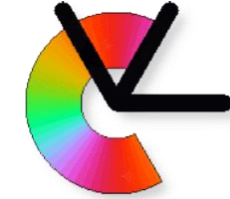


DiffSF: Diffusion Models for Scene Flow Estimation

Yushan Zhang, Bastian Wandt, Maria Magnusson, Michael Felsberg



Problem Formulation:

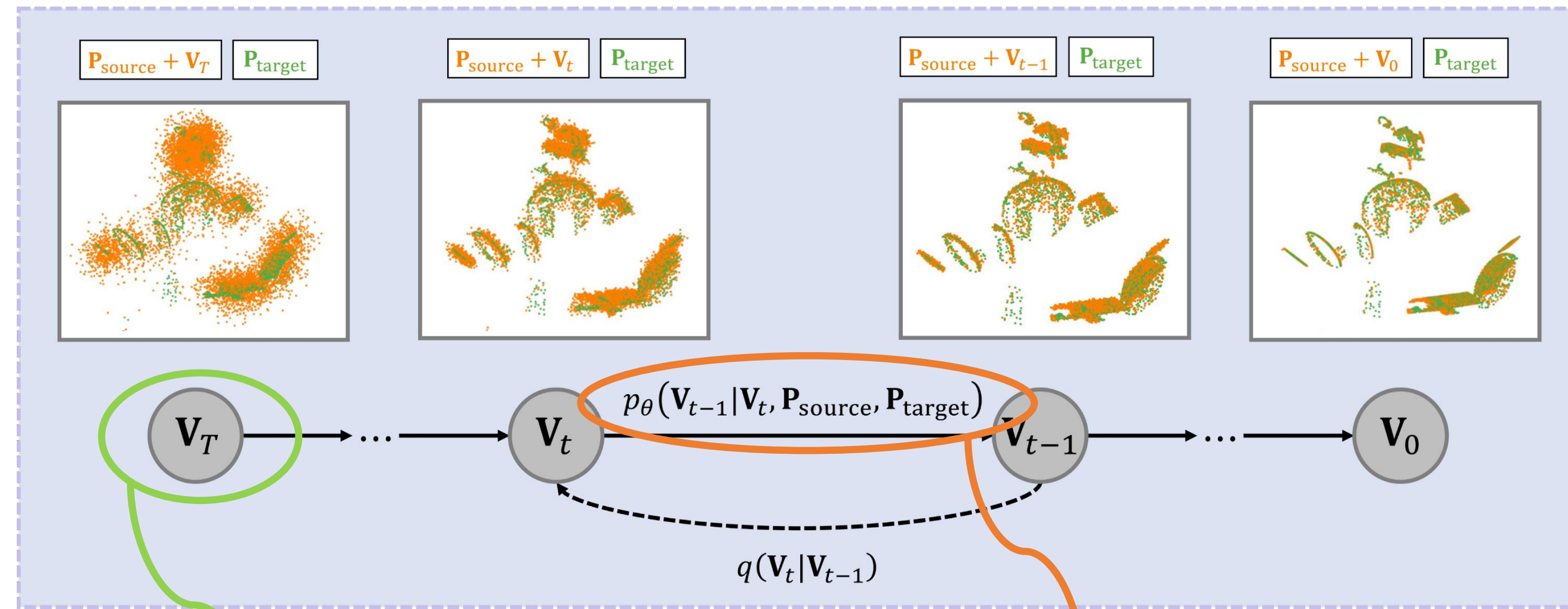
- Source point cloud: $\mathbf{P}_{\text{source}} \in \mathbb{R}^{N_1 \times 3}$
- Target point cloud: $\mathbf{P}_{\text{target}} \in \mathbb{R}^{N_2 \times 3}$
- Objective: Scene flow vector field $\mathbf{V} \in \mathbb{R}^{N_1 \times 3}$



