## **Realistic Test-Time Adaptation of Vision-Language Models**

# Supplementary Material

### A. Additional experimental details

**Datasets.** We follow the setting of previous work [45]. We assess our method on ImageNet [8] and ten other datasets for fine-grained classification of scenes (SUN397 [35]), aircraft types (Aircraft [21]), satellite imagery (EuroSAT [13]), automobiles (StanfordCars [18]), food items (Food101 [2]), pet breeds (OxfordPets [28]), flowers (Flower102 [25]), general objects (Caltech101 [10]), textures (DTD [7]) and human actions (UCF101 [31]). These diverse datasets provide a comprehensive visual classification benchmark. Additional information on the statistics of each dataset is provided in Table 6.

**Hyperparameters** Generalization to unseen cases is crucial for TTA methods. Therefore, optimizing hyperparameters for each scenario would require access to labels and prior knowledge of the specific scenario encountered during testing, which goes against the core purpose of the TTA approach. For instance, we found that TDA largely relies on dataset-specific hyperparameters without clear guidance on how to tune them for a new dataset. Similarly, DMN conducts an hyperparameter search in order to find the optimal balance between the logits obtained from the text prompts and the logits from their model's memory, using knowledge from ground truth labels. To ensure fairness in comparison, we use hyperparameters optimized for ImageNet for all reported experiments.

**Comparative methods.** We use the same handcrafted prompts for all methods, which are listed in Table 5. Due to the more versatile scenarios studied in this paper, we find that our centroid initialization based on text embeddings much more robust, especially when the number of effective classes is reduced. Therefore, we implement it for TransCLIP instead of their original initialization based on the top-confident samples for each class. For ZLaP and Dirichlet we follow the hyperparameters of their official implementation. For TDA and DMN, following our discussion, we use the hyperparameters optimized for ImageNet. For TDA, this means the positive logits mixing coefficients is set to 2, while the negative logits mixing coefficient is set to 0.117. For DMN, since we only consider zero-shot scenarios, we only need to set the coefficient relative to the dynamic memory, which is set to 1. For TENT, we use a learning rate of 0.001 and 10 steps of gradient descent per batch.

#### B. Kullback-Leibler divergence between two multivariate Gaussian distributions

Let  $\mathcal{N}(\boldsymbol{\mu}_p, \boldsymbol{\Sigma}_p)$  and  $\mathcal{N}(\boldsymbol{\mu}_q, \boldsymbol{\Sigma}_q)$  two multivariate Gaussian distributions with respective probability density functions p and q. Then, we have

$$\operatorname{KL}(p||q) = \int_{x} p(x) \log \frac{p(x)}{q(x)} \,\mathrm{d}x \tag{13}$$

$$= \mathbb{E}_p[\log(p) - \log(q)] \tag{14}$$

$$= \mathbb{E}_p\left[\frac{1}{2}\log\frac{|\mathbf{\Sigma}_q|}{|\mathbf{\Sigma}_p|} - \frac{1}{2}(\mathbf{x} - \boldsymbol{\mu}_p)^{\top} \mathbf{\Sigma}_p^{-1}(\mathbf{x} - \boldsymbol{\mu}_p) + \frac{1}{2}(\mathbf{x} - \boldsymbol{\mu}_q)^{\top} \mathbf{\Sigma}_q^{-1}(\mathbf{x} - \boldsymbol{\mu}_q)\right]$$
(15)

$$= \frac{1}{2} \mathbb{E}_p \left[ \log \frac{|\boldsymbol{\Sigma}_q|}{|\boldsymbol{\Sigma}_p|} \right] - \frac{1}{2} \mathbb{E}_p \left[ (\mathbf{x} - \boldsymbol{\mu}_p)^\top \boldsymbol{\Sigma}_p^{-1} (\mathbf{x} - \boldsymbol{\mu}_p) \right] + \frac{1}{2} \mathbb{E}_p \left[ (\mathbf{x} - \boldsymbol{\mu}_q)^\top \boldsymbol{\Sigma}_q^{-1} (\mathbf{x} - \boldsymbol{\mu}_q) \right]$$
(16)

$$= \frac{1}{2} \log \frac{|\boldsymbol{\Sigma}_{q}|}{|\boldsymbol{\Sigma}_{p}|} - \frac{1}{2} \mathbb{E}_{p}[(\mathbf{x} - \boldsymbol{\mu}_{p})^{\top} \boldsymbol{\Sigma}_{p}^{-1} (\mathbf{x} - \boldsymbol{\mu}_{p})] + \frac{1}{2} \mathbb{E}_{p}[(\mathbf{x} - \boldsymbol{\mu}_{q})^{\top} \boldsymbol{\Sigma}_{q}^{-1} (\mathbf{x} - \boldsymbol{\mu}_{q})].$$
(17)

