



**ICML**  
International Conference  
On Machine Learning



模式分析与机器智能  
工业和信息化部重点实验室  
MIT Key Laboratory of  
Pattern Analysis & Machine Intelligence

**ParNeC**



# Online Continual Learning with Dynamic Label Hierarchies



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<http://parnec.nuaa.edu.cn>

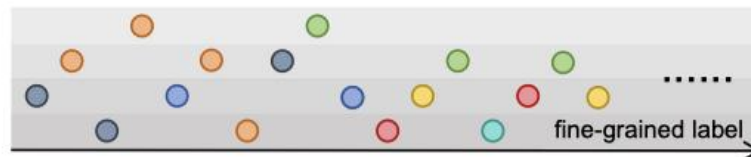
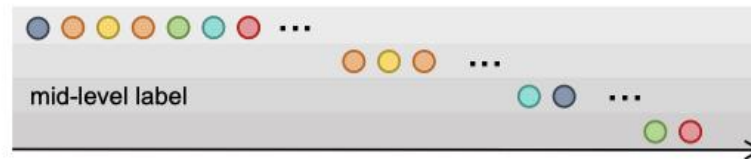
<https://lamp.cvc.uab.es/>

<https://wxr99.github.io/dudusama/>

2026/05

# Background: More Practical Settings

## Data stream

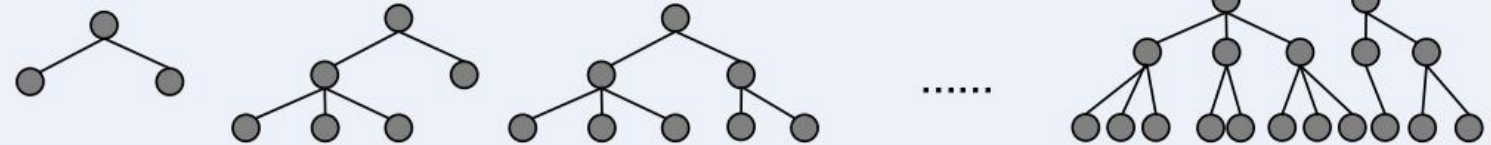


## Hierarchy growth:

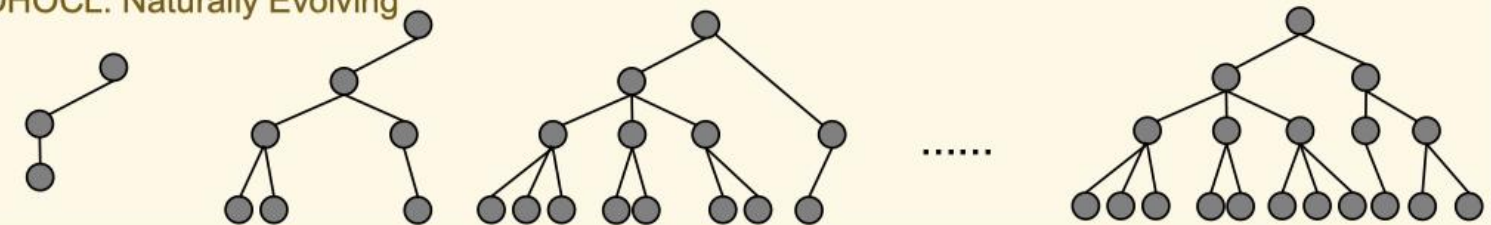
### OCL: No Hierarchy



### HLE or IIRC (Order-Constrained): From Coarse to Fine



### DHOCL: Naturally Evolving



## Final hierarchy

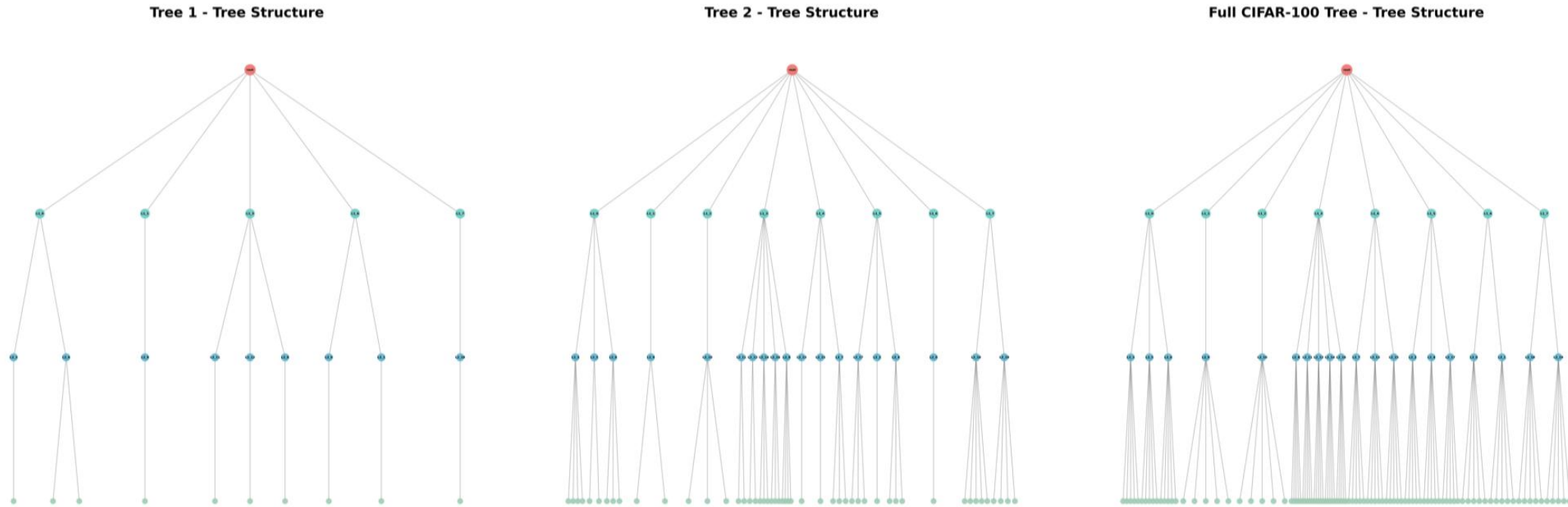
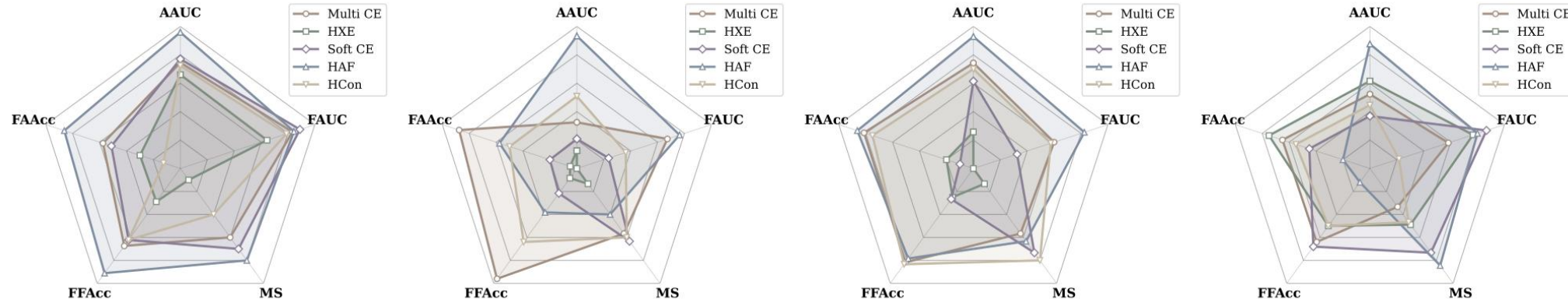
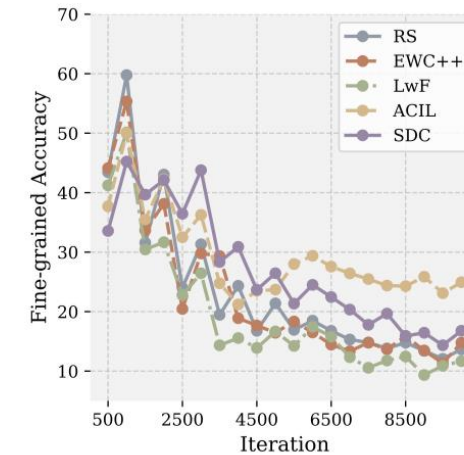
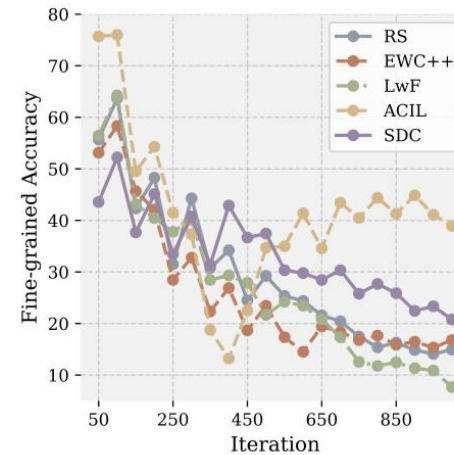
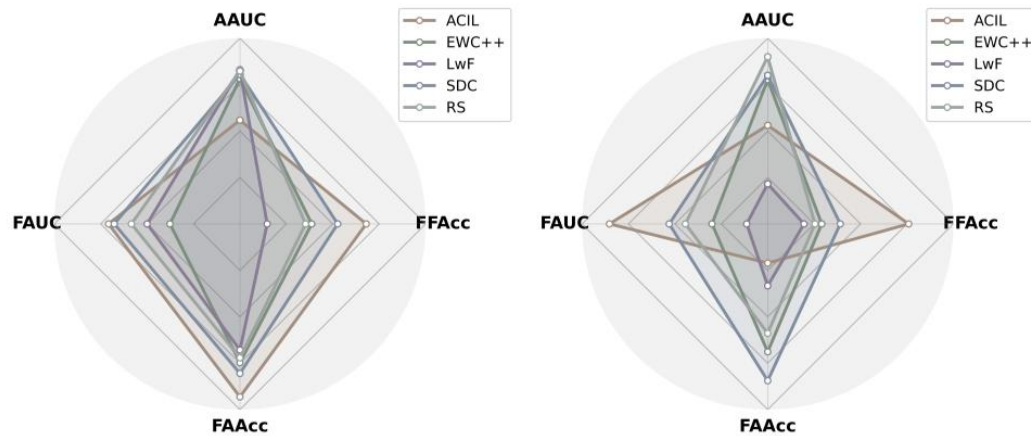