Motivations

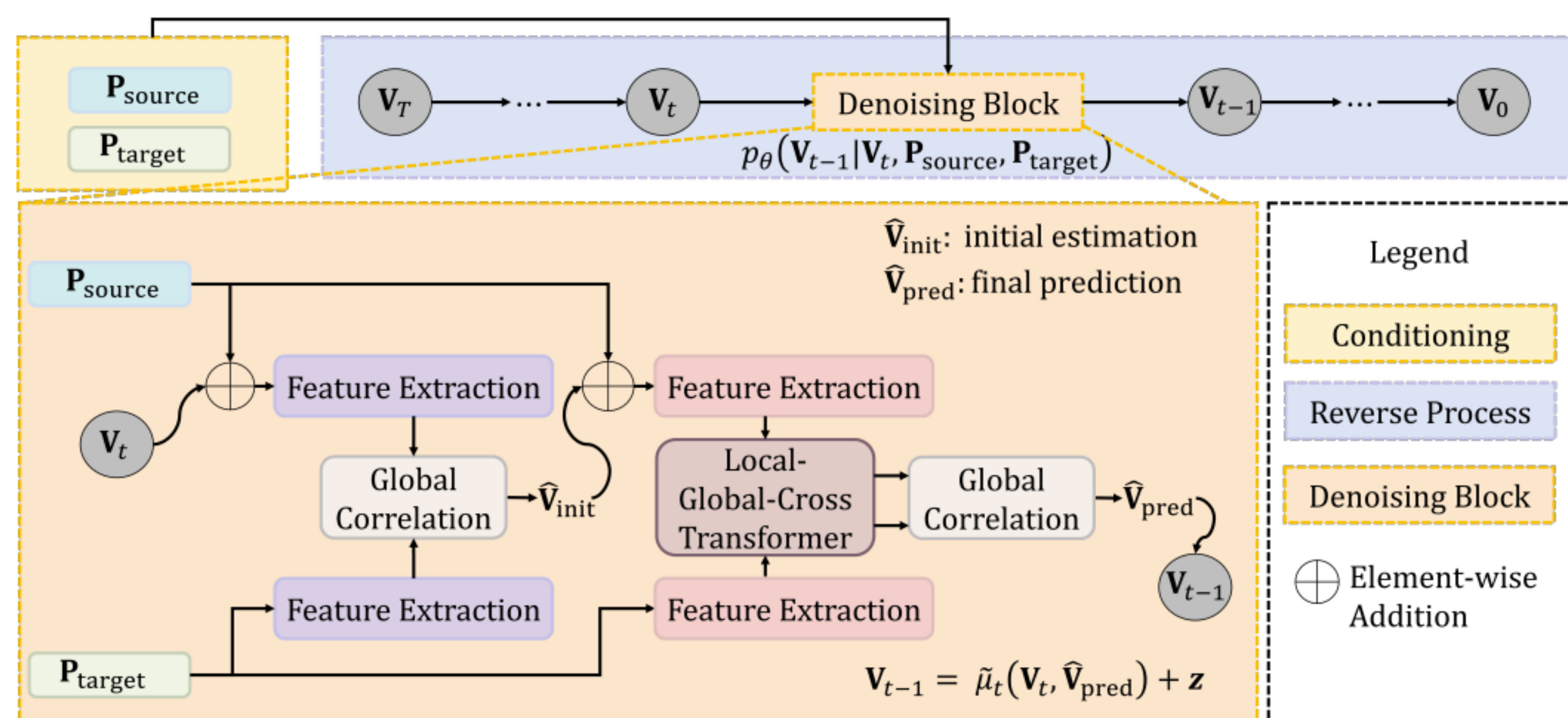
- Deal with **noisy input**.
- Enable **uncertainty estimation**.
- Develop a **novel architecture** based on transformers to learn the reverse diffusion process.