We can rewrite the second term as

$$(\mathbf{x} - \boldsymbol{\mu}_p)^{\top} \boldsymbol{\Sigma}_p^{-1} (\mathbf{x} - \boldsymbol{\mu}_p) = \operatorname{Tr} \left( (\mathbf{x} - \boldsymbol{\mu}_p)^{\top} \boldsymbol{\Sigma}_p^{-1} (\mathbf{x} - \boldsymbol{\mu}_p) \right) = \operatorname{Tr} \left( (\mathbf{x} - \boldsymbol{\mu}_p) (\mathbf{x} - \boldsymbol{\mu}_p)^{\top} \boldsymbol{\Sigma}_p^{-1} \right)$$
(18)

by using

$$Tr(ABC) = Tr(BCA) = Tr(CAB).$$
(19)

For the third term, since we assume x follows a Gaussian distribution  $\mathcal{N}(\boldsymbol{\mu}_p, \boldsymbol{\Sigma}_p)$ , we have (see Matrix cookbook [29] Eq. 380 of Section 8.2)

$$\mathbb{E}[(\mathbf{x} - \boldsymbol{\mu}_q)^{\top} \boldsymbol{\Sigma}_q^{-1} (\mathbf{x} - \boldsymbol{\mu}_q)] = (\boldsymbol{\mu}_p - \boldsymbol{\mu}_q)^{\top} \boldsymbol{\Sigma}_q^{-1} (\boldsymbol{\mu}_p - \boldsymbol{\mu}_q) + \operatorname{Tr}(\boldsymbol{\Sigma}_q^{-1} \boldsymbol{\Sigma}_p)$$
(20)

And therefore

$$\operatorname{KL}(p||q) = \frac{1}{2} \log \frac{|\boldsymbol{\Sigma}_q|}{|\boldsymbol{\Sigma}_p|} - \frac{1}{2} \mathbb{E}_p [\operatorname{Tr}\left((\mathbf{x} - \boldsymbol{\mu}_p)(\mathbf{x} - \boldsymbol{\mu}_p)^\top \boldsymbol{\Sigma}_p^{-1}\right)] + \frac{1}{2} ((\boldsymbol{\mu}_p - \boldsymbol{\mu}_q)^\top \boldsymbol{\Sigma}_q^{-1} (\boldsymbol{\mu}_p - \boldsymbol{\mu}_q) + \operatorname{Tr}\{\boldsymbol{\Sigma}_q^{-1}\boldsymbol{\Sigma}_p\}) \quad (21)$$

$$= \frac{1}{2} \log \frac{|\boldsymbol{\Sigma}_{q}|}{|\boldsymbol{\Sigma}_{p}|} - \frac{1}{2} (\operatorname{Tr} \left( \mathbb{E}_{p} [(\mathbf{x} - \boldsymbol{\mu}_{p})(\mathbf{x} - \boldsymbol{\mu}_{p})^{\top}] \boldsymbol{\Sigma}_{p}^{-1} \right) + \frac{1}{2} ((\boldsymbol{\mu}_{p} - \boldsymbol{\mu}_{q})^{\top} \boldsymbol{\Sigma}_{q}^{-1} (\boldsymbol{\mu}_{p} - \boldsymbol{\mu}_{q}) + \operatorname{Tr} (\boldsymbol{\Sigma}_{q}^{-1} \boldsymbol{\Sigma}_{p})) \quad (22)$$

by using the fact that trace and expectation can be interchanged. Moreover,

$$\mathbb{E}_p[(\mathbf{x} - \boldsymbol{\mu}_p)(\mathbf{x} - \boldsymbol{\mu}_p)^\top] = \boldsymbol{\Sigma}_p$$
(23)

