A Probabilistic Framework for Land Deformation Prediction

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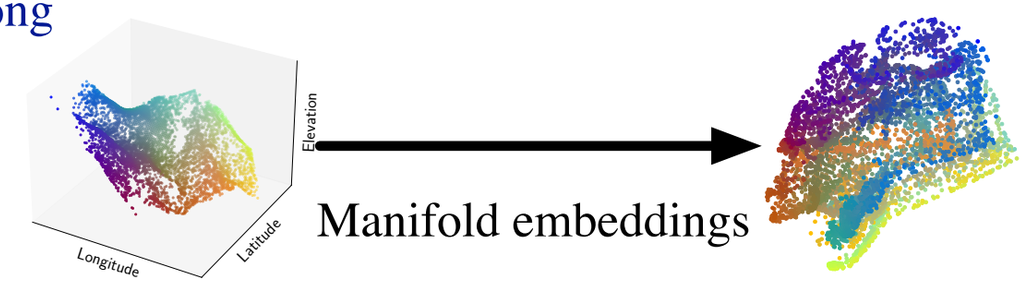
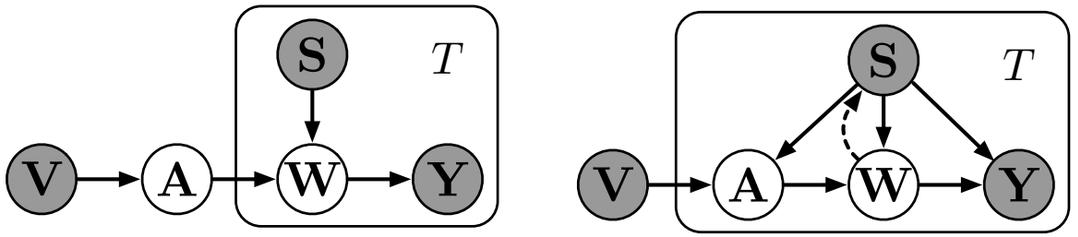


Comparisons and Contributions



Existing methods DAPF

1. Existing approaches lack a dynamic adjacency matrix and only catch static spatial interactions

2. Most existing methods simplify the conditional dependencies, which inevitably cause information loss

3. Prior distributions of variables are ignored, resulting in an over-smoothing problem

Method

Learning manifold embeddings via noised normalizing flow

$$\log p(\mathbf{v}_i + \mathbf{s}_i^\tau) = \log p(\mathbf{u}_i^\tau) - \log \left| \det \frac{\partial f^{-1}(\mathbf{u}_i^\tau | \mathbf{s}_i^\tau)}{\partial \mathbf{u}_i^\tau} \right|$$

Optimize the Evidence Lower Bound

$$D_{\mathrm{KL}}\left(q_\varphi \| p\left(\mathbf{W}\right)\right) - \mathbb{E}_{q_\varphi}[\log p\left(\mathbf{A}, \mathbf{S} | \mathbf{W}\right)]$$
$$- H[q_\phi\left(\mathbf{Y} | \mathbf{W}, \mathbf{S}\right)] - \mathbb{E}_{q_\phi}[\log p\left(\mathbf{Y}\right)]$$

Experiments

Method	RMSE	MAE	ACC	EVS
Historical Average	6.067	4.010	0.050	0.164
GRU	0.200	0.160	0.540	0.137
(Chen et al. 2018)	0.053	0.041	0.710	0.412
(Wu et al. 2020)	0.041	0.027	0.854	0.426
(Zhou et al. 2021)	0.024	0.018	0.956	0.478
DAPF	**0.016**	**0.013**	**0.978**	**0.496**