Overall Framework

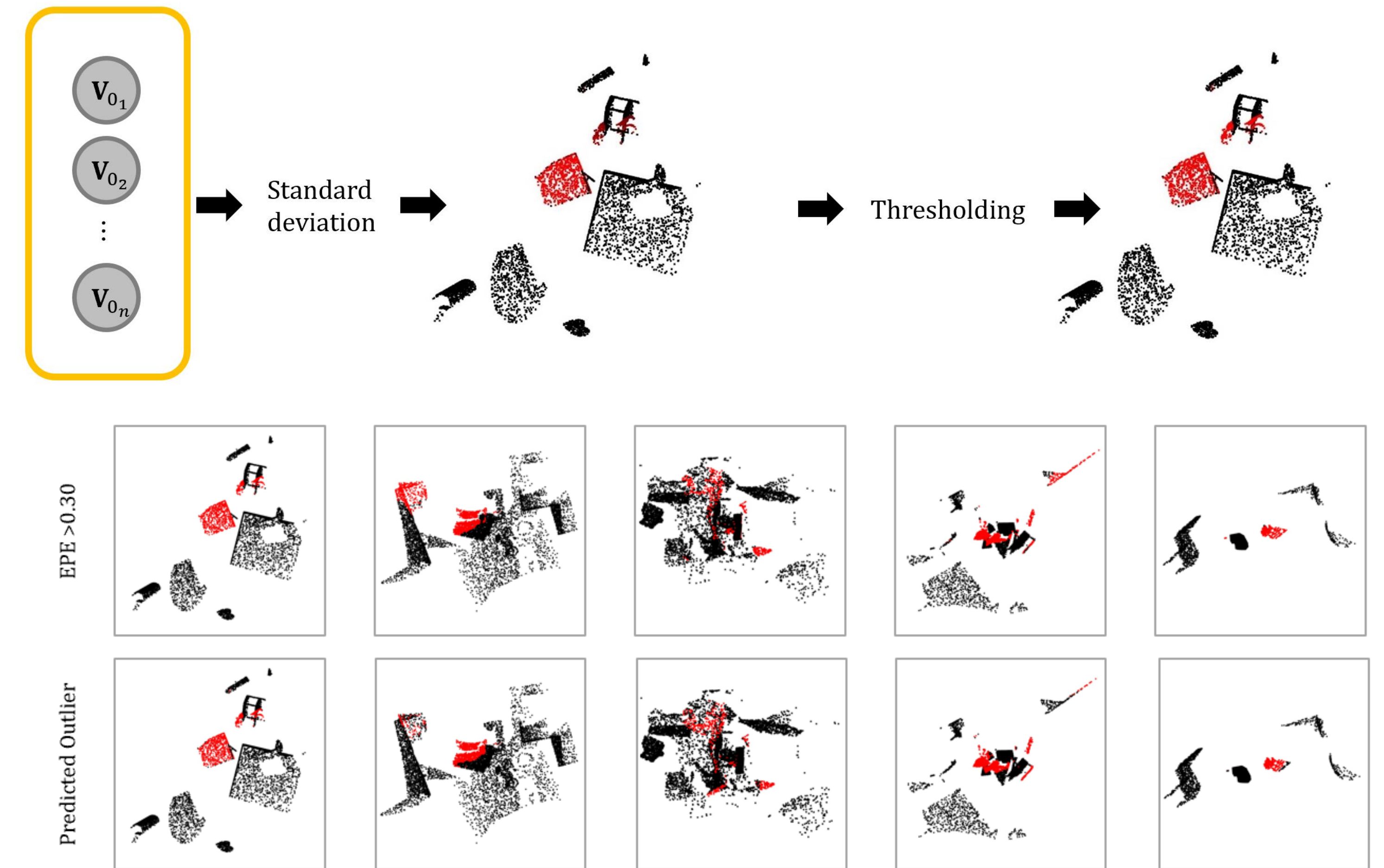


To learn by **ANY** neural network!