which simplifies further the second term of the sum and gives

$$\operatorname{KL}(p||q) = \frac{1}{2} \log \frac{|\boldsymbol{\Sigma}_q|}{|\boldsymbol{\Sigma}_p|} - \frac{1}{2} (\operatorname{Tr}(\boldsymbol{I}_k) + \frac{1}{2} ((\boldsymbol{\mu}_p - \boldsymbol{\mu}_q)^\top \boldsymbol{\Sigma}_q^{-1} (\boldsymbol{\mu}_p - \boldsymbol{\mu}_q) + \operatorname{Tr}(\boldsymbol{\Sigma}_q^{-1} \boldsymbol{\Sigma}_p))$$
(24)

$$= \frac{1}{2} \log \frac{|\boldsymbol{\Sigma}_q|}{|\boldsymbol{\Sigma}_p|} - \frac{d}{2} + \frac{1}{2} ((\boldsymbol{\mu}_p - \boldsymbol{\mu}_q)^\top \boldsymbol{\Sigma}_q^{-1} (\boldsymbol{\mu}_p - \boldsymbol{\mu}_q) + \operatorname{Tr}(\boldsymbol{\Sigma}_q^{-1} \boldsymbol{\Sigma}_p))$$
(25)

$$= \frac{1}{2} \left( \log \frac{|\boldsymbol{\Sigma}_q|}{|\boldsymbol{\Sigma}_p|} - d + (\boldsymbol{\mu}_p - \boldsymbol{\mu}_q)^\top \boldsymbol{\Sigma}_q^{-1} (\boldsymbol{\mu}_p - \boldsymbol{\mu}_q) + \operatorname{Tr}(\boldsymbol{\Sigma}_q^{-1} \boldsymbol{\Sigma}_p) \right)$$
(26)

with d the number of dimensions.

## C. Detailed derivations of the regularized updates of the parameters

We write  $p_k$  and  $q_k$  the respective probability density functions of the distributions  $\mathcal{N}(\mu_k, \Sigma_k)$  and  $\mathcal{N}(\mu'_k, \Sigma'_k)$ . With the results of Appendix Section B, we have

$$\mathcal{A}(\boldsymbol{\mu}, \boldsymbol{\Sigma}) = \sum_{k} \mathrm{KL}(q_{k} || p_{k}) = \frac{1}{2} \sum_{k} (\boldsymbol{\mu'}_{k} - \boldsymbol{\mu}_{k})^{\top} \boldsymbol{\Sigma}_{k}^{-1} (\boldsymbol{\mu'}_{k} - \boldsymbol{\mu}_{k}) + \mathrm{Tr}(\boldsymbol{\Sigma}_{k}^{-1} \boldsymbol{\Sigma'}_{k}) + \log \frac{|\boldsymbol{\Sigma}_{k}|}{|\boldsymbol{\Sigma'}_{k}|} - d.$$

## **C.1.** With respect to $\mu_k$

$$\frac{\partial \mathcal{L}}{\partial \boldsymbol{\mu}_{k}} = \frac{\partial}{\partial \boldsymbol{\mu}_{k}} \left( -\sum_{i \in \mathcal{Q}} \mathbf{z}_{i}^{\top} \log(\mathbf{p}_{i}) - \sum_{i \in \mathcal{Q}} \sum_{j \in \mathcal{Q}} w_{ij} \mathbf{z}_{i}^{\top} \mathbf{z}_{j} + \sum_{i \in \mathcal{Q}} \mathrm{KL}(\mathbf{z}_{i} || \hat{\mathbf{y}}_{i}) + \alpha \mathcal{A}(\boldsymbol{\mu}, \boldsymbol{\Sigma}) \right)$$

$$(27)$$

$$= \frac{\partial}{\partial \boldsymbol{\mu}_{k}} \left( -\sum_{i \in \mathcal{Q}} \mathbf{z}_{i}^{\top} \log(\mathbf{p}_{i}) - \sum_{i \in \mathcal{Q}} \sum_{j \in \mathcal{Q}} w_{ij} \mathbf{z}_{i}^{\top} \mathbf{z}_{j} + \sum_{i \in \mathcal{Q}} \mathrm{KL}(\mathbf{z}_{i} || \hat{\mathbf{y}}_{i}) + \alpha \sum_{l=1}^{K} \mathrm{KL}(\mathbf{q}_{l} || \mathbf{p}_{l}) \right)$$
(28)

