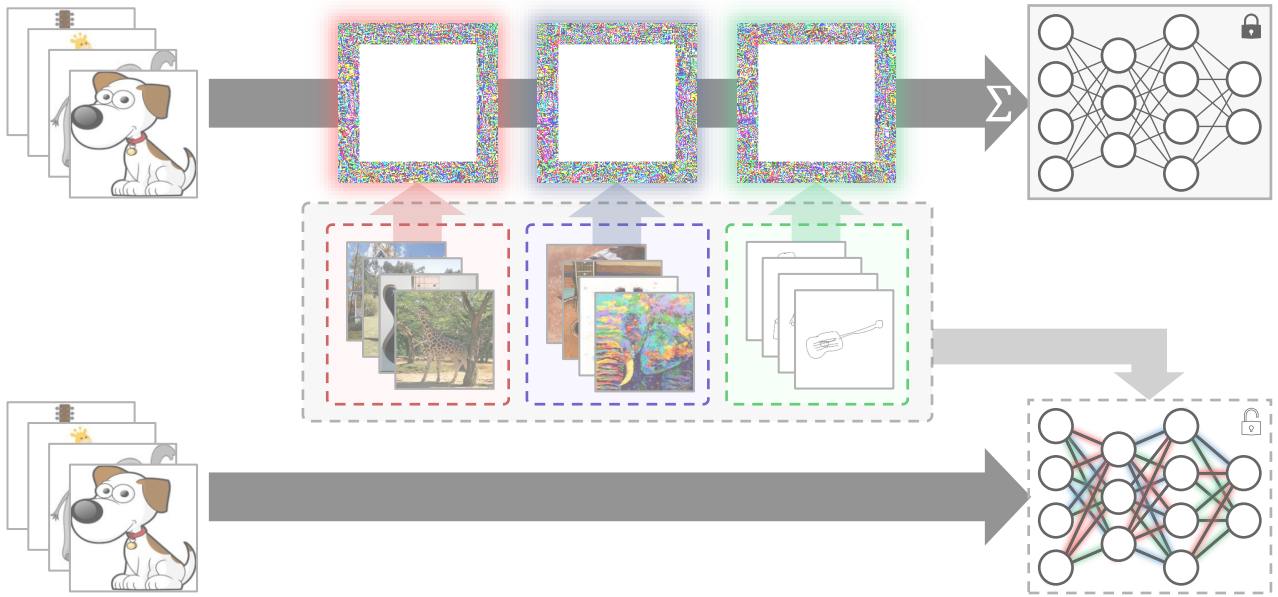
A2XP:
Towards Private Domain Generalization