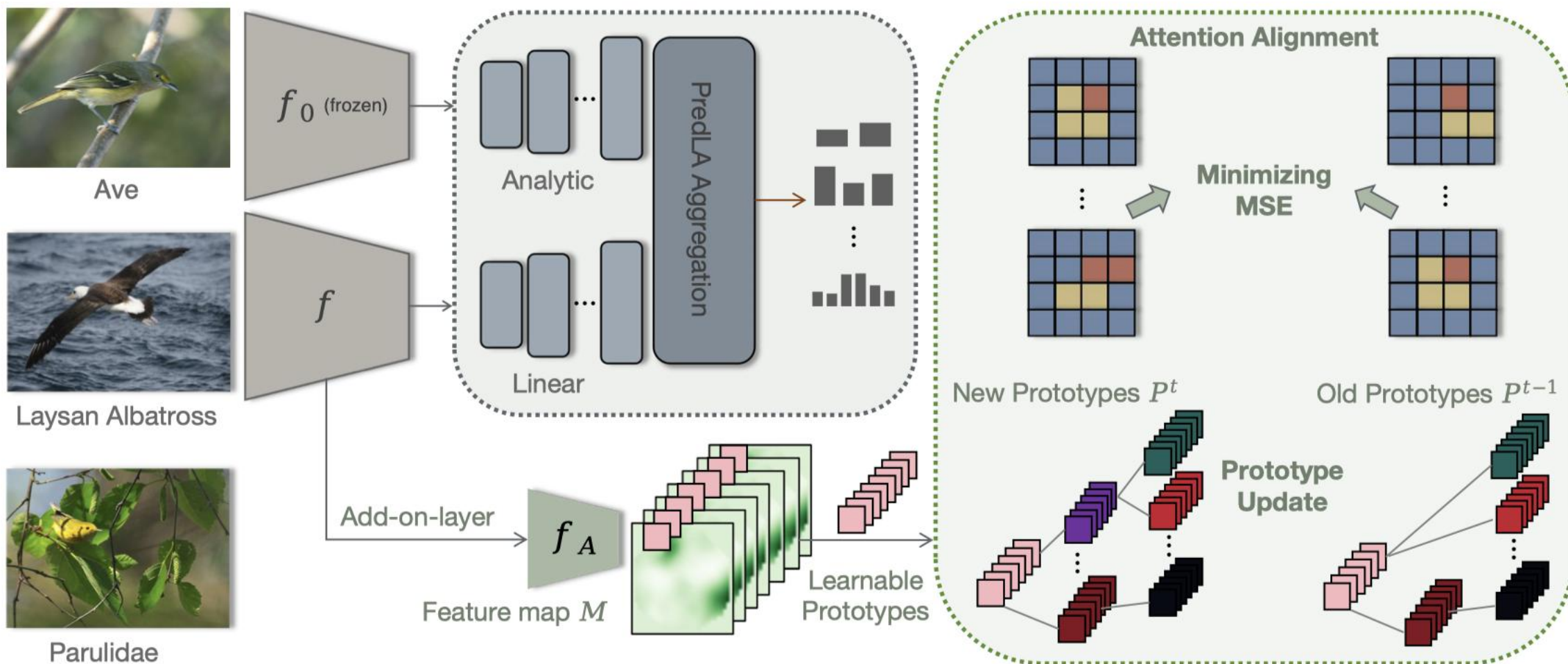
Figure 12. Growing label hierarchies for CIFAR-100. The left, middle, and right subfigures show the label hierarchies after confronting 10, 50, 100 (all) fine-grained classes.