$$= \frac{\partial}{\partial \boldsymbol{\mu}_{k}} \left( -\sum_{i \in \mathcal{Q}} z_{i,k} \left( -\frac{1}{2} \log |\boldsymbol{\Sigma}_{k}| - \frac{1}{2} (\mathbf{f}_{i} - \boldsymbol{\mu}_{k})^{\top} \boldsymbol{\Sigma}_{k}^{-1} (\mathbf{f}_{i} - \boldsymbol{\mu}_{k}) \right) + \frac{\alpha}{2} (\boldsymbol{\mu}'_{k} - \boldsymbol{\mu}_{k})^{\top} \boldsymbol{\Sigma}_{k}^{-1} (\boldsymbol{\mu}'_{k} - \boldsymbol{\mu}_{k}) \right)$$
(29)

$$= -\sum_{i \in \mathcal{Q}} z_{i,k} \left( \boldsymbol{\Sigma}_k^{-1} (\mathbf{f}_i - \boldsymbol{\mu}_k) \right) + \alpha \boldsymbol{\Sigma}_k^{-1} (\boldsymbol{\mu'}_k - \boldsymbol{\mu}_k)$$
(30)

Observe that the term  $\alpha \Sigma_k^{-1}(\mu'_k - \mu_k)$  directly comes from the derivative of our statistical anchor  $\mathcal{A}(\mu, \Sigma)$  with regard to  $\mu_k$ . By setting the derivative to 0

$$-\sum_{i\in\mathcal{Q}}z_{i,k}(\mathbf{f}_i-\boldsymbol{\mu}_k)-\alpha(\boldsymbol{\mu'}_k-\boldsymbol{\mu}_k)=0$$
(31)

$$\sum_{i \in \mathcal{Q}} z_{i,k} \mathbf{f}_i + \alpha \boldsymbol{\mu'}_k = \sum_{i \in \mathcal{Q}} z_{i,k} \boldsymbol{\mu}_k + \alpha \boldsymbol{\mu}_k$$
(32)

$$\sum_{i \in \mathcal{Q}} z_{i,k} \mathbf{f}_i + \alpha \boldsymbol{\mu'}_k = \left(\sum_{i \in \mathcal{Q}} z_{i,k} + \alpha\right) \boldsymbol{\mu}_k$$
(33)

We then obtain the centroid update

$$\boldsymbol{\mu}_{k} = \frac{\sum_{i \in \mathcal{Q}} z_{i,k} \mathbf{f}_{i} + \alpha \boldsymbol{\mu'}_{k}}{\sum_{i \in \mathcal{Q}} z_{i,k} + \alpha}.$$
(34)

If we write

$$\beta_k = \frac{\sum_{i \in \mathcal{Q}} z_{i,k}}{\sum_{i \in \mathcal{Q}} z_{i,k} + \alpha}$$
(35)

and

$$\boldsymbol{v}_{k} = \frac{\sum_{i \in \mathcal{Q}} z_{i,k} \mathbf{f}_{i}}{\sum_{i \in \mathcal{Q}} z_{i,k}}$$
(36)

we get the new centroid update

$$\boldsymbol{\mu}_{k} = \beta_{k} \boldsymbol{v}_{k} + (1 - \beta_{k}) \boldsymbol{\mu'}_{k}$$
(37)

C.2. With respect to  $\boldsymbol{\Sigma}_k^{-1}$ 

$$\frac{\partial \mathcal{L}}{\partial \boldsymbol{\Sigma}_{k}^{-1}} = \frac{\partial}{\partial \boldsymbol{\Sigma}_{k}^{-1}} \left( -\sum_{i \in \mathcal{Q}} \mathbf{z}_{i}^{\top} \log(\mathbf{p}_{i}) - \sum_{i \in \mathcal{Q}} \sum_{j \in \mathcal{Q}} w_{ij} \mathbf{z}_{i}^{\top} \mathbf{z}_{j} + \sum_{i \in \mathcal{Q}} \mathrm{KL}(\mathbf{z}_{i} || \hat{\mathbf{y}}_{i}) + \alpha \mathcal{A}(\boldsymbol{\mu}, \boldsymbol{\Sigma}) \right)$$
(38)

