



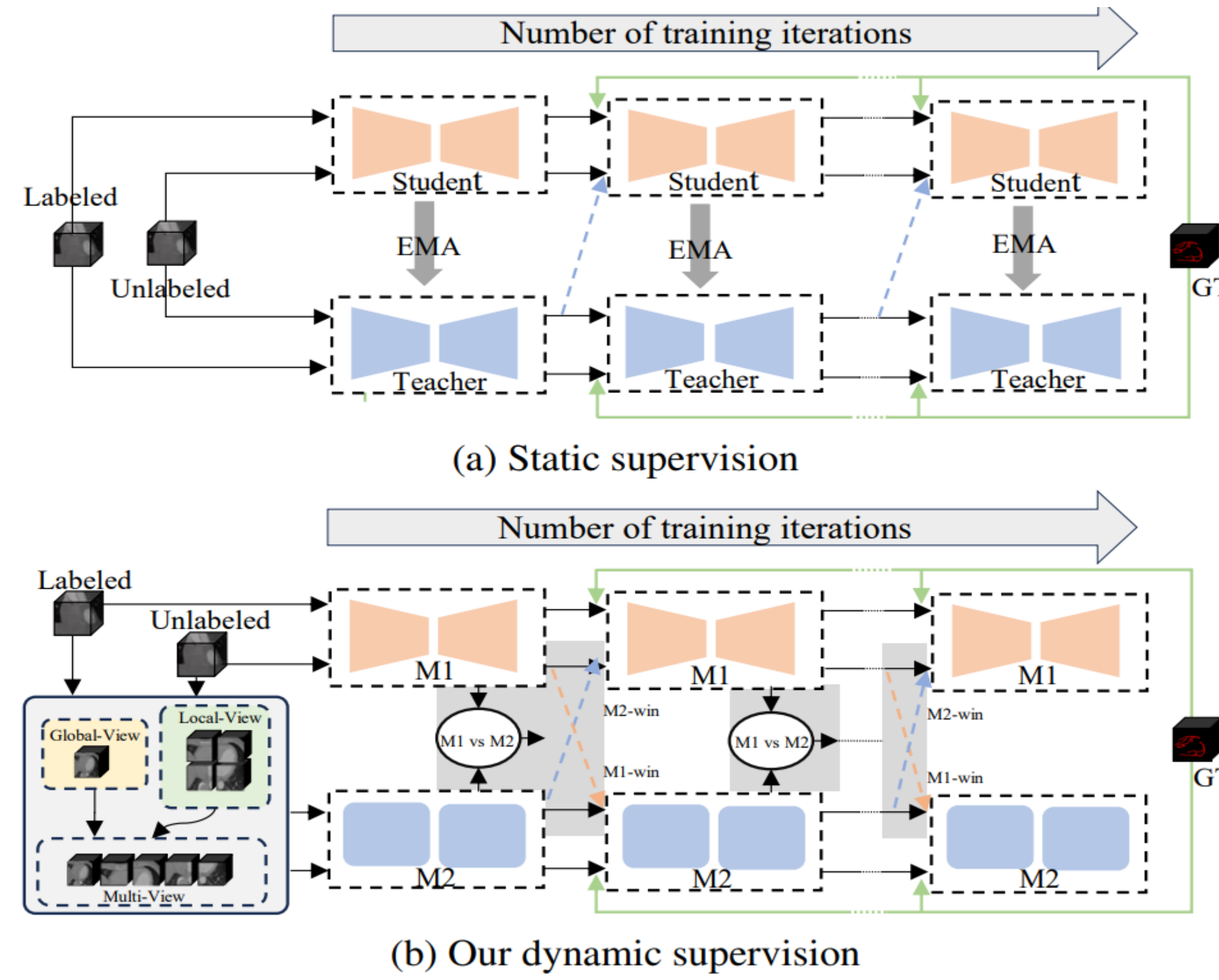
Learning Dynamic Collaborative Network for Semi-supervised 3D Vessel Segmentation

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Motivation : Explore a simple and effective semi-supervised framework



Problems with existing vessel segmentation:

- Scarcity of labeled data
- Complex appearance

Intuition: It is necessary to explore a simple semi-supervised vessel segmentation framework.

