DIFFUSION MODEL as a ROBUST CLASSIFIER for Learning from NOISY LABELS

Jian Chen, Ruiyi Zhang, Tong Yu, Rohan Sharma,
Zhiqiang Xu, Tong Sun, Changyou Chen

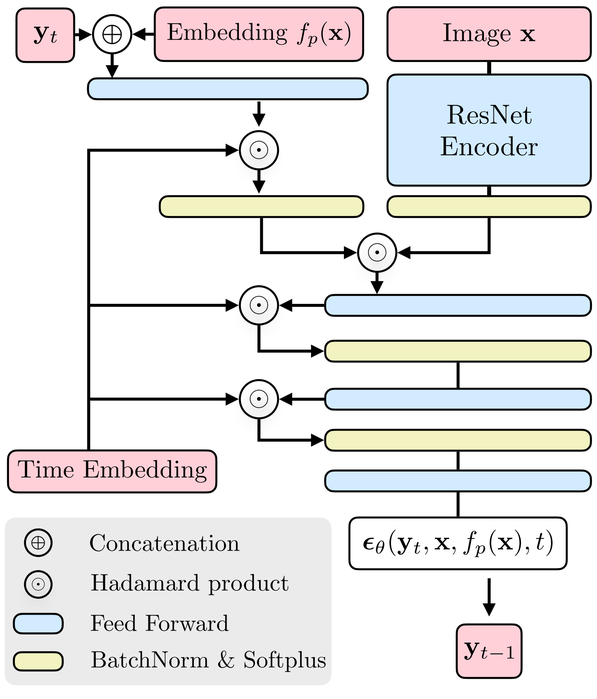
NEURAL INFORMATION PROCESSING SYSTEMS

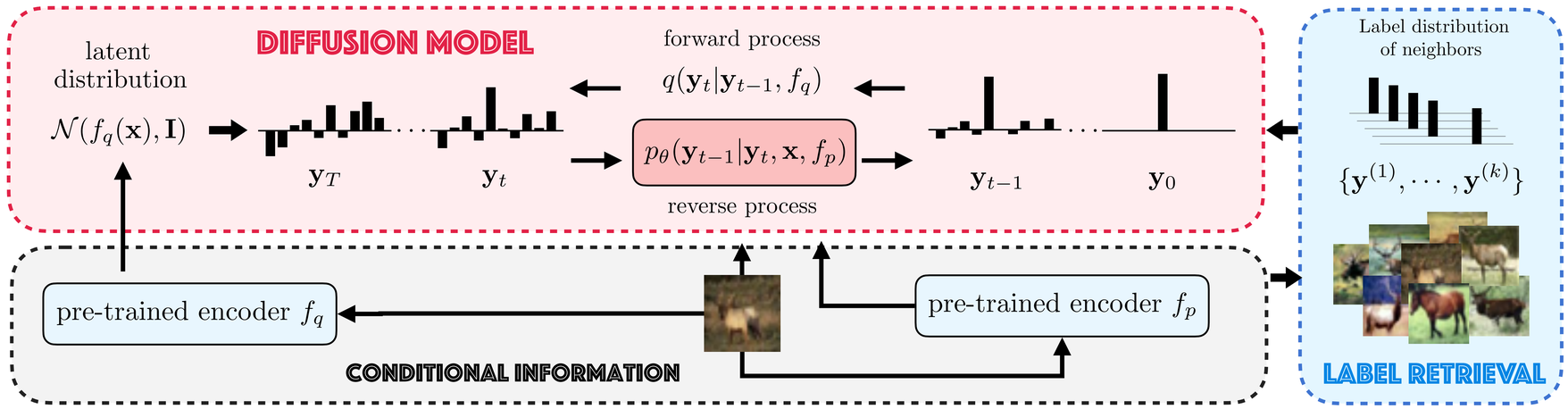
Diffusion Classification Model

The inherent ambiguity within data introduces uncertainty into the labeling process. Thus, we model data annotation as a stochastic conditional label generation process using a diffusion model.

Efficient Inference

Compared to the traditional ResNet classifier, our model requires only a few extra linear layers, and the incorporation of DDIM can substantially improve inference efficiency.





Robust Encoder

We use pre-trained features as conditional information to retrieve neighboring labels. The fixed feature encoders are pre-trained on external datasets or through unsupervised/semi-supervised methods, ensuring they remain unaffected by label noise.

Neighbor Consistency

The diffusion model is trained to learn the label distribution within neighborhoods defined by a pre-trained feature encoder. This design encourages samples with similar features to have similar labels.

Benchmark Experiment

Our experiment results showcases the model's superior performance.

Methods	CIFAR-10				
	35% PMD	70% PMD	35% PMD + 30% U	35% PMD + 60% U	35% PMD + 30% A
Standard	78.11 ± 0.74	41.98 ± 1.96	75.26 ± 0.32	64.25 ± 0.78	75.21 ± 0.64
Co-teaching+	79.97 ± 0.15	40.69 ± 1.99	78.72 ± 0.53	55.49 ± 2.11	75.43 ± 2.96
GCE	80.65 ± 0.39	36.52 ± 1.62	78.08 ± 0.66	67.43 ± 1.43	76.91 ± 0.56
SL	79.76 ± 0.72	36.29 ± 0.66	77.79 ± 0.46	67.63 ± 1.36	77.14 ± 0.70
LRT	80.98 ± 0.80	41.52 ± 4.53	75.97 ± 0.27	59.22 ± 0.74	76.96 ± 0.45
CC	81.23 ± 0.78	42.43 ± 1.56	79.6 ± 0.44	70.71 ± 0.34	78.66 ± 0.66
PLC	82.80 ± 0.27	42.74 ± 2.14	79.04 ± 0.50	72.21 ± 2.92	78.31 ± 0.41
SimCLR KNN	83.71	29.45	78.25	54.82	75.37
C2D + SimCLR	83.84 ± 0.13	34.23 ± 0.45	85.61 ± 0.29	81.39 ± 0.68	83.06 ± 0.57
LRA-diffusion (SimCLR)	88.76 ± 0.24	42.63 ± 1.97	88.41 ± 0.37	84.43 ± 0.82	85.64 ± 0.23
CLIP KNN	91.80	30.66	84.67	57.03	81.76
LRA-diffusion (CLIP)	96.54 ± 0.13	44.62 ± 0.18	95.71 ± 0.17	87.21 ± 0.71	93.65 ± 0.40

SCAN ME