## Hierarchy-aware loss fails



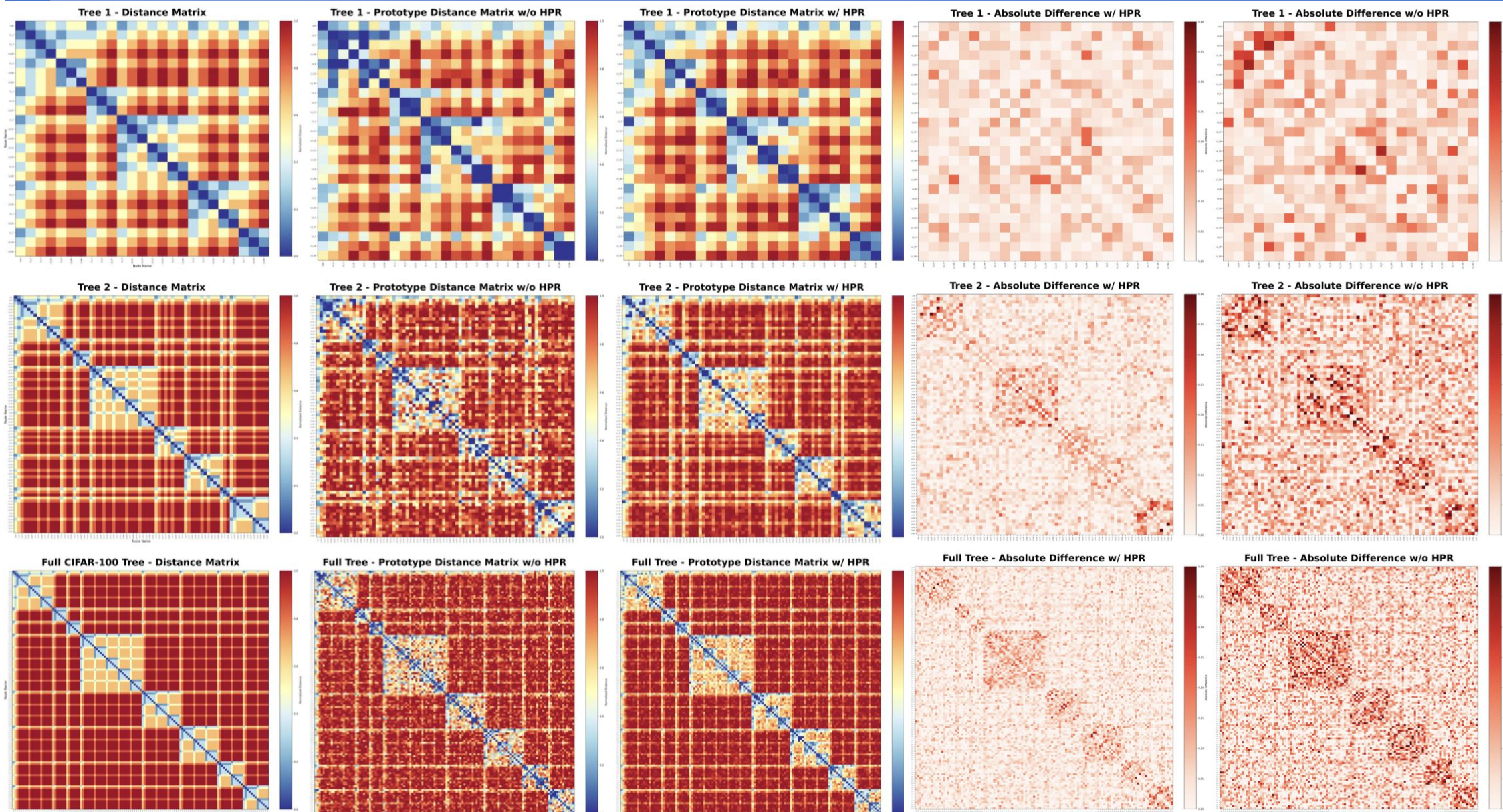
## Anti-forgetting methods also struggles