Geunhyeok Yu **Hyoseok Hwang**

AIRLab

KYUNG HEE UNIVERSITY

Introduction



Domain Generalization

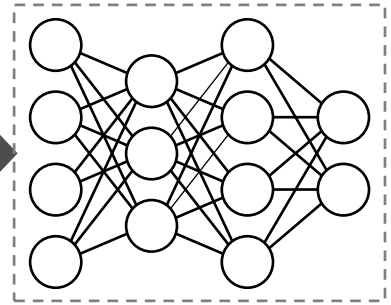
Private vs Non-Private

Unseen Domain

Inference

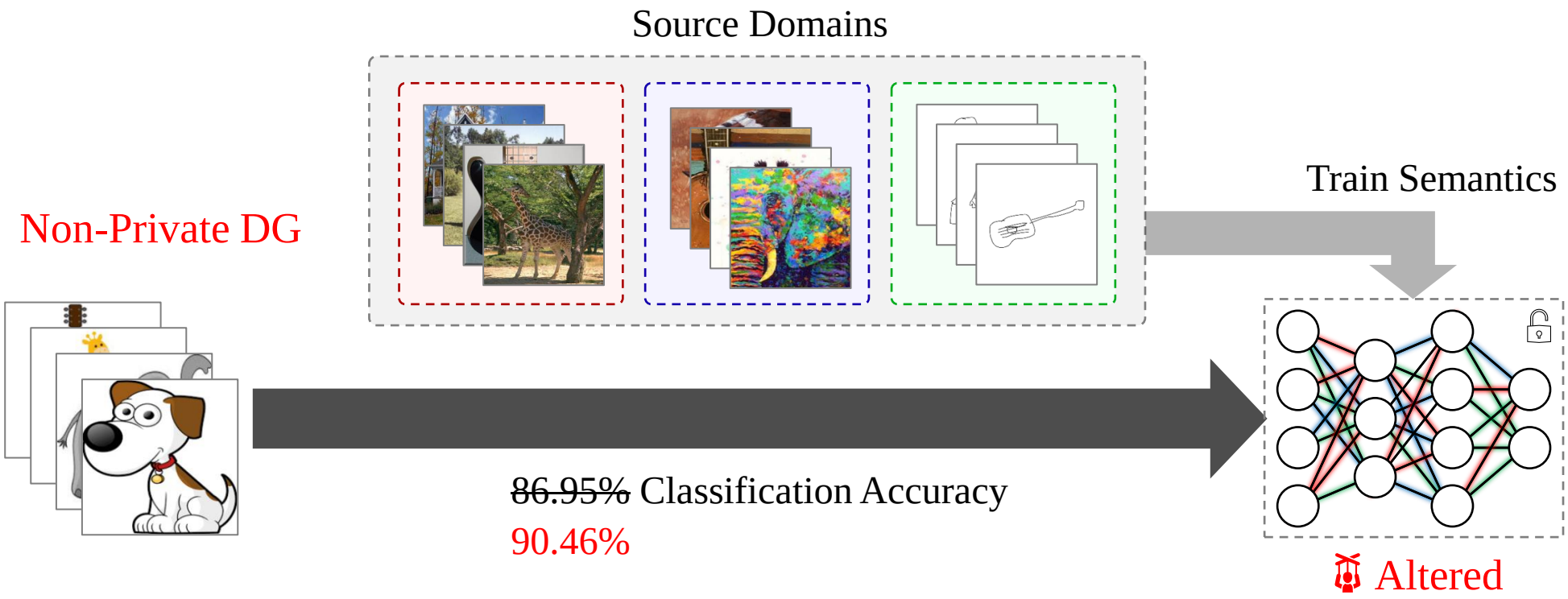
86.95% Classification Accuracy

ImageNet Pre-trained Network



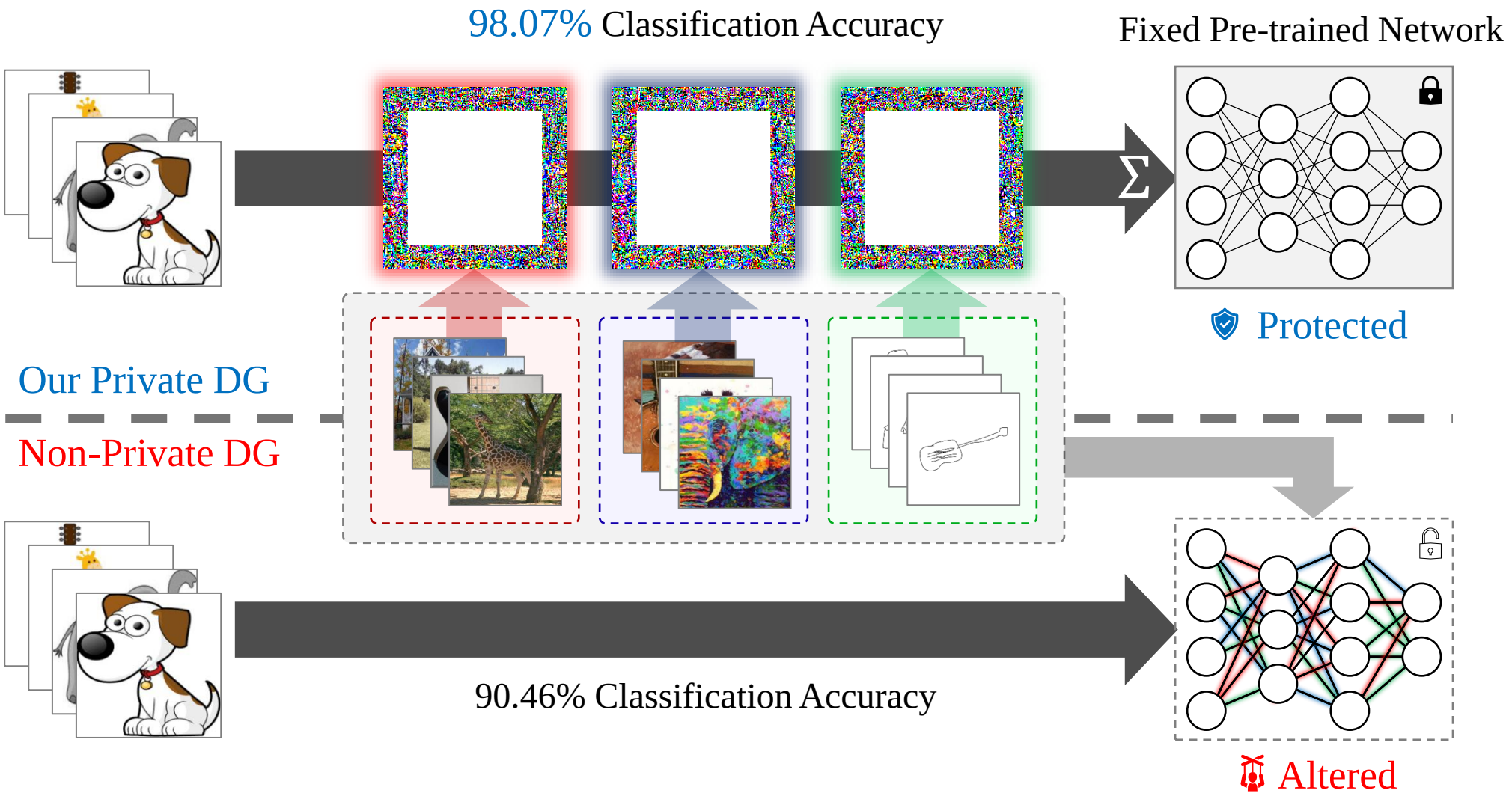
Domain Generalization

Private vs Non-Private

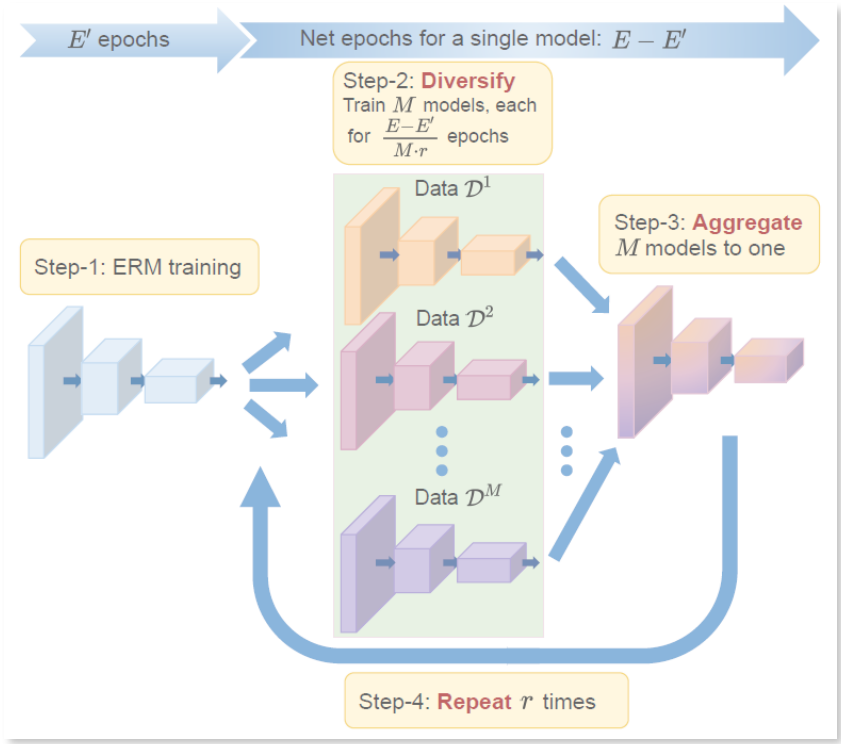


