GeoNet: Benchmarking Unsupervised Adaptation across Geographies
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SCAN ME

1. GeoNet Dataset

205	**#classes**	600
400,000	**#images**	**300,000**

Scene Recognition → **Object Classification**
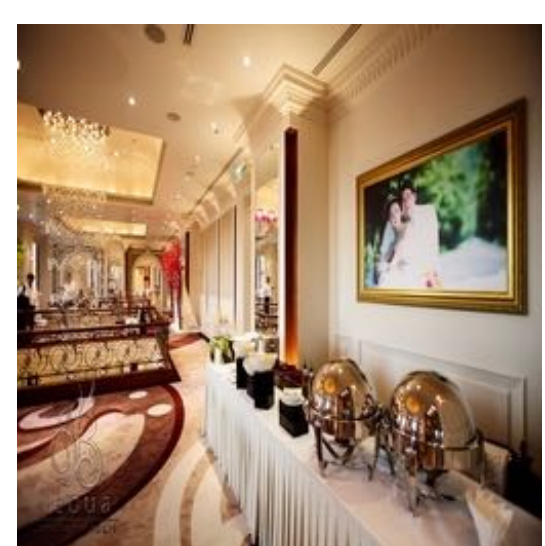
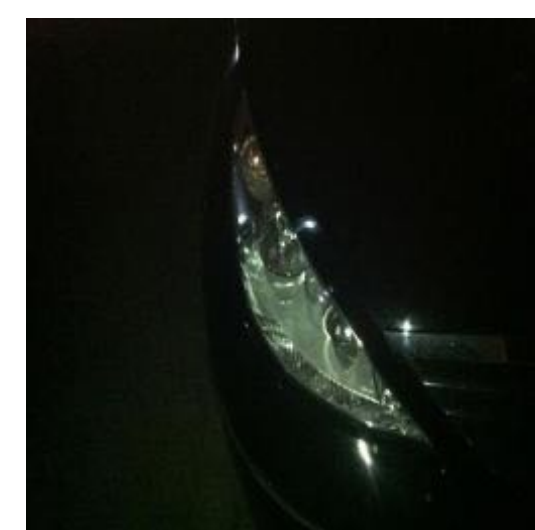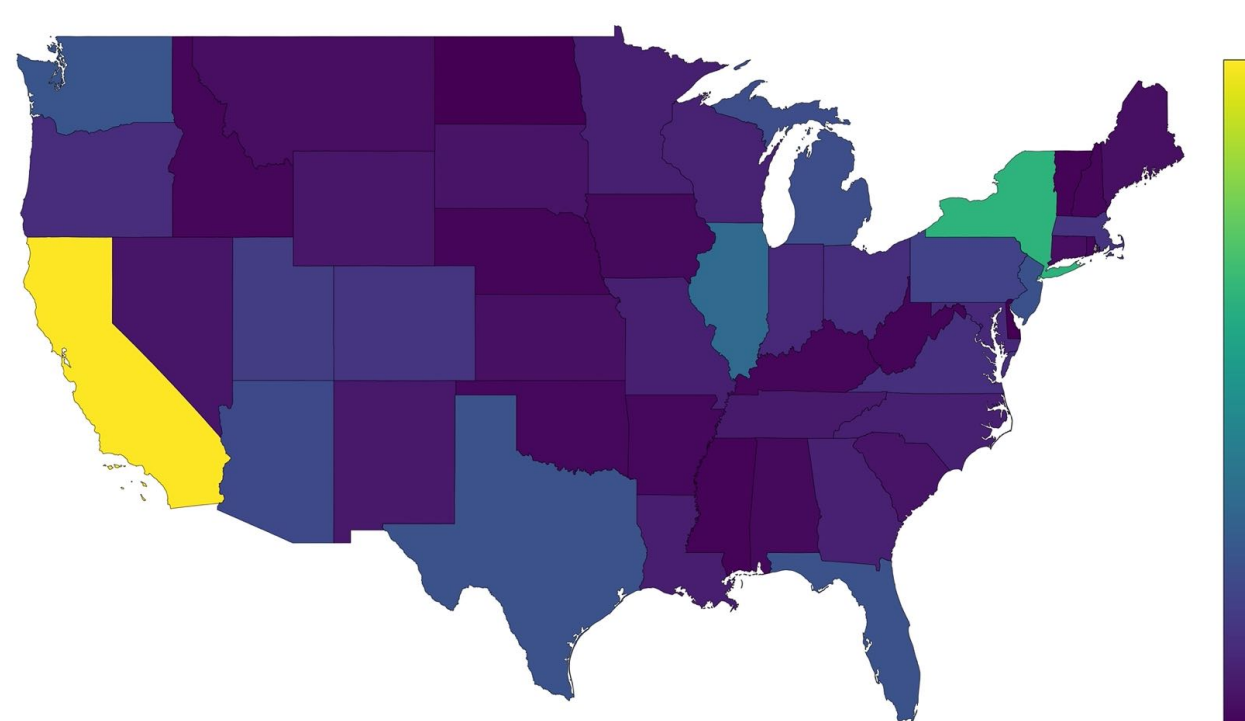**Restaurant**   **Freight Car**
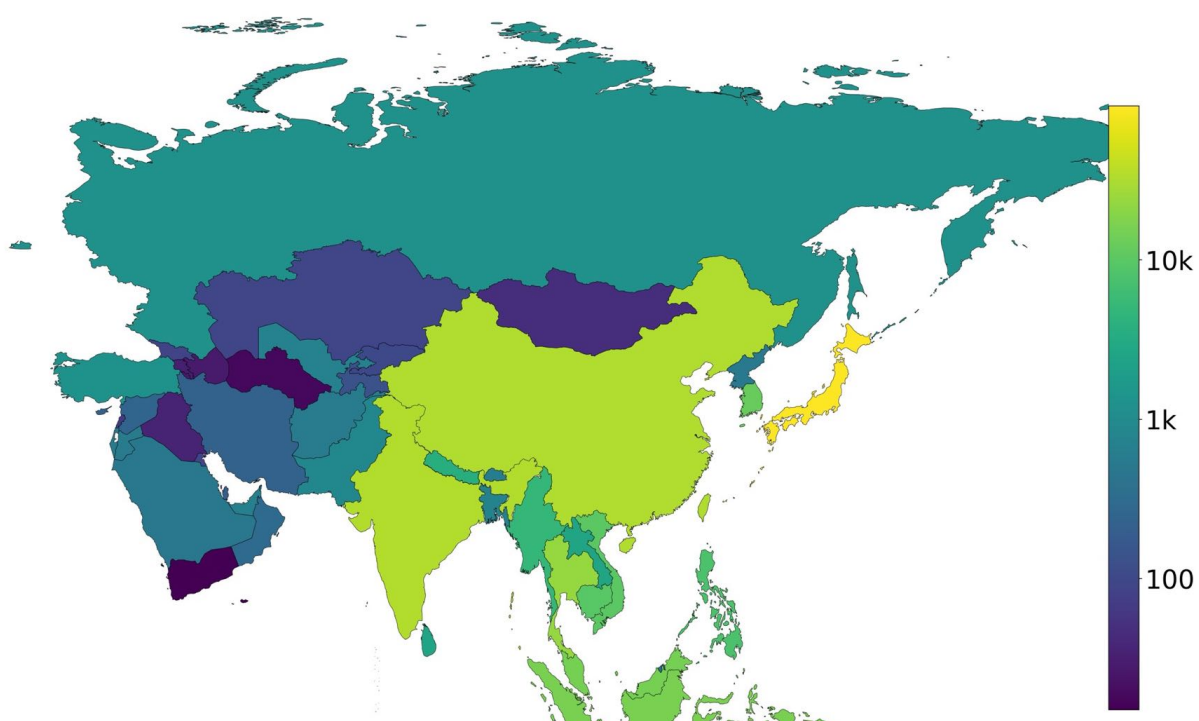
Shopfront   **Headlight**