$$= \frac{\partial}{\partial \boldsymbol{\Sigma}_{k}^{-1}} \left( -\sum_{i \in \mathcal{Q}} \mathbf{z}_{i}^{\top} \log(\mathbf{p}_{i}) - \sum_{i \in \mathcal{Q}} \sum_{j \in \mathcal{Q}} w_{ij} \mathbf{z}_{i}^{\top} \mathbf{z}_{j} + \sum_{i \in \mathcal{Q}} \operatorname{KL}(\mathbf{z}_{i} || \hat{\mathbf{y}}_{i}) + \alpha \sum_{l=1}^{K} \operatorname{KL}(\mathbf{q}_{l} || \mathbf{p}_{l}) \right)$$
(39)  
$$= \frac{\partial}{\partial \boldsymbol{\Sigma}_{k}^{-1}} \left( -\sum_{i \in \mathcal{Q}} \mathbf{z}_{i}^{\top} \left( -\frac{1}{2} \log |\boldsymbol{\Sigma}_{k}| - \frac{1}{2} (\mathbf{f}_{i} - \boldsymbol{\mu}_{k})^{\top} \boldsymbol{\Sigma}_{k}^{-1} (\mathbf{f}_{i} - \boldsymbol{\mu}_{k}) \right) + \frac{\alpha}{2} (\log \frac{|\boldsymbol{\Sigma}_{k}|}{|\boldsymbol{\Sigma}'_{k}|} + (\boldsymbol{\mu}'_{k} - \boldsymbol{\mu}_{k})^{\top} \boldsymbol{\Sigma}_{k}^{-1} (\boldsymbol{\mu}'_{k} - \boldsymbol{\mu}_{k}) + \operatorname{Tr}(\boldsymbol{\Sigma}_{k}^{-1} \boldsymbol{\Sigma}'_{k}) ) \right)$$
(40)

Note that the term  $\log \frac{|\Sigma_k|}{|\Sigma'_k|} + (\mu'_k - \mu_k)^\top \Sigma_k^{-1} (\mu'_k - \mu_k) + \operatorname{Tr}(\Sigma_k^{-1} \Sigma'_k)$  directly comes from the derivative of our statistical anchor  $\mathcal{A}(\mu, \Sigma)$  with regard to  $\Sigma_k^{-1}$ . Using the formulas (from Matrix cookbook [29])

$$\frac{\partial}{\partial X} (\log |X|) = (X^{-1})^{\top}$$
(41)

$$\frac{\partial}{\partial X^{-1}} (\log |X|) = -X^{\top}$$
(42)

and

$$\frac{\partial}{\partial X}(\operatorname{Tr}(AXB)) = A^{\top}B^{\top}$$
(43)

$$\frac{\partial}{\partial X}(\operatorname{Tr}(AX^{-1}B)) = -(X^{-1}BAX^{-1})^{\top}$$
(44)

as well as the fact that covariances are symmetric ( $\Sigma^{\top} = \Sigma$ ), setting the derivative to 0 yields

$$-\sum_{i\in\mathcal{Q}} z_{i,k} \left( \boldsymbol{\Sigma}_k - (\mathbf{f}_i - \boldsymbol{\mu}_k)(\mathbf{f}_i - \boldsymbol{\mu}_k)^\top \right) + \alpha \left( -\boldsymbol{\Sigma}_k^\top + (\boldsymbol{\mu'}_k - \boldsymbol{\mu}_k)(\boldsymbol{\mu'}_k - \boldsymbol{\mu}_k)^\top + \boldsymbol{\Sigma'}_k^\top \right) = 0$$
(45)

$$-\sum_{i\in\mathcal{Q}} z_{i,k} \left( \boldsymbol{\Sigma}_k - (\mathbf{f}_i - \boldsymbol{\mu}_k) (\mathbf{f}_i - \boldsymbol{\mu}_k)^\top \right) + \alpha (-\boldsymbol{\Sigma}_k + (\boldsymbol{\mu'}_k - \boldsymbol{\mu}_k) (\boldsymbol{\mu'}_k - \boldsymbol{\mu}_k)^\top + \boldsymbol{\Sigma'}_k) = 0$$
(46)