Domain Generalization

Private vs Non-Private

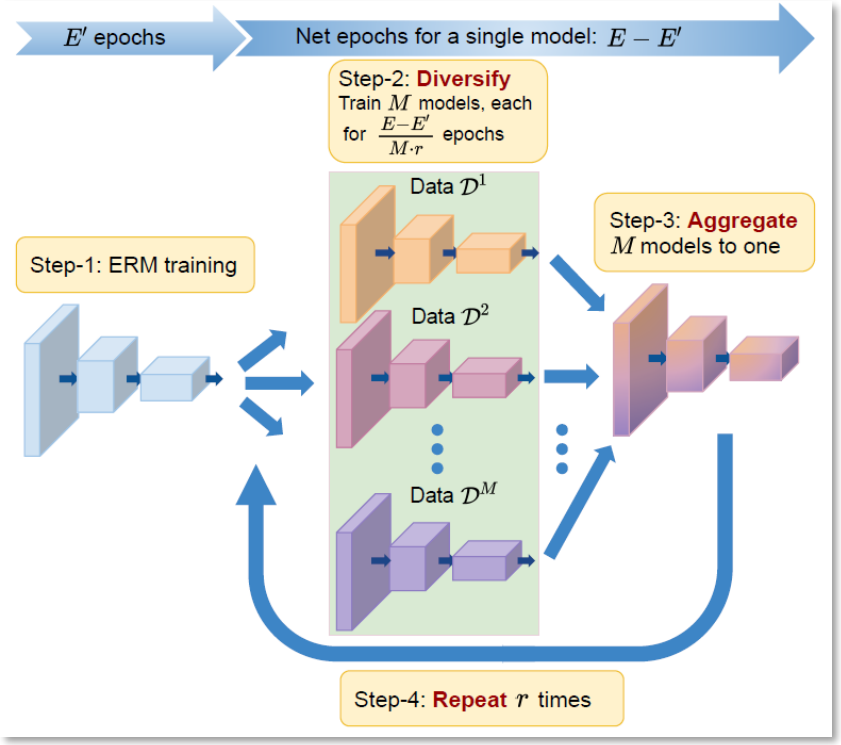


Related Works

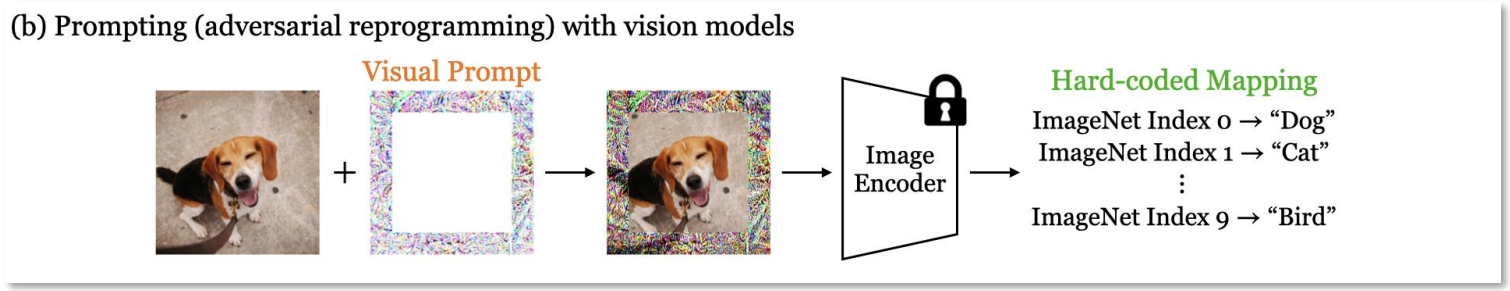


Related Works

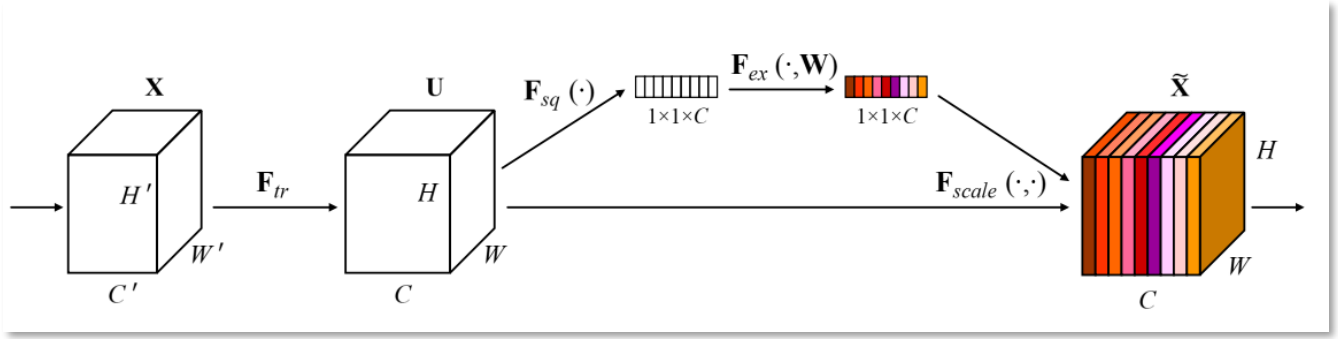
Building Blocks



Ensemble-based Domain Generalization [1]



Visual Prompt Tuning [2]

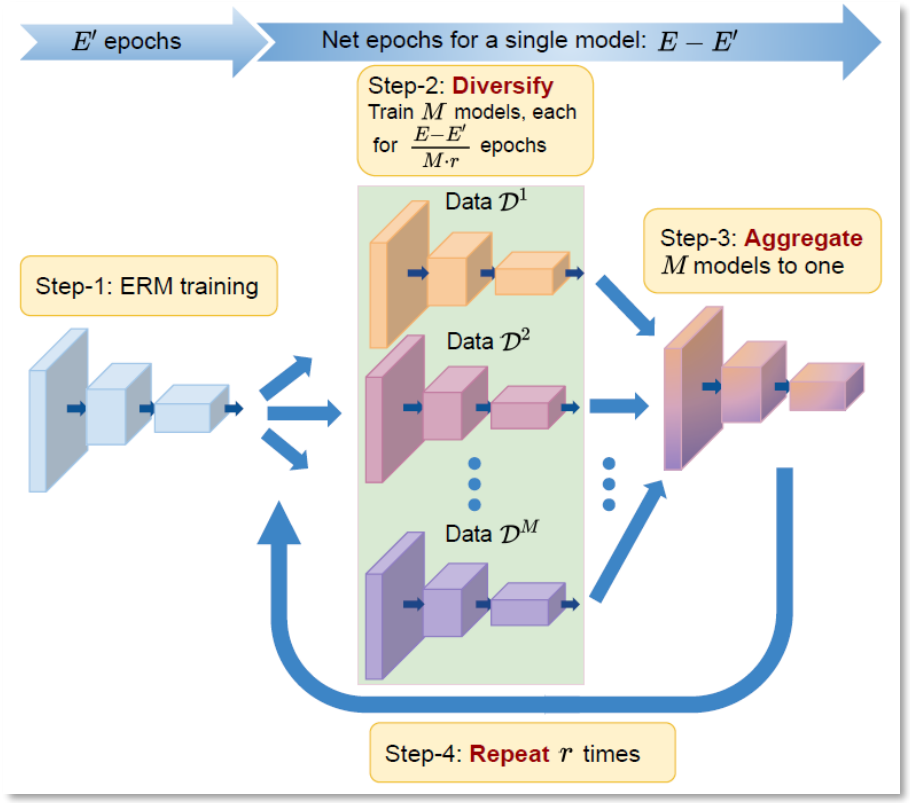


Attention Mechanism [3]