Geographical Image Distribution in GeoNet

USA   **Asia**

We study the significant accuracy drop observed on images from under-represented geographies.

GPS: (41.20,77.19)
Location: Pennsylvania,USA
Category: Mailbox
Prediction: Mailbox

GPS: (39.74,-104.99)
Location: Denver, USA
Category: Running Track
Prediction: Running Track

GPS: (12.28,77.94)
Location: Mysore, India
Category: Mailbox
Prediction: Red Maple

GPS: (35.67, 139.65)
Location: Tokyo, Japan
Category: Running Track
Prediction: Baseball Field

Training Domain USA ⟷ *Context Shift / Design Shift* ⟷ **Testing Domain Asia**
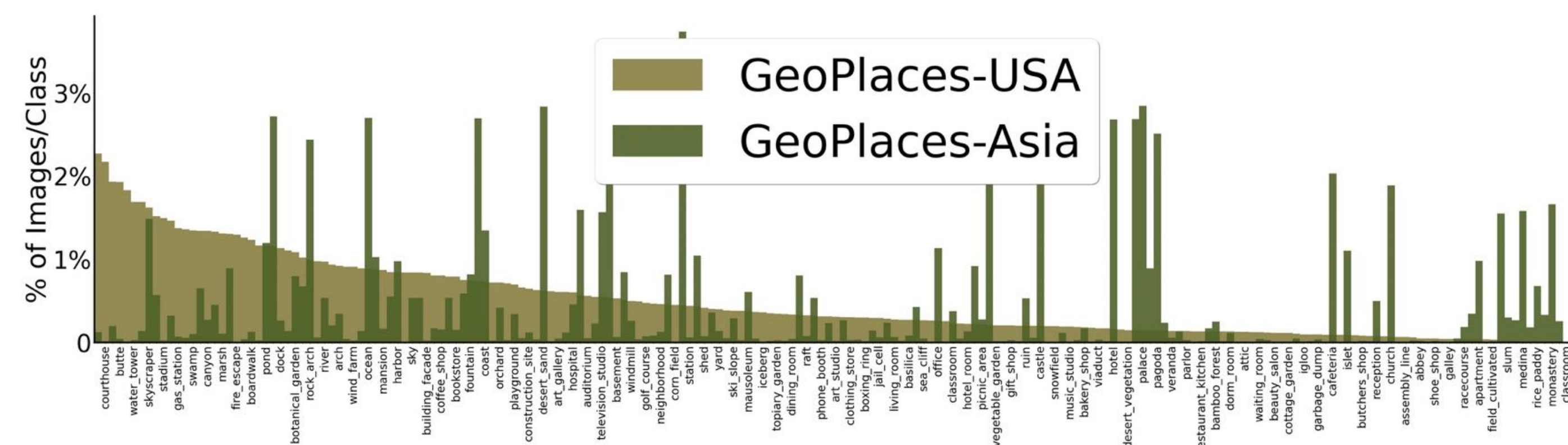
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2. GeoNet Analysis

$$P(x,y) = P(b_x|y) \cdot P(f_x|y) \cdot P(y)$$

Context Shift
$$P_s(b_x|y) \neq P_t(b_x|y)$$
Background of scenes shift across domains