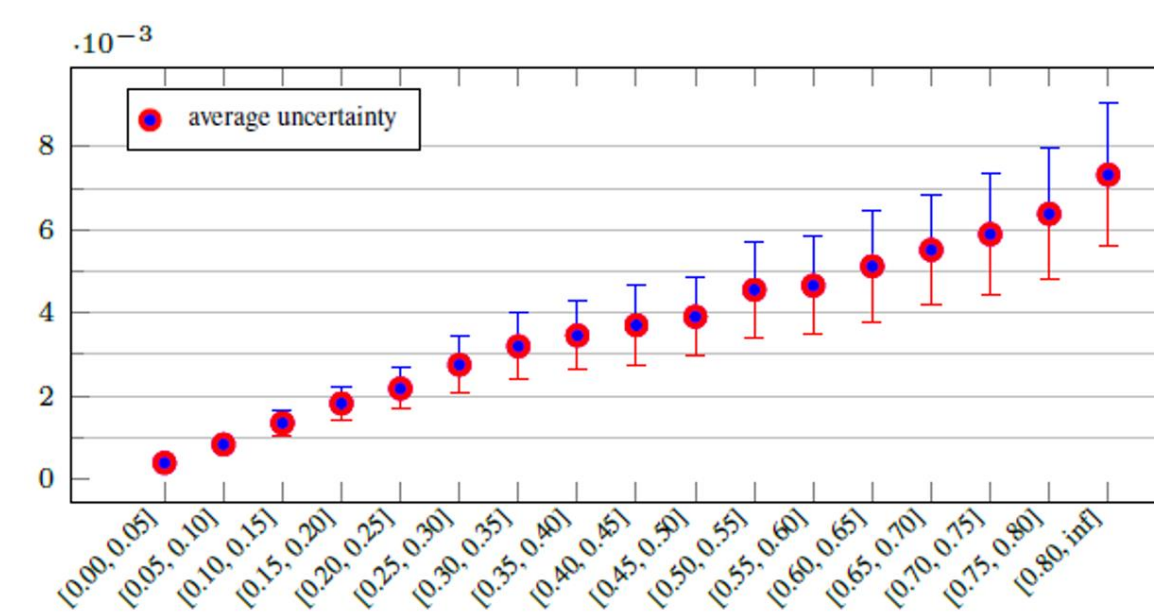
Multiple inference to indicate **uncertainty**!



Uncertainty Estimation



Results



Method	EPE _{3D} ↓	ACC _S ↑	ACC _R ↑	Outliers ↓	EPE _{3D} ↓	ACC _S ↑	ACC _R ↑	Outliers ↓
FlowNet3D (25)CVPR'19	0.157	22.8	58.2	80.4	0.183	9.8	39.4	79.9
HPLFlowNet (11)CVPR'19	0.168	26.2	57.4	81.2	0.343	10.3	38.6	81.4
PointPWC (44)ECCV'20	0.155	41.6	69.9	63.8	0.118	40.3	75.7	49.6
FLOT (29)ECCV'20	0.153	39.6	66.0	66.2	0.130	27.8	66.7	52.9
Bi-PointFlow (6)ECCV'22	0.073	79.1	89.6	27.4	0.065	76.9	90.6	26.4
3DFlow (39)ECCV'22	0.063	79.1	90.9	27.9	0.073	81.9	89.0	26.1
MSBRN (7)ICCV'23	0.053	83.6	92.6	23.1	0.044	87.3	95.0	20.8
DiffFlow3D (24)CVPR'24	0.047	88.2	94.0	15.0	0.029	95.9	97.5	10.8
GMSF (46)NIPS'23	0.022	95.0	97.5	5.6	0.033	91.6	95.9	13.7
DiffSF(ours)	0.015	96.7	98.1	3.5	0.029	94.5	97.00	13.0

Figure 1: Uncertainty-error correspondence

Table 1: State-of-the-art comparison on Flyingthings3D dataset