[1] Jain *et al*. "DART: Diversify-Aggregate-Repeat Training Improves Generalization of Neural Networks" CVPR 2023.
[2] Bahng *et al*. "Exploring Visual Prompts for Adapting Large-Scale Models" arXiv:2203.17274.
[3] Hu *et al*. "Squeeze-and-Excitation Networks" CVPR 2018.

Related Works

Limitation of Previous Ensemble-based Domain Generalization



Diversify-Aggregate-Repeat

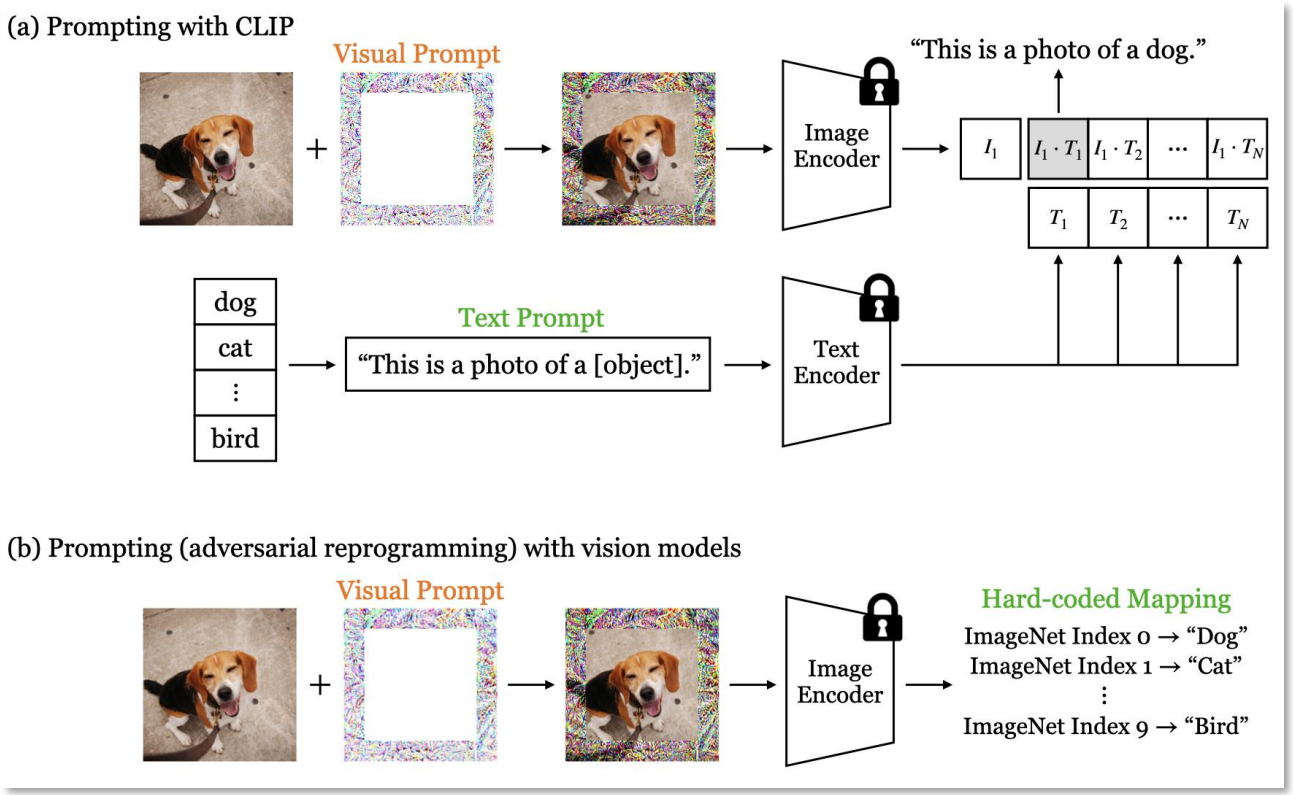
Demands too much computation.