Design Shift
$$P_s(f_x|y) \neq P_t(f_x|y)$$
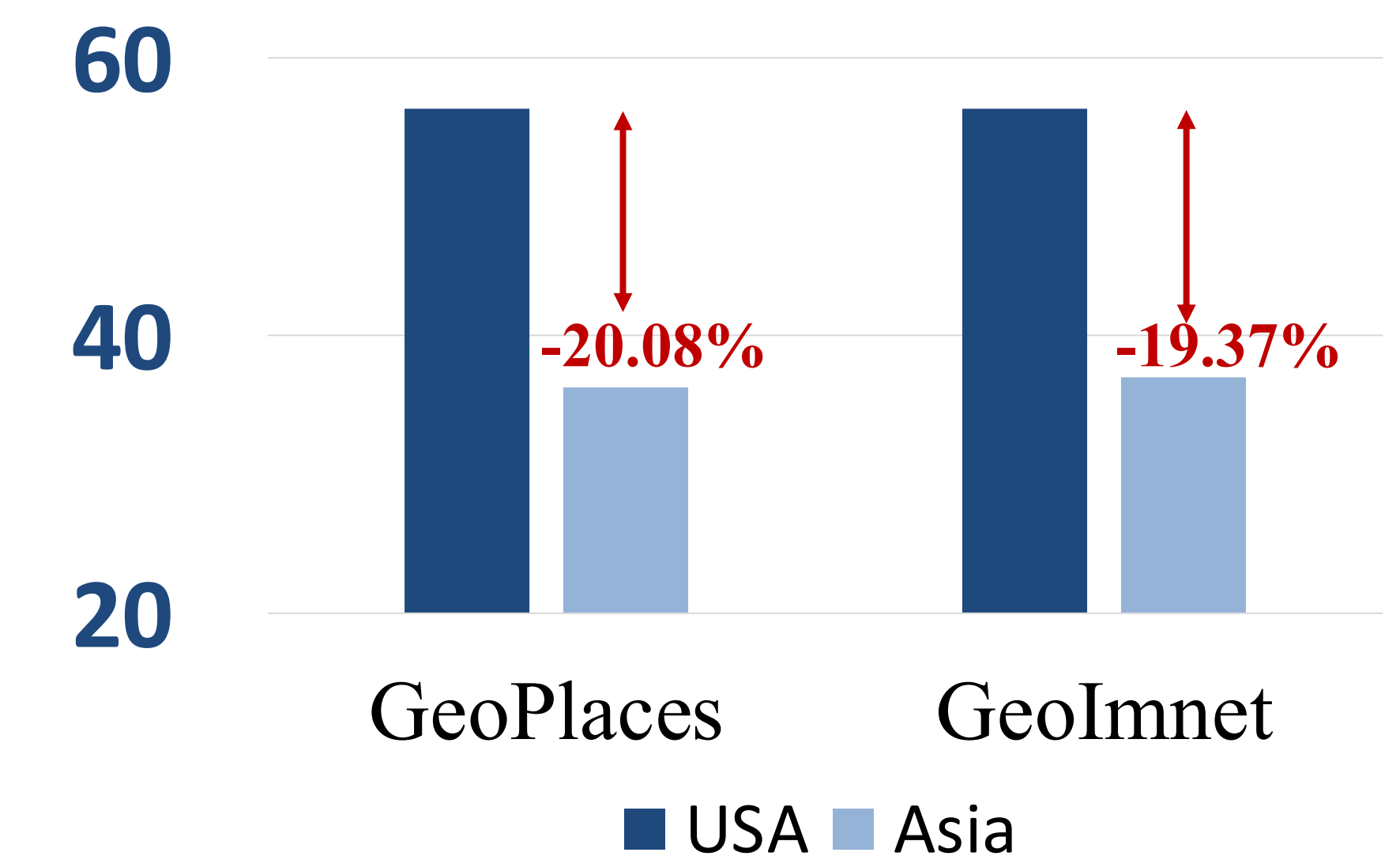*Design of objects change across domains*

