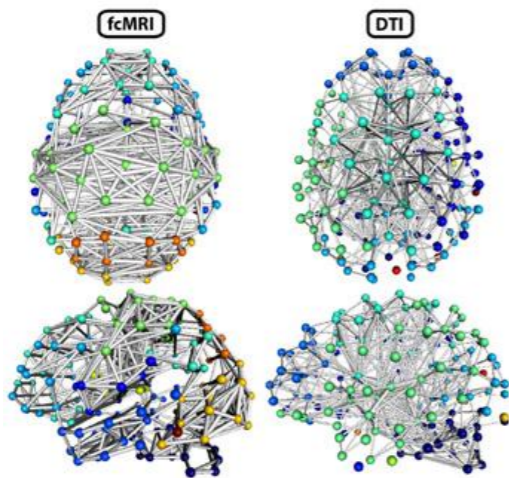
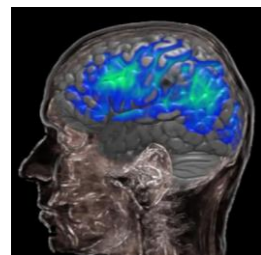


Background



- Hard to collect
- Limited data samples
- Incomplete scans

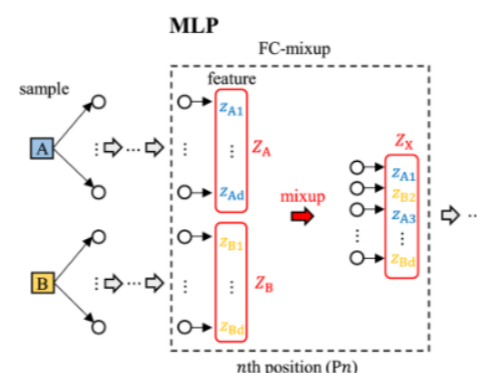
Method

Modal-mixup



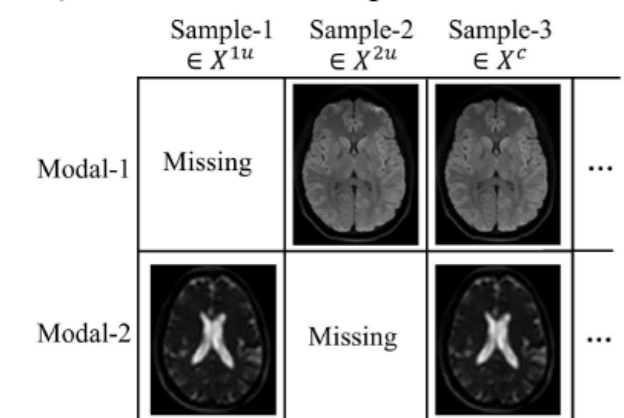
Image [1.0, 0.0] cat dog [0.0, 1.0] cat dog [0.7, 0.3] cat dog

