Crafting Distribution Shifts for Validation and Training in Single Source Domain Generalization

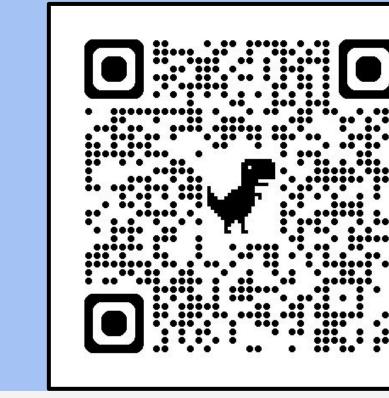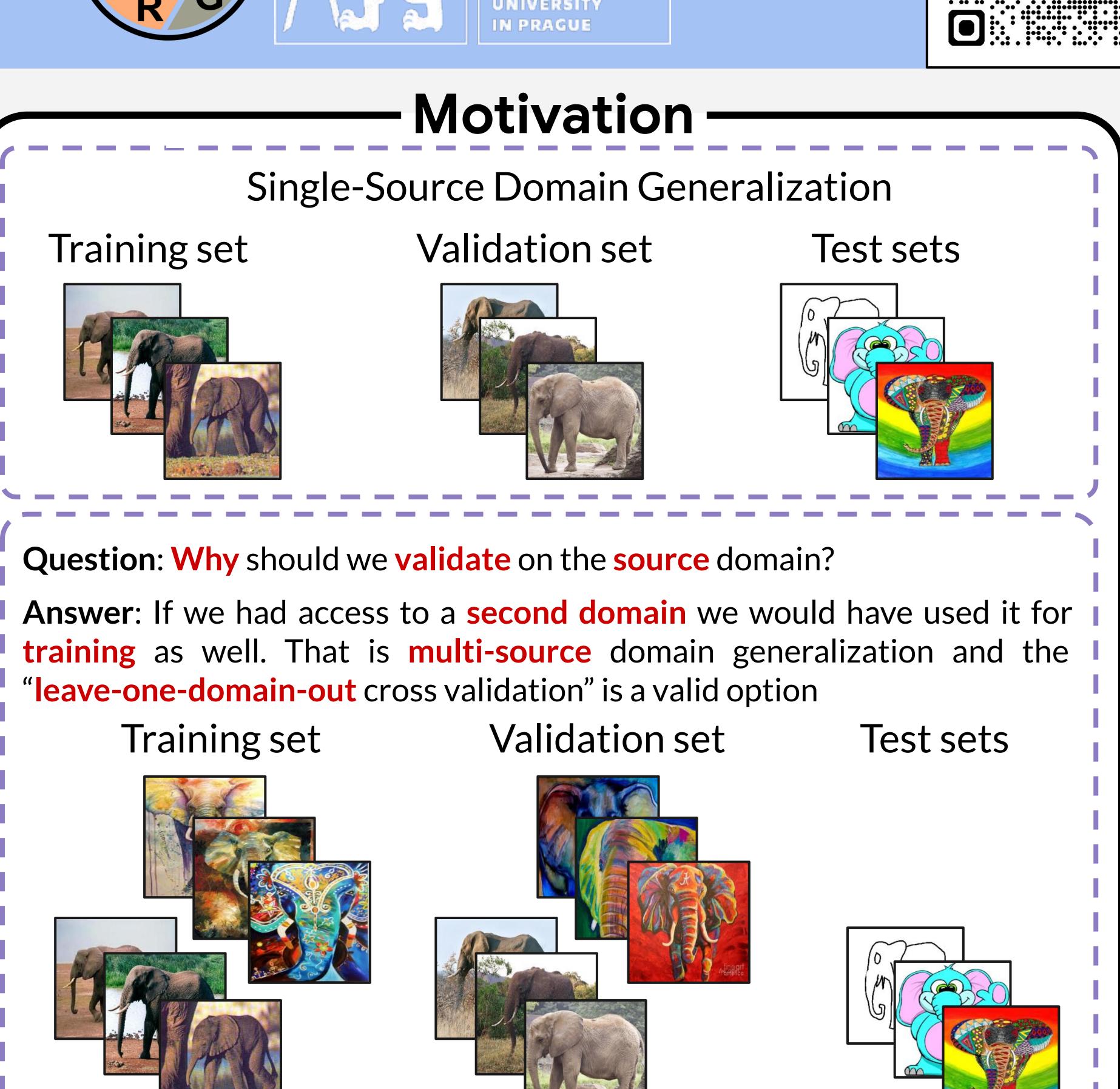Nikos Efthymiadis, Giorgos Tolias, Ondřej Chum