Label Shift
$$P_s(y) \neq P_t(y)$$
Class-distribution shift across geographies
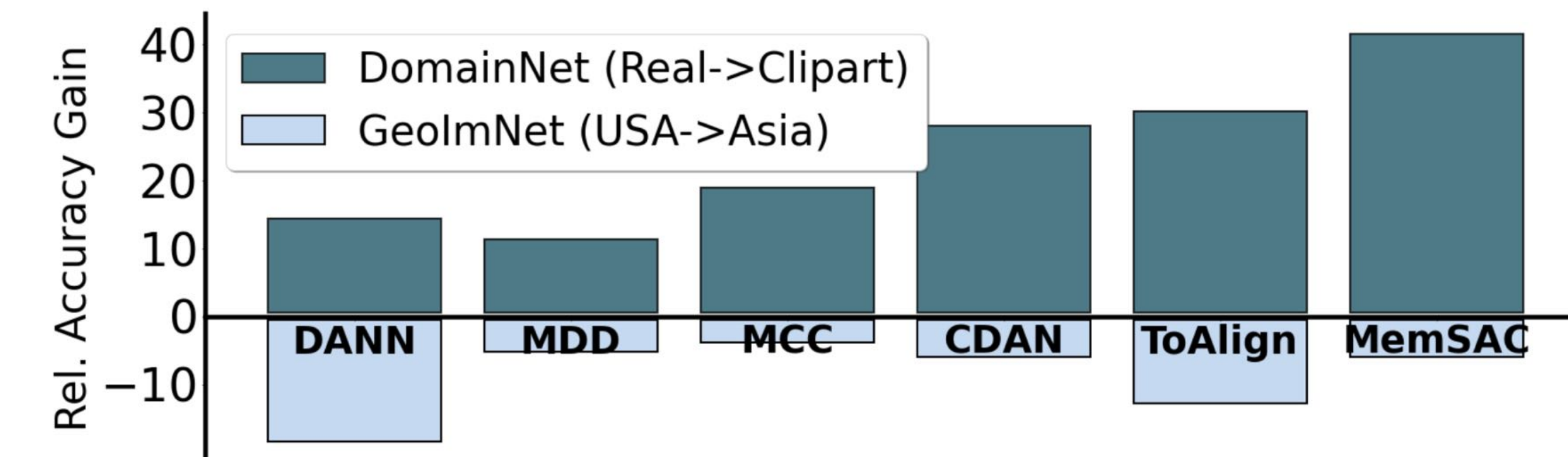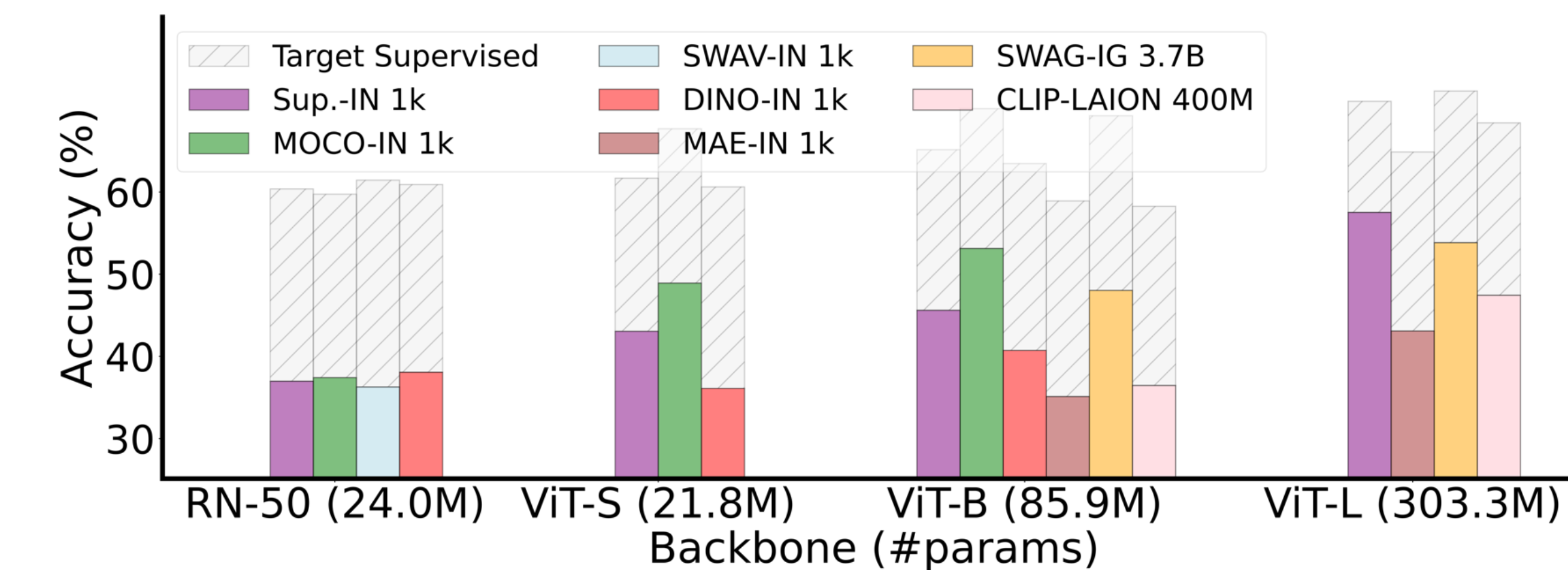
Label Distribution in GeoNet

Legend: GeoPlaces-USA, GeoPlaces-Asia

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3. GeoNet Benchmarking

Cross-domain Performance

-20.08%   -19.37%

GeoPlaces   GeoImnet

Legend: USA, Asia

Unsupervised Domain Adaptation

Rel. Accuracy Gain

Legend: DomainNet (Real→Clipart), GeoImNet (USA→Asia)

DANN   MDD   MCC   CDAN   ToAlign   MemSAC

Large-Scale Pretraining

Accuracy (%)

Legend: Target Supervised, Sup.-IN 1k, MOCO-IN 1k, SWAV-IN 1k, DINO-IN 1k, MAE-IN 1k, SWAG-IG 3.7B, CLIP-LAION 400M

RN-50 (24.0M)   ViT-S (21.8M)   ViT-B (85.9M)   ViT-L (303.3M)

Backbone (#params)

Unsupervised adaptation and large-scale pre-training do not suffice for bridging geographical disparity between domains.