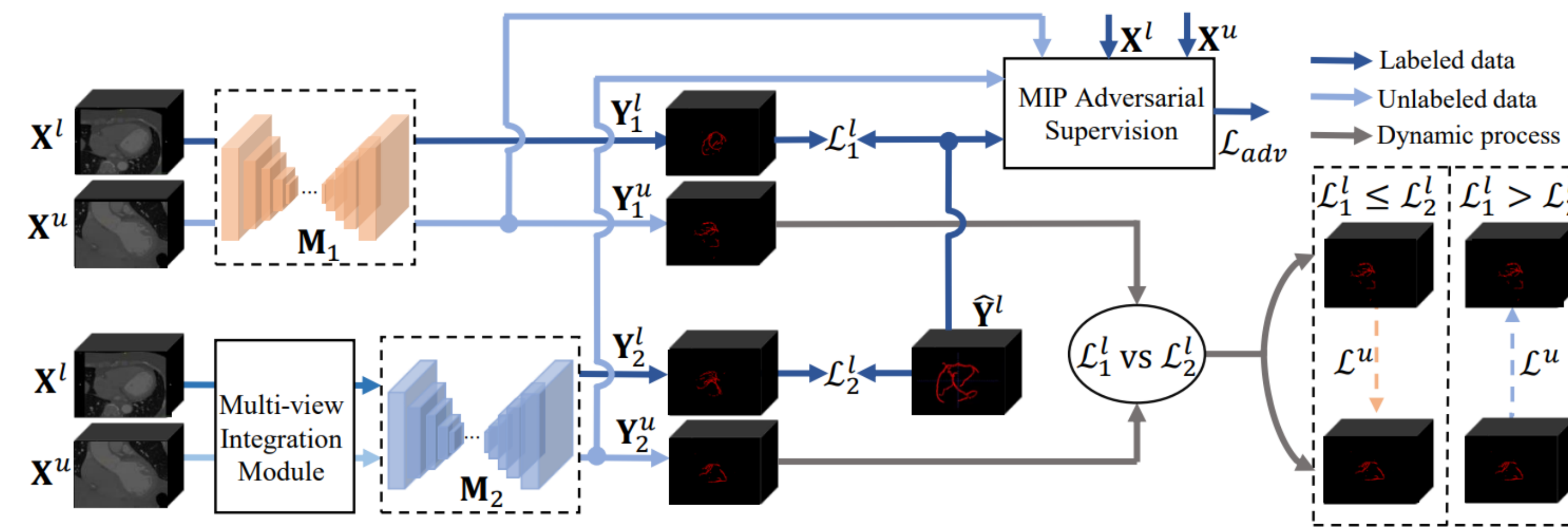
A simple solution: Improving the cognitive bias of the basic MT network to facilitate the learning of unsupervised data.

MV vs DiCO

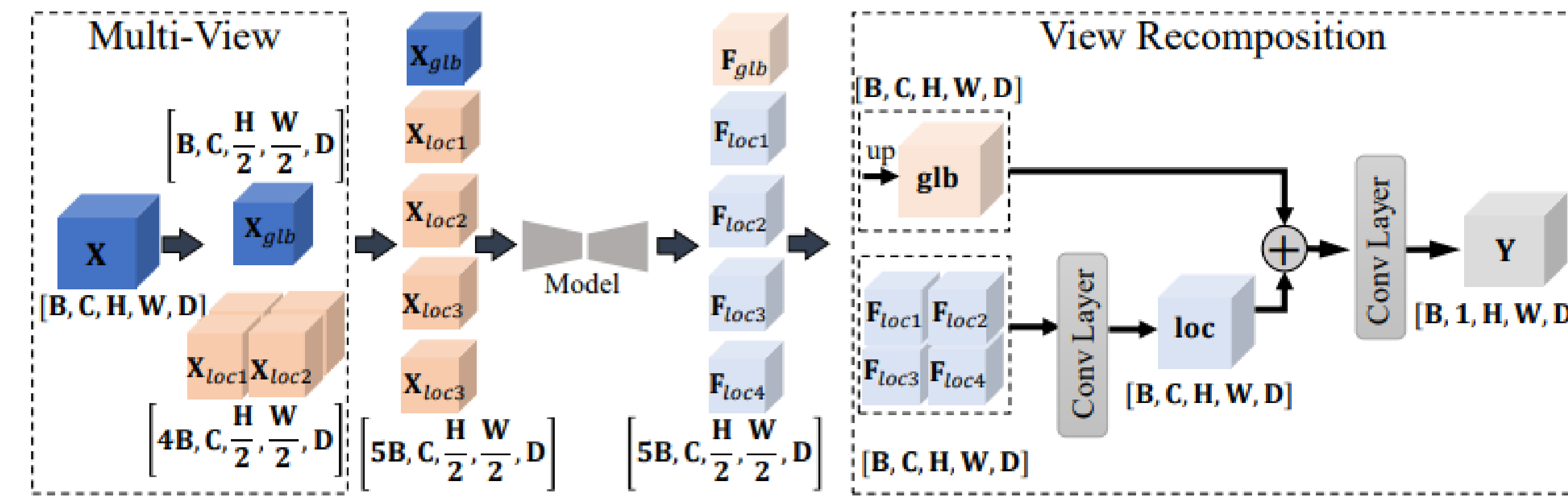
Dataset	Metric	C+T	C+C	T+T	MT
ImageCAS	DSC↑	70.37	69.45	62.67	71.05
	NSD↑	56.36	53.42	47.54	56.32
	ASD↓	23.87	25.89	32.47	24.06
CAS2023	DSC↑	83.59	82.74	78.56	73.94
	NSD↑	73.44	70.89	67.28	58.33
	ASD↓	1.79	1.97	2.17	15.21
Parse2022	DSC↑	63.85	62.77	62.89	58.36
	NSD↑	43.39	43.21	42.45	42.58
	ASD↓	9.02	10.84	9.65	11.37