Network parameters must be updated.

[1] Jain *et al*. "DART: Diversify-Aggregate-Repeat Training Improves Generalization of Neural Networks" CVPR 2023.

Related Works

Visual Prompt Tuning



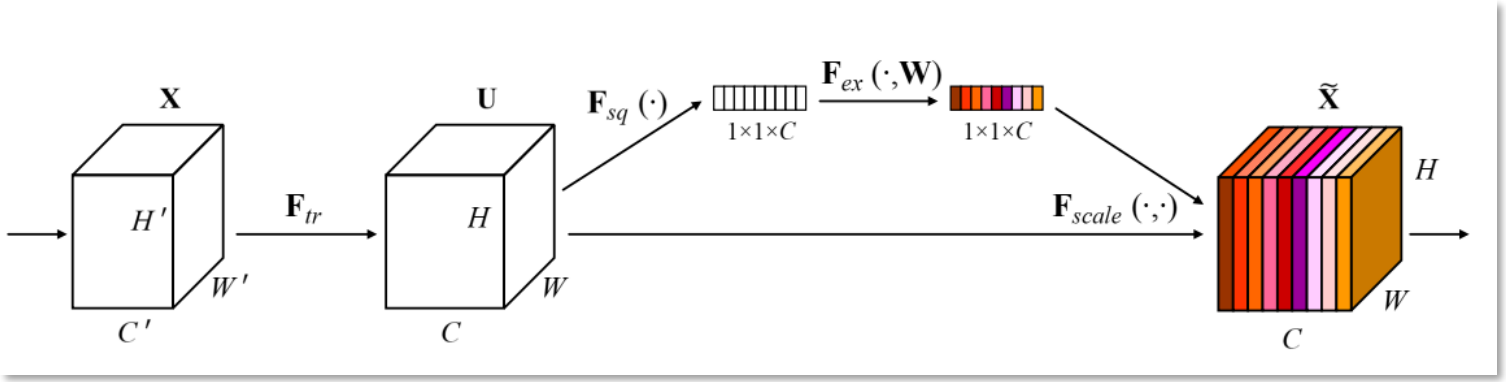
Fixed Network

Fine-tuning Available

[2] Bahng *et al*. "Exploring Visual Prompts for Adapting Large-Scale Models" arXiv:2203.17274.

Related Works

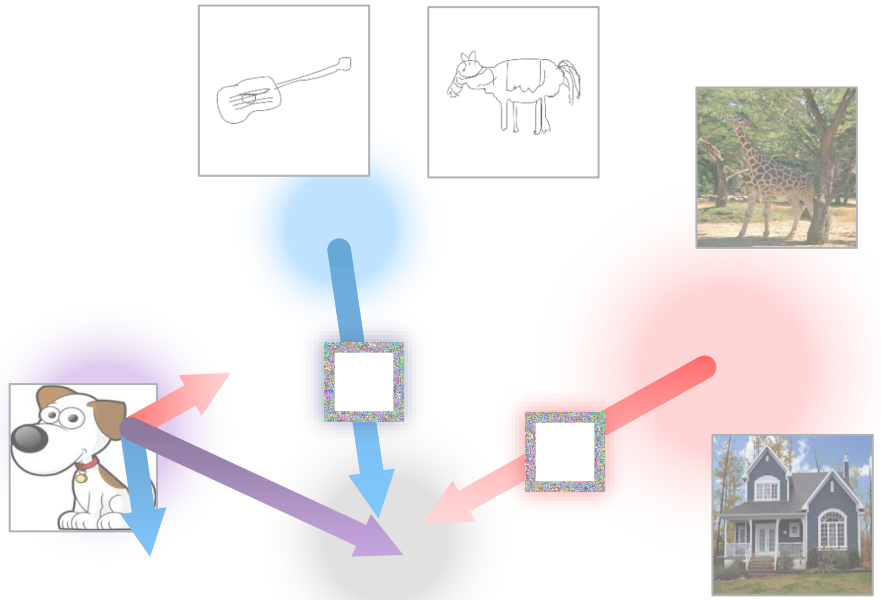
Attention Mechanism



Mathematic Representation of Learned Selection

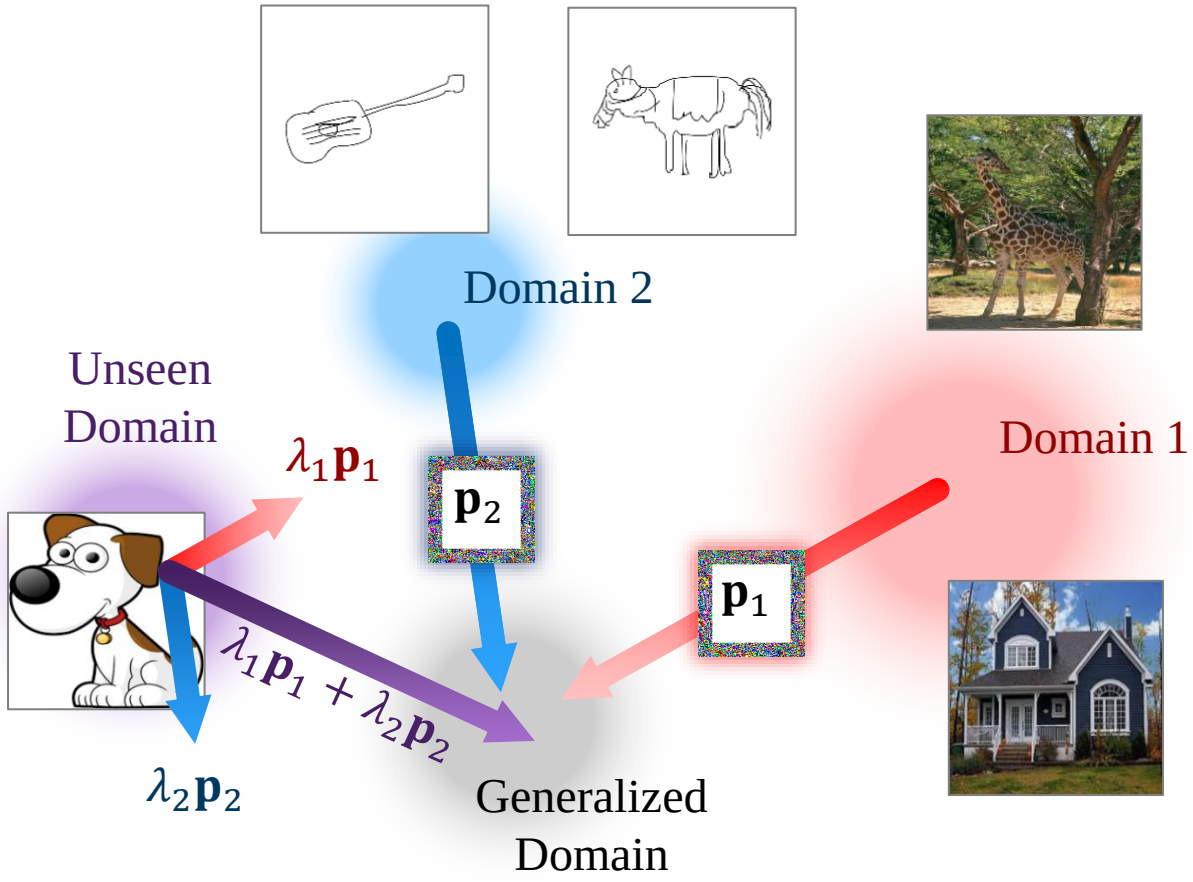
[3] Hu *et al*. “Squeeze-and-Excitation Networks” CVPR 2018.