(47)

$$\left(\sum_{i\in\mathcal{Q}}z_{i,k}+\alpha\right)\boldsymbol{\Sigma}_{k}=\sum_{i\in\mathcal{Q}}z_{i,k}(\mathbf{f}_{i}-\boldsymbol{\mu}_{k})(\mathbf{f}_{i}-\boldsymbol{\mu}_{k})^{\top}+\alpha(\boldsymbol{\Sigma}'_{k}+(\boldsymbol{\mu}'_{k}-\boldsymbol{\mu}_{k})(\boldsymbol{\mu}'_{k}-\boldsymbol{\mu}_{k})^{\top}).$$
(48)

We get

$$\boldsymbol{\Sigma}_{k} = \frac{\sum_{i \in \mathcal{Q}} z_{i,k} (\mathbf{f}_{i} - \boldsymbol{\mu}_{k}) (\mathbf{f}_{i} - \boldsymbol{\mu}_{k})^{\top} + \alpha (\boldsymbol{\Sigma}'_{k} + (\boldsymbol{\mu}'_{k} - \boldsymbol{\mu}_{k}) (\boldsymbol{\mu}'_{k} - \boldsymbol{\mu}_{k})^{\top})}{\sum_{i \in \mathcal{Q}} z_{i,k} + \alpha}.$$
(49)

By writing the old  $\Sigma_k$ -update

$$\boldsymbol{T}_{k} = \frac{\sum_{i \in \mathcal{Q}} z_{i,k} (\mathbf{f}_{i} - \boldsymbol{\mu}_{k}) (\mathbf{f}_{i} - \boldsymbol{\mu}_{k})^{\top}}{\sum_{i \in \mathcal{Q}} z_{i,k}},$$
(50)

we obtain the new covariance update

$$\boldsymbol{\Sigma}_{k} = \beta_{k} \boldsymbol{T}_{k} + (1 - \beta_{k}) (\boldsymbol{\Sigma'}_{k} + (\boldsymbol{\mu'}_{k} - \boldsymbol{\mu}_{k}) (\boldsymbol{\mu'}_{k} - \boldsymbol{\mu}_{k})^{\top}).$$
(51)

#### **D.** Detailed derivations of the complete formulation

We refer to the derivations and the convergence proof in the TransCLIP paper [40]. The optimization follows a Block Majorize-Minimize (BMM) procedure over three blocks of variables:  $\mathbf{z}$ ,  $\boldsymbol{\mu}$ , and  $\boldsymbol{\Sigma}$ . For the Majorize-Minimize (MM) with respect to the  $\mathbf{z}$ -block (while  $\boldsymbol{\mu}$  and  $\boldsymbol{\Sigma}$  are fixed), both the GMM- and KL-based terms are convex w.r.t  $\mathbf{z}_i$ . Consequently, we can proceed using similar arguments. For PSD matrix W, the Laplacian regularization term in Eq. (11) is concave. To address this, we can replace the quadratic Laplacian term by a linear bound. By introducing simplex constraints  $\mathbf{z}_i \in \Delta_K$  ( $\lambda_i$  the corresponding Lagrange multiplier) for  $i \in Q$ ,

$$\frac{\partial \mathcal{L}}{\partial \mathbf{z}_{i}} = \frac{\partial}{\partial \mathbf{z}_{i}} \left( -\sum_{i \in \mathcal{Q}} \mathbf{z}_{i}^{\top} \log(\mathbf{p}_{i}) - \sum_{i \in \mathcal{Q}} \sum_{j \in \mathcal{Q}} w_{ij} \mathbf{z}_{i}^{\top} \mathbf{z}_{j} + \sum_{i \in \mathcal{Q}} \operatorname{KL}(\mathbf{z}_{i} || \hat{\mathbf{y}}_{i}) + \alpha \mathcal{A}(\boldsymbol{\mu}, \boldsymbol{\Sigma}) + \sum_{i \in \mathcal{Q}} \lambda_{i}(\boldsymbol{z}_{i}^{\top} \mathbb{1}_{K} - 1) \right)$$
(52)

$$= -\log(\mathbf{p}_i) - \sum_{j \in \mathcal{Q}} w_{ij} \mathbf{z}_j - \log(\hat{\mathbf{y}}_i) + \log(\mathbf{z}_i) + (1 + \lambda_i) \mathbb{1}_K.$$
(53)