• Image mix-up

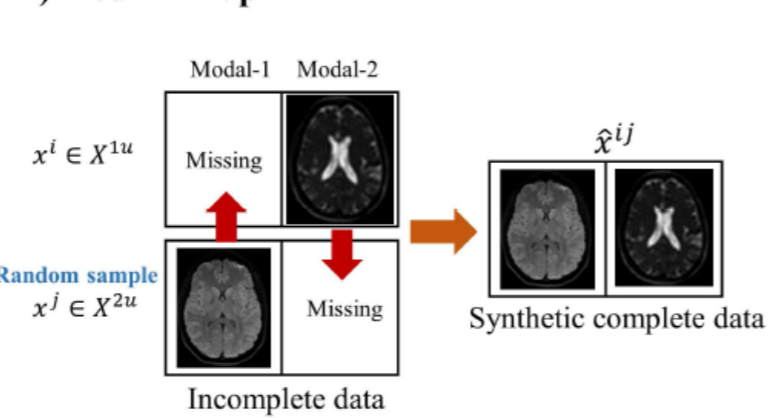


• Feature mix-up

A) Formulation of samples



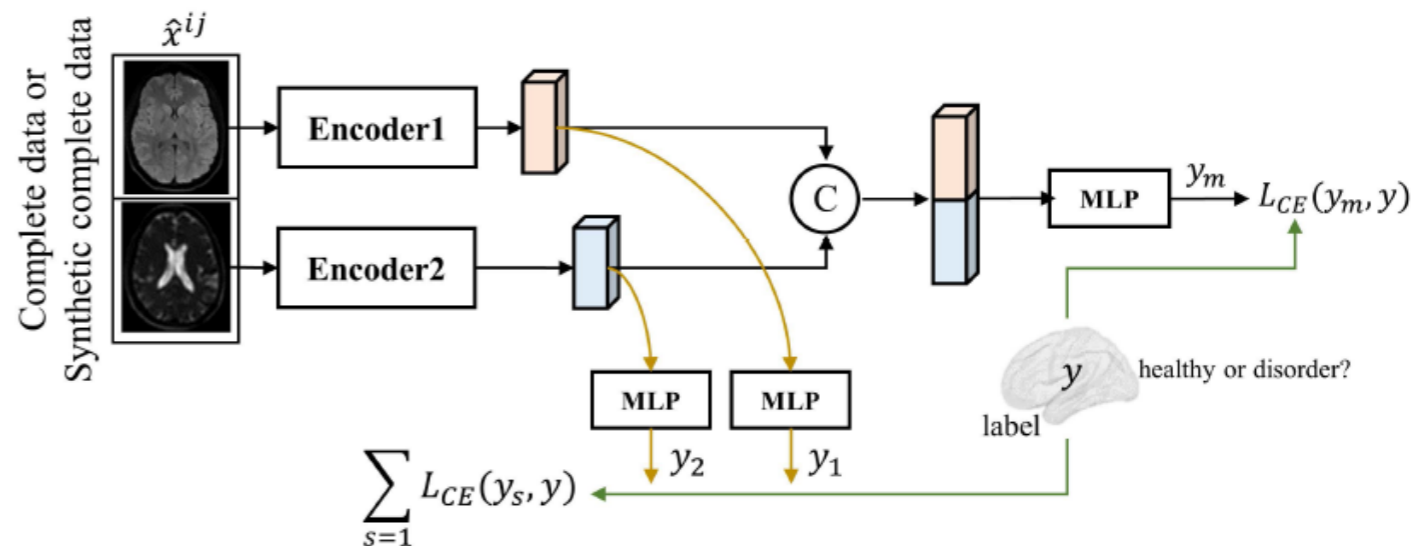
B) Modal-mixup



$$\text{For } x^i \in X^{1u}, \hat{x}^{ik} = \|\{x^i, x^k\}, x^k \in X^{2u} \cup X^c, y^i = y^k$$

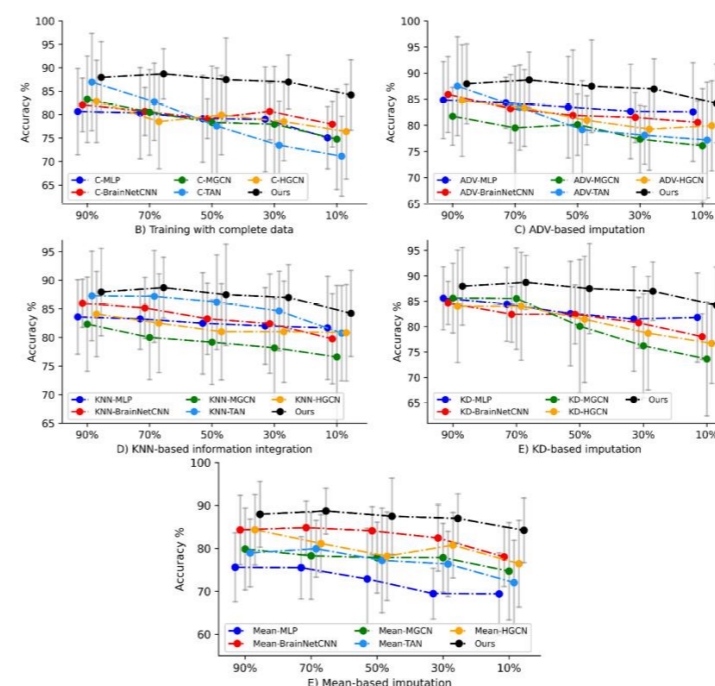
$$\text{For } x^j \in X^{2u}, \hat{x}^{jk} = \|\{x^k, x^j\}, x^k \in X^{1u} \cup X^c, y^j = y^k$$

Bilateral Network with Deep Supervision



- Deep-supervision can also be a self-knowledge distillation for self-supervised learning
- Mono-modal representations are regularized with disease-specific information for classification.

Experiments and Results



		ADNI Dataset		
Type	Model	ACC	Sen	F1
C	MLP	75.08±6.64	75.66±7.94	75.08±6.64
	BrainNetCNN	77.95±4.84	81.67±12.62	77.95±4.84
	M-GCN	74.77±10.73	77.644±9.89	75.91±12.57
	TripletNet	71.14±8.51	76.17±9.92	71.14±8.51
	HGCN	76.44±10.09	74.38±9.47	80.35±9.18
ADV	MLP	82.58±9.44	81.13±8.82	85.15±8.11
	BrainNetCNN	80.56±4.11	79.80±7.03	80.56±4.11
	M-GCN	76.09±10.91	76.56±13.33	76.09±10.91
	TripletNet	77.20±11.08	77.35±14.84	81.90±7.21
	HGCN	79.92±8.61	79.18±12.67	79.92±8.61
KNN	MLP	81.67±9.02	81.93±10.25	83.99±8.48
	BrainNetCNN	79.77±7.87	88.10±10.43	79.77±7.87
	M-GCN	76.59±12.51	81.82±14.47	78.71±10.62
	TripletNet	80.76±8.33	82.23±10.63	80.76±8.34
	HGCN	80.83±8.43	84.52±11.39	80.83±8.43
KD	MLP	81.80±8.76	80.47±9.97	81.80±8.76
	BrainNetCNN	78.03±4.49	86.85±11.15	78.03±4.49
	M-GCN	73.64±11.20	81.43±15.97	73.64±11.20
	HGCN	76.71±7.88	84.83±9.50	76.71±7.88
	MLP	69.39±9.58	74.05±15.09	69.39±9.58
Mean	BrainNetCNN	78.03±6.93	82.61±13.30	78.03±6.92
	M-GCN	74.69±11.33	74.03±11.14	74.69±11.33
	TripletNet	72.04±9.83	83.27±14.77	72.05±9.83
	HGCN	76.44±10.09	74.38±9.47	76.44±10.09
	Modal-mixup	Deep-supervision (ours)	84.21±7.52	89.79±10.84

Modal-mixup	deep-supervision	10%	30%	50%	70%	90%
✓		82.65±9.98	83.41±5.76	84.39±9.85	85.15±5.34	86.14±7.64
✓	✓	84.21±7.52	86.97±6.79	87.48±8.87	88.71±6.55	87.95±10.01

- Our Modal-mixup outperforms other approaches
- More details can be seen in our paper.