Methodology



Our Approach

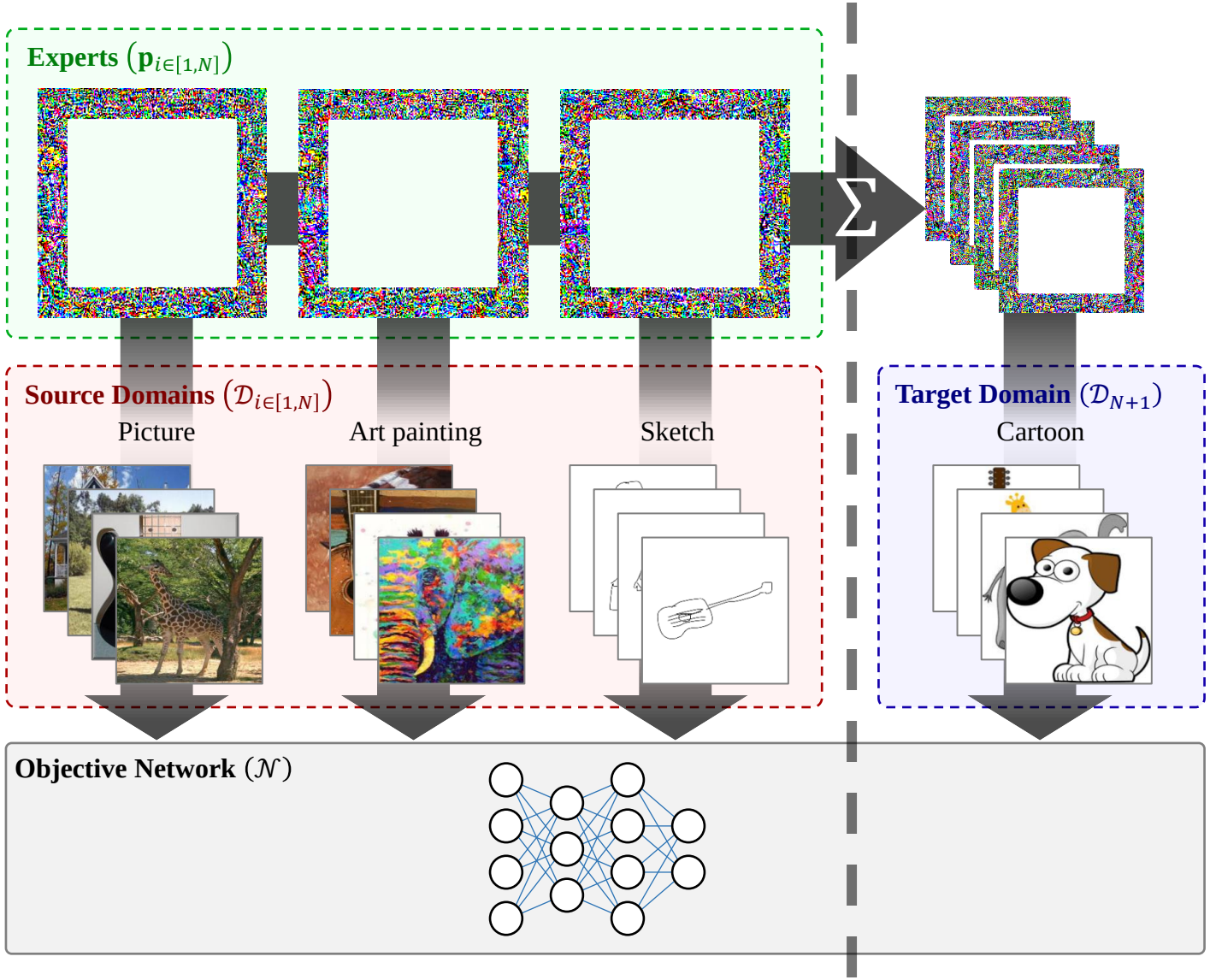
Problem Definition



Our Approach

A2XP: Attend to eXpert Prompts

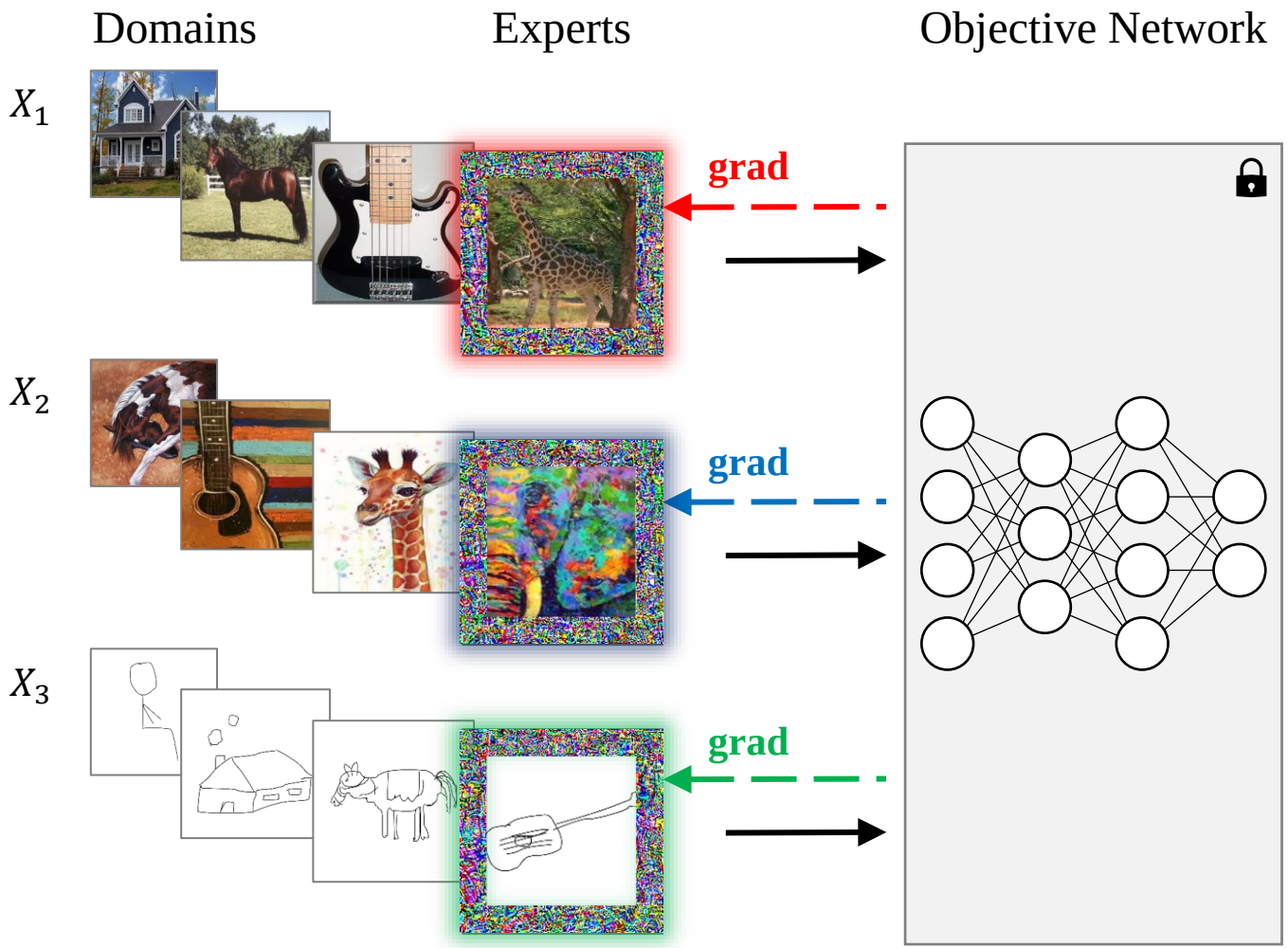
Phase1
Adaptation



Phase2
Generalization

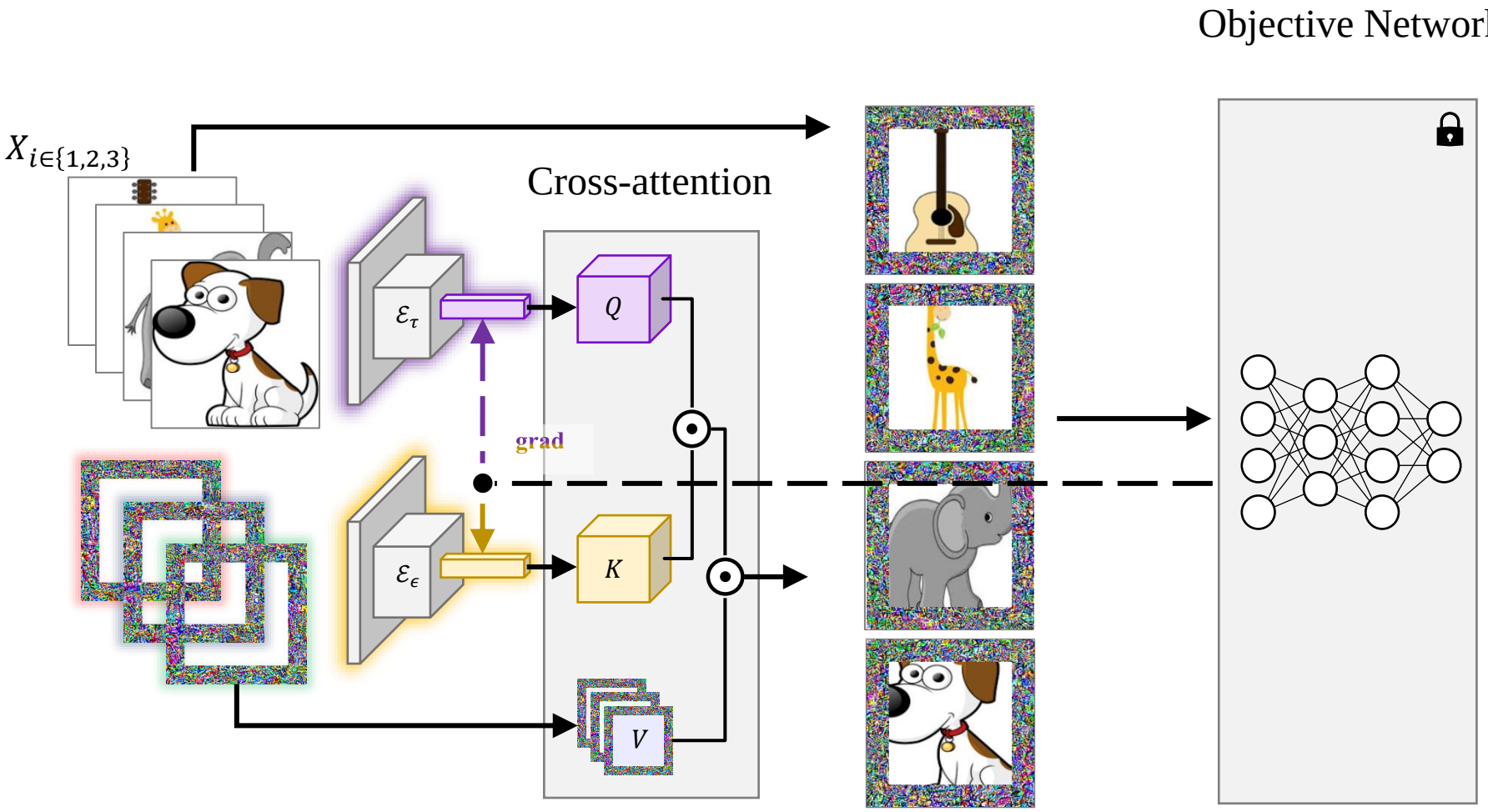
Our Approach

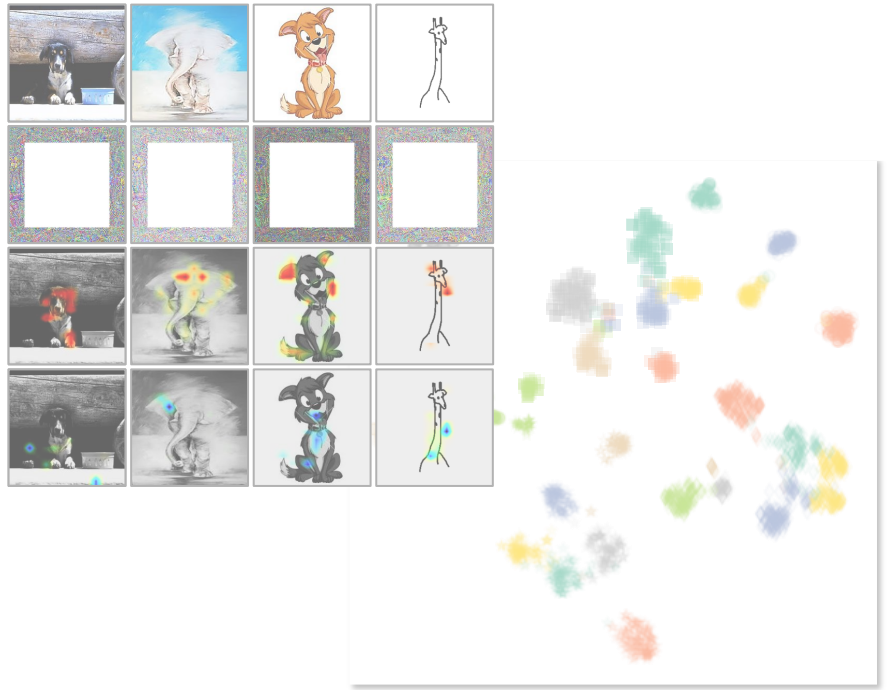
A2XP 1st Phase: Expert Adaptation



Our Approach

A2XP 2nd Phase: Attention-based Generalization



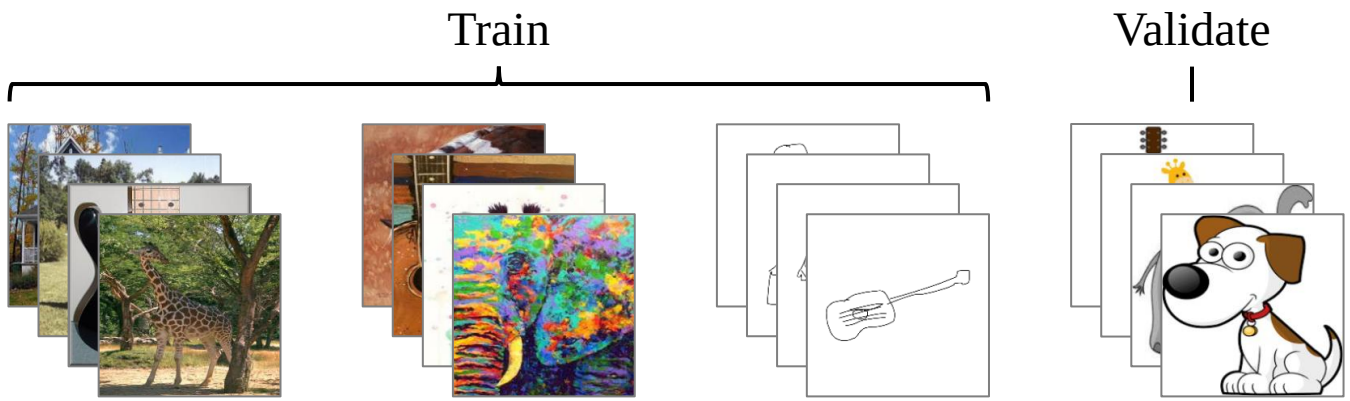


Evaluation & Analysis

Quantitative Evaluation

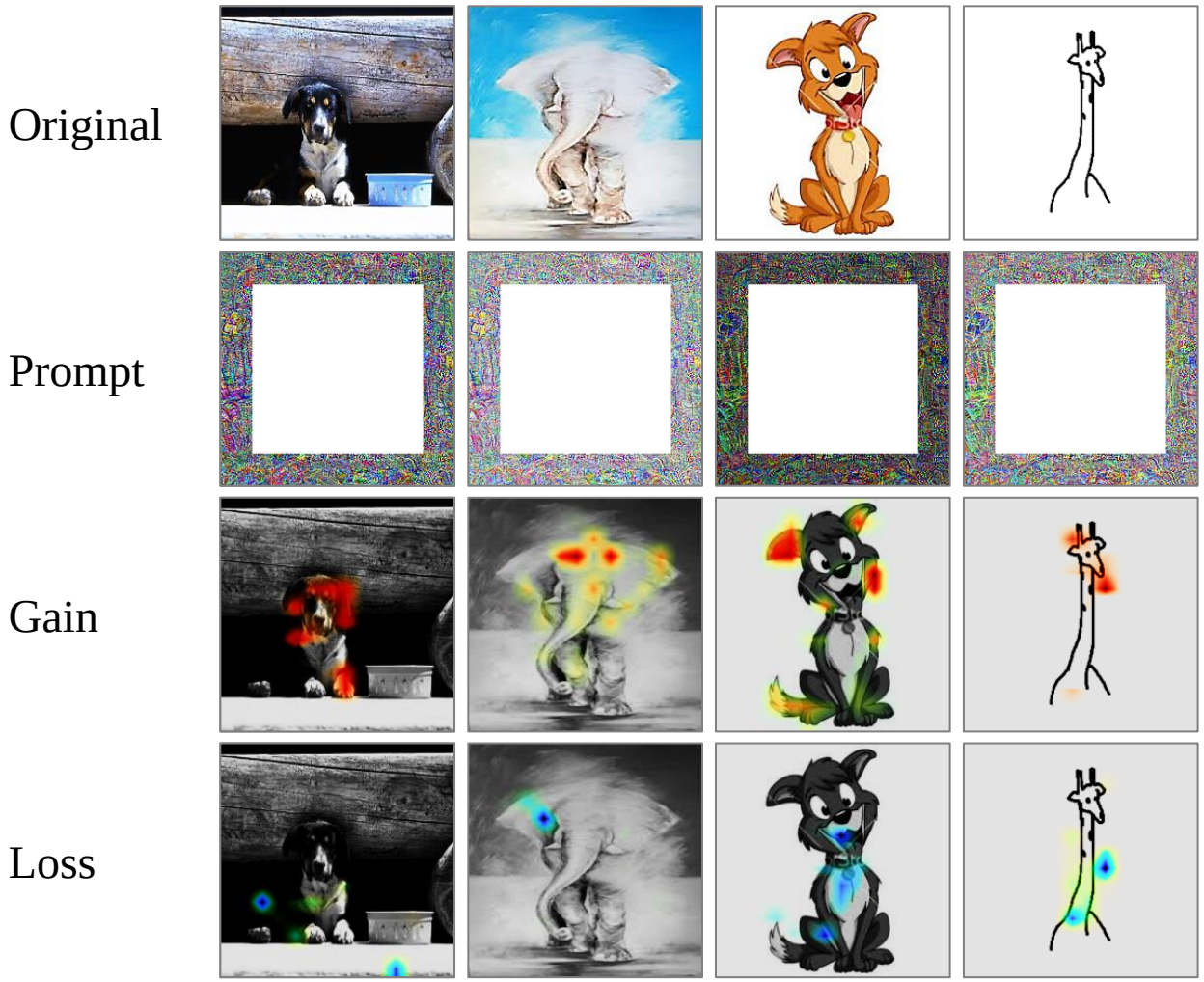
Leave-one-domain-out Evaluation

Method	DART [19] Supported	PACS [23] Picture	Art	Cartoon	Sketch	Avg.	VLCS [42] VOC 2007	LabelMe	Caltech101	SUN09	Avg.
SAM [13]	✓	18.41	15.13	21.38	19.12	18.51	44.72	46.02	61.13	41.62	48.38
ERM [44]	✓	97.08	87.19	86.25	82.38	88.22	75.60	64.47	97.08	77.49	78.66
SagNet [33]	✓	91.99	84.56	69.19	20.07	66.45	51.02	62.63	61.13	61.16	58.98
DANN [14]	✓	97.68	89.93	86.41	81.11	88.78	77.86	66.97	98.59	73.53	79.24
MIRO [2]	✓	96.48	90.79	90.46	83.59	90.33	78.05	66.68	97.53	71.97	78.56
A2XP (ours)	✗	**99.07**	**95.27**	**98.07**	**87.85**	**95.07**	**84.07**	**68.72**	**99.62**	**80.19**	**83.15**