Method	CIFAR100				FGVC-Aircraft				CUB-200				iNaturalist			
	AAUC	FAUC	MS ↓	FFAcc	AAUC	FAUC	MS ↓	FFAcc	AAUC	FAUC	MS ↓	FFAcc	AAUC	FAUC	MS ↓	FFAcc
RS (HAF)(Garg et al., 2022)	54.0	37.6	1.22	25.3	20.2	16.2	2.03	9.9	50.5	20.3	1.51	15.7	71.7	24.8	2.02	11.6
CBRS(Chrysakis & Moens, 2020)	39.9	27.4	1.53	9.88	26.4	24.1	1.87	11.5	49.8	19.7	1.45	18.6	70.4	26.3	1.90	14.7
MIR(Aljundi et al., 2019a)	39.5	23.3	1.89	12.4	32.1	23.6	1.82	12.4	53.5	27.9	1.42	21.4	68.4	23.0	2.27	15.3
CLIB(Koh et al., 2022)	52.4	34.6	1.41	19.5	23.9	17.0	1.94	11.7	50.6	23.4	1.44	18.9	72.8	26.4	1.93	19.4
RM(Bang et al., 2021)	52.7	39.0	1.25	18.8	31.5	22.6	1.94	13.4	52.3	23.1	1.40	17.4	72.0	25.4	2.07	14.4
PLFMS(Lee et al., 2023)	46.5	35.4	1.34	24.0	26.1	23.3	1.81	13.3	52.2	22.9	1.53	16.3	70.4	25.4	2.03	16.2
iCaRL w/ SDC(Yu et al., 2020)	49.8	39.6	1.19	23.1	28.4	22.7	1.80	18.1	47.4	24.5	1.43	22.4	67.3	28.1	1.89	17.1
LwF w/ RS(Li & Hoiem, 2017)	54.1	36.5	1.21	27.2	24.3	16.1	1.94	11.1	50.8	21.8	1.47	16.7	60.8	17.6	2.35	14.3
EWC++ w/ RS(Kirkpatrick et al., 2017)	53.3	34.9	1.39	30.8	30.9	15.8	1.93	10.3	51.5	23.9	1.46	14.7	65.4	21.9	2.32	18.4
ICICLE w/ RS(Rymarczyk et al., 2023)	49.0	30.8	1.37	19.6	18.4	9.80	1.77	7.30	46.4	21.6	1.40	15.6	57.4	20.1	2.39	9.40
ACIL(Zhuang et al., 2022)	49.5	39.2	1.37	35.8	38.1	27.4	1.77	<b>30.5</b>	52.5	30.9	1.34	35.8	67.2	34.6	2.24	26.8
GACIL(Zhuang et al., 2024a)	51.5	43.9	1.12	<b>36.1</b>	38.6	26.7	1.75	30.3	54.7	31.2	1.30	35.8	69.0	34.1	2.20	30.9
OnPro(Wei et al., 2023)	50.6	31.5	1.45	20.9	25.6	28.3	1.93	21.6	47.6	20.9	1.51	15.1	61.4	17.7	2.16	13.5
NsCE(Wang et al., 2024b)	53.4	36.7	1.34	24.0	26.8	18.4	1.85	22.3	50.3	24.6	1.49	17.7	69.2	21.4	2.35	14.3
CCL-DC(Wang et al., 2024a)	54.5	35.9	1.42	25.8	33.1	28.0	1.75	25.9	51.5	20.8	1.42	18.4	70.8	27.2	2.03	16.5
OnLora(Wei et al., 2025)	52.1	34.2	1.28	28.4	34.5	26.7	1.69	24.7	53.2	28.4	1.29	28.9	73.5	30.2	1.89	22.1
<b>Ours</b>	<b>59.2</b>	<b>43.5</b>	<b>1.13</b>	32.0	<b>40.6</b>	<b>36.6</b>	<b>1.28</b>	28.9	<b>62.9</b>	<b>46.2</b>	<b>0.93</b>	<b>37.6</b>	<b>78.3</b>	<b>40.8</b>	<b>1.55</b>	<b>40.1</b>

# Results





Thanks

[https://github.com/wxr99/HALO\\_ICML26](https://github.com/wxr99/HALO_ICML26)