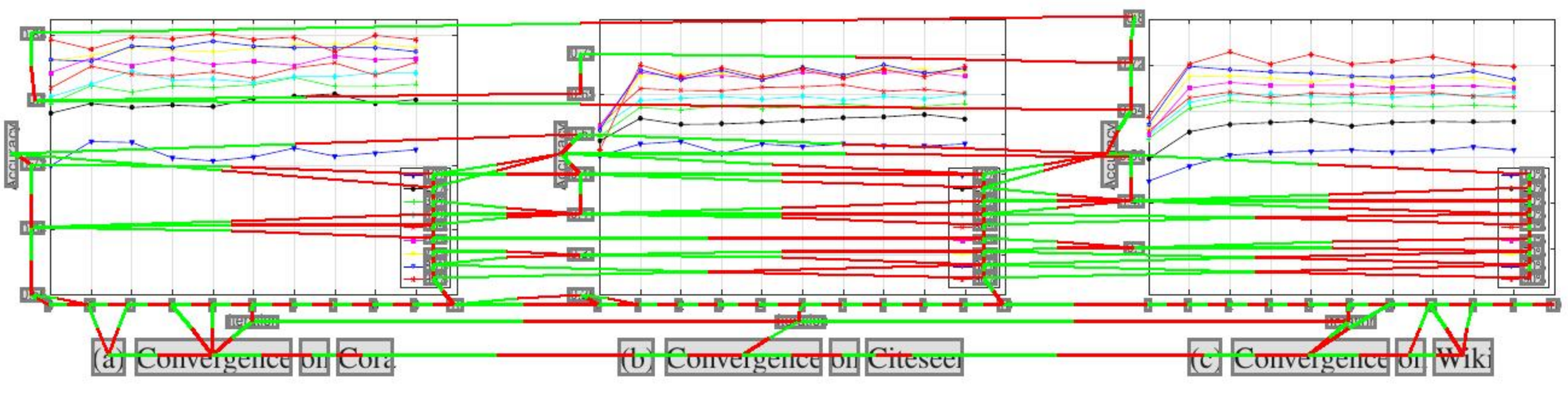
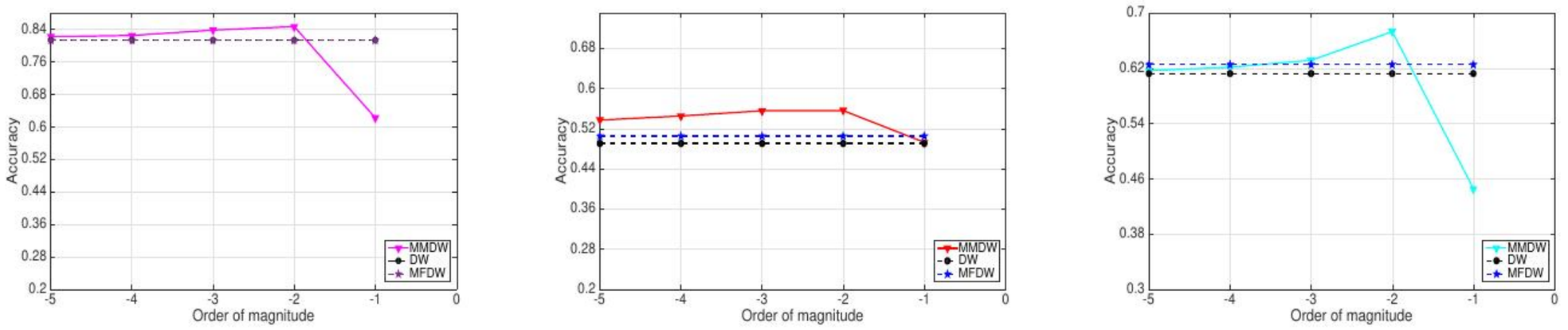
Table 3: Accuracy (%) of vertex classification on Wiki.

%Labeled Nodes	10%	20%	30%	40%	50%	60%	70%	80%	90%
DW	52.05	54.62	59.80	60.29	61.20	65.41	65.84	66.53	68.16
MFDW	56.40	60.28	61.96	63.39	62.59	62.87	64.45	62.71	61.63
LINE	52.17	53.62	57.81	57.26	58.94	62.46	62.24	66.74	67.35
MMDW($\gamma = 10^{-2}$)	**57.76**	**62.34**	**65.76**	**67.31**	**67.33**	**68.97**	**70.12**	**72.82**	**74.29**
MMDW($\gamma = 10^{-3}$)	54.31	58.69	61.24	62.63	63.18	63.58	65.28	64.83	64.08
MMDW($\gamma = 10^{-4}$)	53.98	57.48	60.10	61.94	62.18	62.36	63.21	62.29	63.67



(a) Convergence on Cora (b) Convergence on Citeseer (c) Convergence on Wiki



(d) Parameter sensitivity on Cora (e) Parameter sensitivity on Citeseer (f) Parameter sensitivity on Wiki

Figure 2: Convergence and parameter sensitivity on different datasets

Figure 3: t-SNE 2D representations on Wiki (left: DeepWalk right: MMDW).

6 6 Conclusion and Future Work

In this paper, we propose max-margin DeepWalk (MMDW), a discriminative representation learning model for social networks. With the introduction of labeling information and max-margin principle, MMDW learns vertex representations which reflect both their network structure and labeling information. Experimental results on real-world datasets show that MMDW is effective for predictive tasks. Moreover, visualizations of the learnt representations confirm the discrimination of MMDW.

We will explore more in future work as follows:

• We have proved the effectiveness of max-margin DeepWalk. In the future, we aim to explore how to conduct max-margin methods on other social representation learning models, such as LINE.

• We learn a discriminative DeepWalk by transforming the orignal DeepWalk into matrix factorization form. In this way, it's easier to balance the bias vector and the gradient. Nevertheless, it's an offline method. In the future, we strive to explore the online discriminative learning methods.

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