DiCO : Learning Dynamic Collaborative Network for Semi-supervised 3D Vessel Segmentation

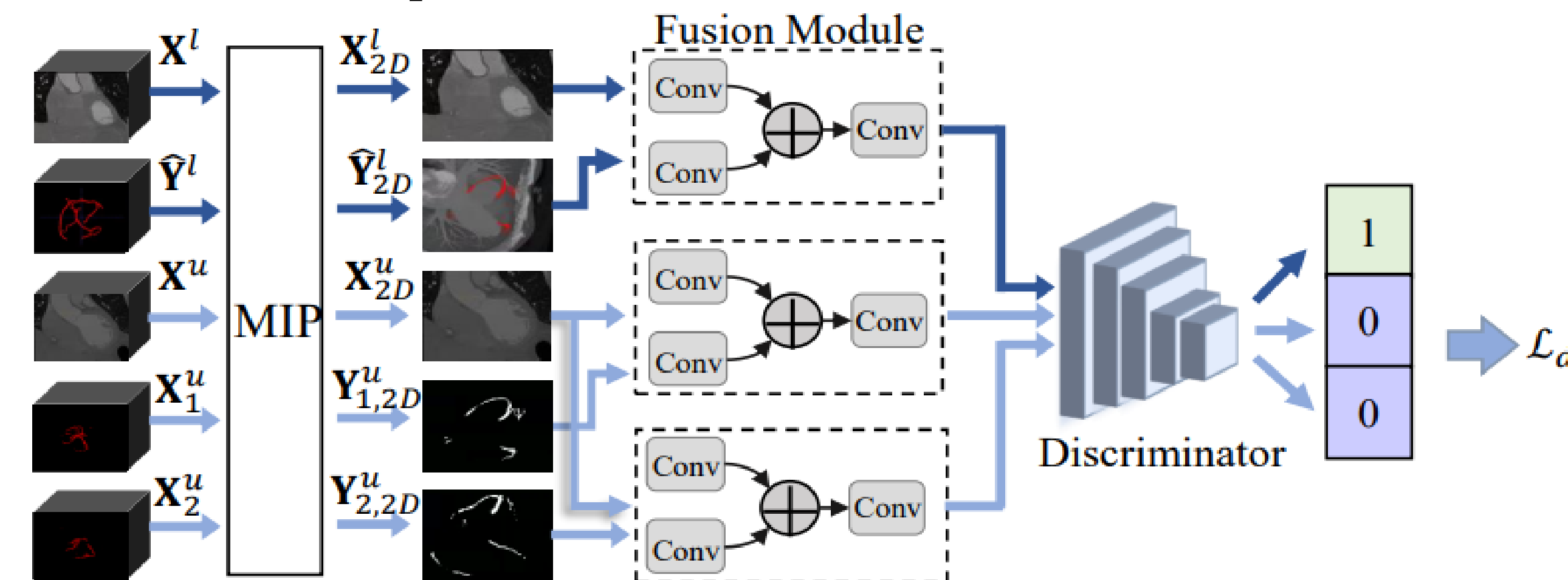
Architecture of the DiCO framework



Multi-view integration module



MIP adversarial supervision module



Experiments: SOTA comparison & ablation study

Method		Source	Scans Used		Metrics		
			L Volumes	U Volumes	DSC↑ (%)	NSD ↑(%)	ASD ↓(voxel)
Semi-supervised	MT [27]	ICLR'17	45	855	71.05	56.32	24.06
	UA-MT [40]	MICCAI'19	45	855	70.11	55.83	23.11
	SASSNet [13]	MICCAI'20	45	855	72.73	58.54	21.96
	SLCNet [15]	MICCAI'22	45	855	72.78	57.36	20.44
	MagicNet [2]	CVPR'23	45	855	71.88	57.50	22.10
	CAML [6]	MICCAI'23	45	855	71.66	58.03	23.73
	CauSSL [18]	ICCV'23	45	855	69.14	53.25	24.79
	GuidedNet [42]	ACMMM'24	45	855	65.24	50.63	30.21
	DiCo	Ours	45	855	73.79	58.59	20.00

Method		Source	Scans Used		Metrics		
			L Volumes	U Volumes	DSC↑ (%)	NSD ↑(%)	ASD ↓(voxel)
Semi-supervised	MT [27]	ICLR'17	5	85	73.94	58.33	15.21
	UA-MT [40]	MICCAI'19	5	85	77.31	59.22	5.89
	SASSNet [13]	MICCAI'20	5	85	75.43	58.82	7.67
	SLCNet [15]	MICCAI'22	5	85	77.21	61.65	3.65
	MagicNet [2]	CVPR'23	5	85	84.13	72.73	1.92
	CAML [6]	MICCAI'23	5	85	79.64	67.43	2.19
	CauSSL [18]	ICCV'23	5	85	76.72	62.48	2.22
	GuidedNet [42]	ACMMM'24	5	85	81.60	69.00	2.01
	DiCo	Ours	5	85	86.05	74.35	1.49

Method		Source	Scans Used		Metrics		
			L Volumes	U Volumes	DSC↑ (%)	NSD ↑(%)	ASD ↓(voxel)