Qualitative Evaluation

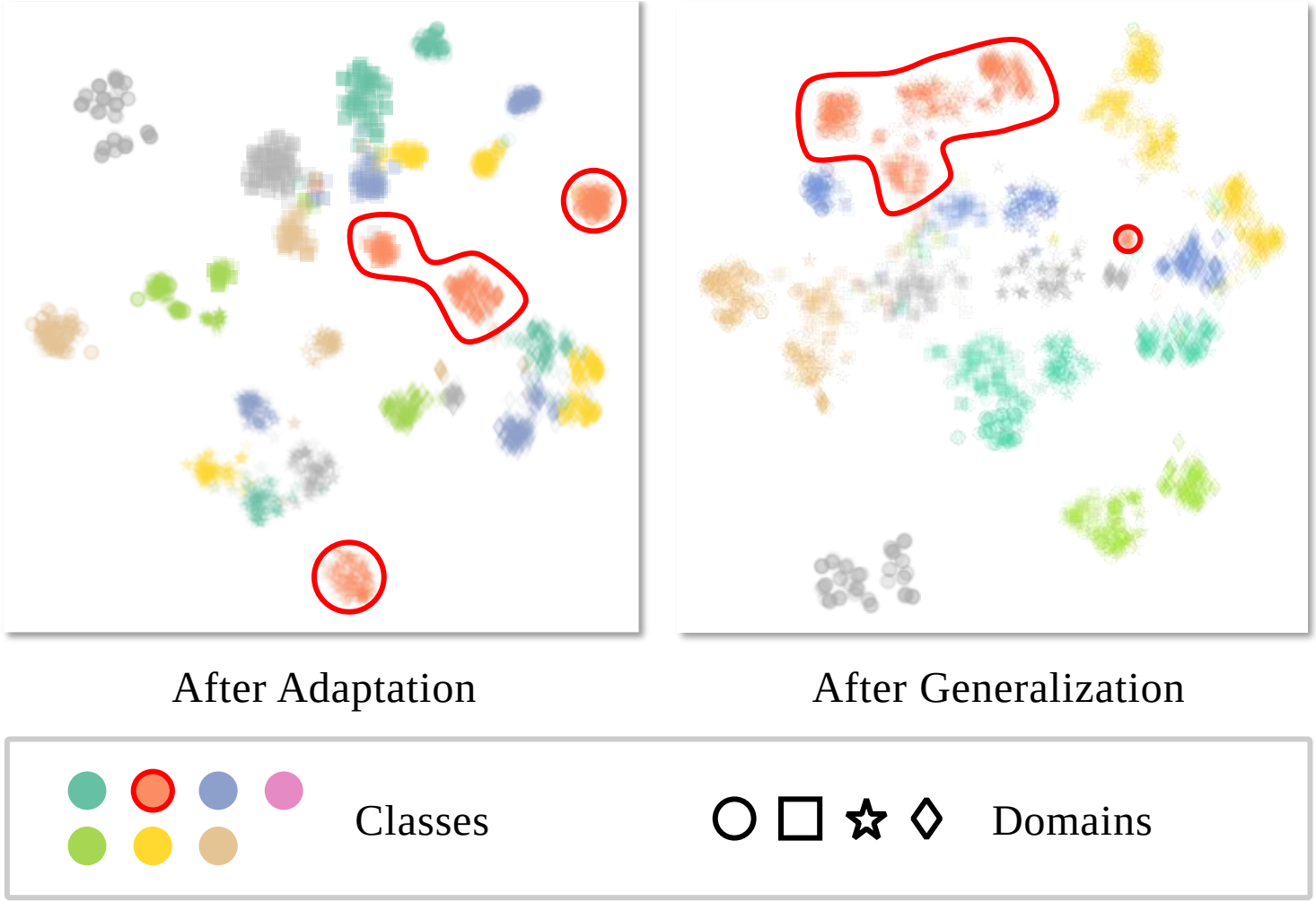
Visualization of Activation



Activation: Visualization of gain and loss of Grad-CAM.

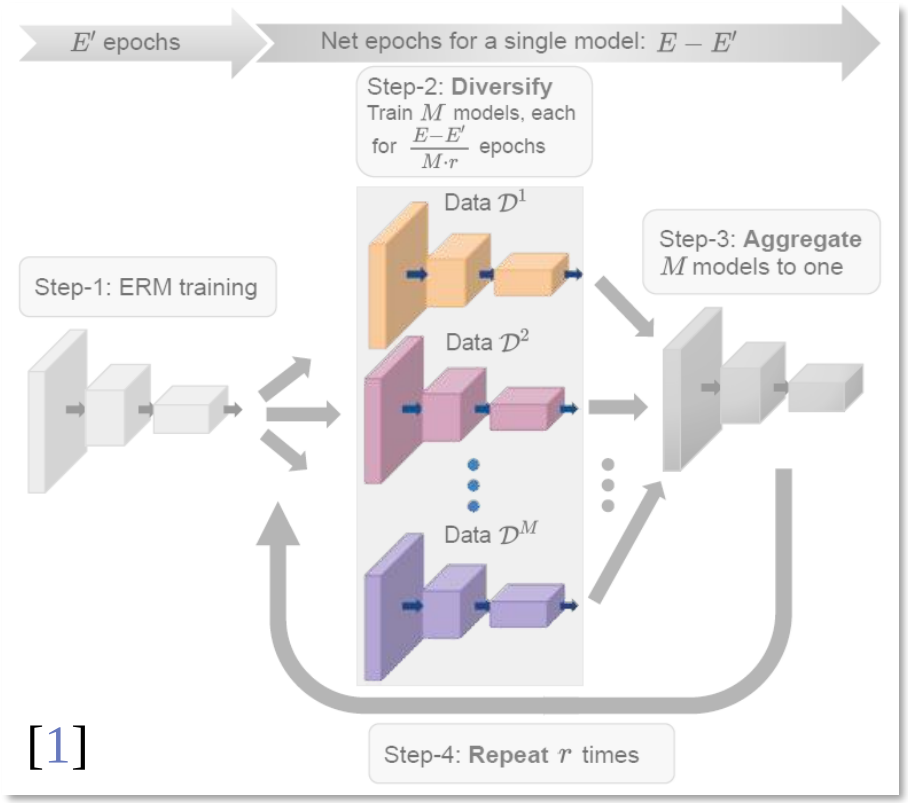
Qualitative Evaluation

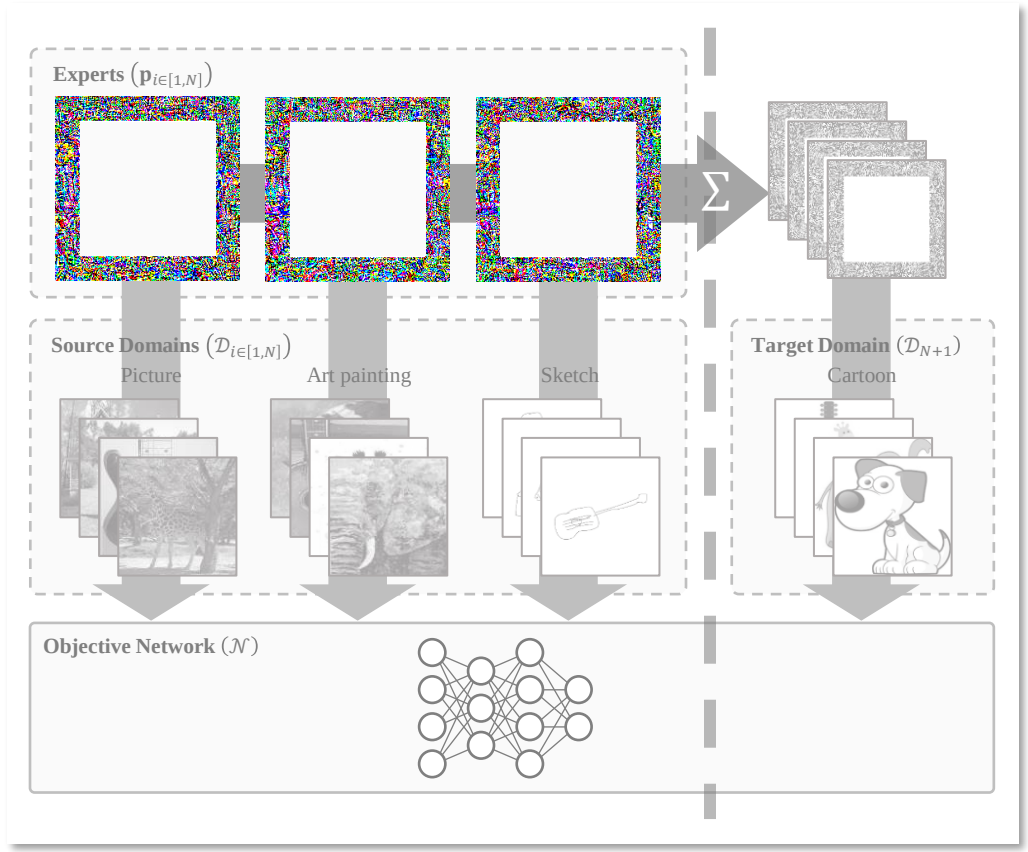
Visualization of Manifold



Manifold: t-SNE result of the manifold space after each phase.

Complexity Analysis





$\mathbf{O}_{\mathrm{DART}}(M) = M \times$ number of parameters per network

$\mathbf{O}_{\mathrm{A2XP}}(N) = N \times$ number of perameters per prompt

[1] Jain *et al.* "DART: Diversify-Aggregate-Repeat Training Improves Generalization of Neural Networks" CVPR 2023.

Thank You

Website: airlabkhu.github.io/A2XP

E-mail: geunhyeok@khu.ac.kr

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