Paper

Code

WACV 2025
TUCSON, ARIZONA • FEB 28 - MAR 4
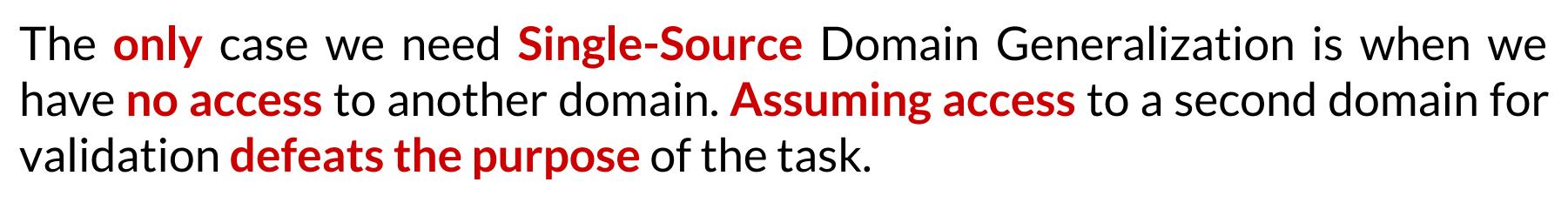
TL;DR: *Validation* protocol <u>*that works*</u> *for Single-Source Domain Generalization. Also a SoTA method.*

Motivation

Single-Source Domain Generalization

Training set   Validation set   Test sets

Question: Why should we **validate** on the **source** domain?

Answer: If we had access to a **second domain** we would have used it for **training** as well. That is **multi-source** domain generalization and the "**leave-one-domain-out**" cross validation is a valid option

Training set   Validation set   Test sets

The **only** case we need **Single-Source** Domain Generalization is when we have **no access** to another domain. **Assuming access** to a second domain for validation **defeats the purpose** of the task.
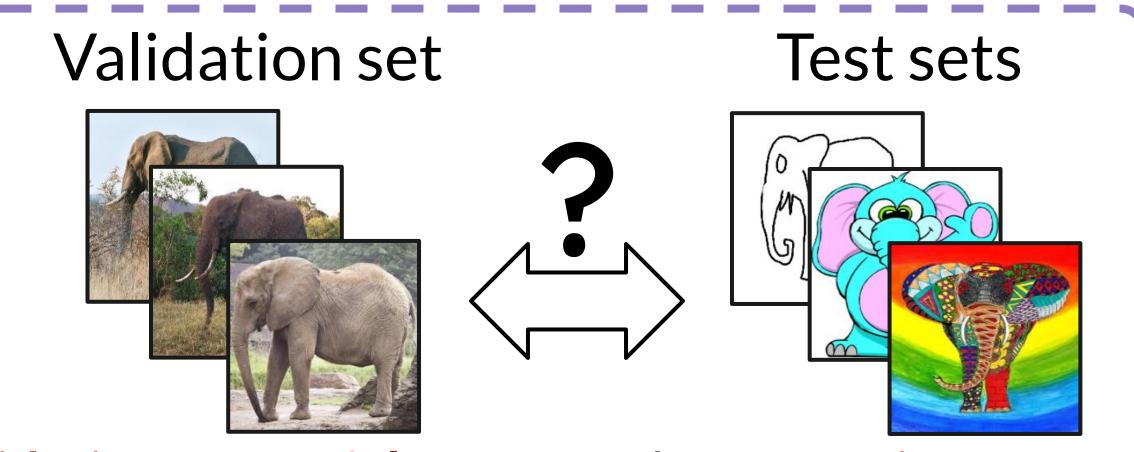
Validation set   Test sets

Question: Is the **source validation** set **useful** for generalization **as is**?

Our Contribution

- A **validation protocol** for Single-Source Domain Generalization that captures the **generalization abilities** of each model while having access only to the **source** domain

- A Single-Source Domain Generalization **method** that is **State-of-The-Art** in **four** popular generalization **datasets**

Proposed Validation Protocol

Original Val Set   Augmented Val Set

10 groups of **76 kinds** of augmentations

How to augment your validation

Augmented Train   Augmented Val

Val Acc 1

Augmented Train   Augmented Val

Val Acc 2

Augmented Train

Average(Val Acc 1, Val Acc 2)

How to train and validate with the same augmentations

Spearman's Corr. **0.22**   Spearman's Corr. **0.86**

PACS, ViT-small   PACS, ResNet18

V_S: standard val. acc. V_A: augmented val. acc.

Spearman's Corr. **-0.20**   Spearman's Corr. **0.74**

Baseline   ACVC   L2D   SelfReg   SagNet   Ours

V_S: standard val. acc. V_A: augmented val. acc.

V_S 43.3 V_A 65.5

Proposed V_A — Standard V_S — Oracle V_O

What will you gain!

Proposed Method

training image   augment   shape   network f CE   label   CE λ $\times$ $+$ total loss

training

val image   augment   validation only

test image   augment   shape   network f w $1-w$ $\times$

validation and test

PACS - AlexNet
46.4   55.2   57.2   61.0
ERM   L2D   MetaCNN   Ours

PACS - ResNet18
38.9   49.5   48.5   56.7   62.9   65.9
ERM   SelfReg   SagNet   CADA   ProRandC   Ours

Mini-DomainNet - ResNet18
47.6   56.4   51.3   53.7   51.8   57.4
ERM   SagNet   ACVC   SelfReg   L2D   Ours

Camelyon17 - ResNet50
80.4   82.6   84.0   85.4   87.7   93.6
ERM   AugMax   AdvBNN   AugMix   RandConv   Ours

Digits - LeNet
57.0   74.5   74.6   78.8   80.6   81.4   82.6
ERM   L2D   RandConv   MetaCNN   CADA   ProRandC   Ours

SoTA in 4 datasets!

Performance