Semi-supervised	MT [27]	ICLR'17	5	85	58.36	42.58	11.37
	UA-MT [40]	MICCAI'19	5	85	62.70	45.72	10.51
	SASSNet [13]	MICCAI'20	5	85	68.33	29.19	7.57
	SLCNet [15]	MICCAI'22	5	85	66.13	48.87	8.18
	MagicNet [2]	CVPR'23	5	85	69.19	53.25	5.53
	CAML [6]	MICCAI'23	5	85	66.75	50.22	7.27
	CauSSL [18]	ICCV'23	5	85	66.45	48.88	7.94
	GuidedNet [42]	ACMMM'24	5	85	68.80	51.80	6.74
	DiCo	Ours	5	85	70.93	55.26	5.74
Full-supervised	VNet [1]	ICCV'16	90	0	65.53	48.87	8.08
	CTNet [21]	BIBM'22	90	0	73.12	58.92	5.88
	ERNet [35]	Med Image Anal '22	90	0	76.39	64.72	3.81
	DSCNet [23]	ICCV'23	90	0	75.04	59.66	4.49

Dataset	Metric	MT	Base	+MIP	+MV	All
ImageCAS	DSC↑	71.05	70.37	71.15	72.37	73.79
	NSD↑	56.32	56.36	53.64	57.36	58.59
	ASD↓	24.06	23.87	21.97	19.44	20.00
CAS2023	DSC↑	73.94	83.59	84.42	85.63	86.05
	NSD↑	58.33	73.44	73.24	73.40	74.35
	ASD↓	15.21	1.79	2.31	1.63	1.49
Parse2022	DSC↑	58.36	63.85	66.29	68.46	70.93
	NSD↑	42.58	47.39	50.15	52.14	55.26
	ASD↓	11.37	9.02	7.24	5.92	5.74

Datasets	Method	Metric		
		DSC↑	NSD↑	ASD↓
ImageCAS	3D	60.79	43.73	46.31
	2D	71.15	53.64	21.97
CAS2023	3D	83.25	71.39	2.49
	2D	84.42	73.24	2.31
Pares2022	3D	59.33	46.92	12.68
	2D	66.29	50.15	7.24

Conclusion

- A new efficient Semi-supervised framework that
 - ✓ alleviates cognitive bias
 - ✓ performs well in vascular structure segmentation
 - ✓ achieves SOTA performance