Using the constraint

$$\mathbb{1}_{K}^{\top} \mathbf{z}_{i} = 1, \tag{54}$$

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we solve the Karush-Kuhn-Tucker (KKT) conditions independently for each  $z_i$  and finally obtain

$$\mathbf{z}_{i}^{(l+1)} = \frac{\hat{\mathbf{y}}_{i} \odot \exp(\log(\mathbf{p}_{i}) + \sum_{j \in \mathcal{Q}} w_{ij} \mathbf{z}_{j}^{(l)})}{(\hat{\mathbf{y}}_{i} \odot \exp(\log(\mathbf{p}_{i}) + \sum_{j \in \mathcal{Q}} w_{ij} \mathbf{z}_{j}^{(l)}))^{\top} \mathbb{1}_{K}}.$$
(55)

Notice that the obtained z-updates are decoupled, yielding computationally efficient transduction for large-scale datasets (see runtime in Table 3).

#### E. Text prompts

We use the same text prompts for all our experiments. They are given in Table 5.

## F. Implementation details for online test-time adaptation

For generating non i.i.d. data streams, we follow the setup of recent works [36] and adopt a framework based on Dirichlet distributions. Namely, we distribute each class over a fixed number of slots according to proportions drawn following a Dirichlet distribution parametrized by a single scalar parameter  $\gamma$ . Therefore, for large values of  $\gamma$  each class is evenly distributed among slots (i.i.d data stream) while for small values each class is distributed in a single slot (highly correlated data stream). Then, samples are randomly shuffled within each slot. For every dataset and a given batch size, the number of

slots is min{K,  $\left\lfloor \frac{|Q|}{\text{batch size}} \right\rfloor$ }. This is illustrated in Figure 4.



Figure 4. Correlation matrix of per-batch  $\ell_2$  normalized vectors of class proportions for batch size 128. x and y axis of each plot is the batch index corresponding to the order in which the batches are processed. This illustrates the inter-batch correlation increasing as the Dirichlet parameter  $\gamma$  decreases.

Table 5. Prompt templates used in all experiments.

Dataset	Prompt template
ImageNet	"a photo of a []."
SUN397	"a photo of a []."
Aircraft	"a photo of a [], a type of aircraft.",
EuroSAT	"a centered satellite photo of [].",
Cars	"a photo of a [].",
Food101	"a photo of [], a type of food.",
Pets	"a photo of [], a type of pet.",
Flower102	"a photo of a [], a type of flower.",
Caltech101	"a photo of a [].",
DTD	"[] texture.",
UCF101	"a photo of a person doing [].",

Table 6. Additional information on the datasets.

Dataset name	Other given name	# classes	# test samples	task description
SUN397	Sun397	397	19,850	scenes classification
Aircraft	FGVCAircraft	100	3,333	aircraft classification
EuroSAT	EuroSAT	10	8,100	satellite images classification
Cars	StanfordCars	196	8,041	cars classification
Food101	Food101	101	30,300	food classification
Pets	OxfordPets	37	3,669	pets classification
Flowers102	OxfordFlowers	102	2,463	flowers classification
Caltech101	Caltech101	101	2,465	objects classification
DTD	DTD	47	1,692	textures classification
UCF101	UCF101	101	3,783	actions classification
ImageNet	ImageNet	1000	50,000	objects classification

## G. Additional results with other backbones

We present results on four additional CLIP encoders: two convolutional neural networks (ResNet-50 and ResNet-101) and two transformer-based architectures (ViT-B/32 and ViT-L/14), aiming to demonstrate that the findings in the main paper generalize well to other model choices. For batch test-time adaptation (see Tables 7, 8, and 9), we observe consistent improvements across various architectures and model sizes. Similarly, for online test-time adaptation (see Table 10), the results show that the observed improvements remain consistent regardless of the architecture or model size.

## H. Additional results with other batch sizes

We present results on intermediate batch sizes (128, 256 and 500) with the ViT-B/16 backbone in Table 11 to demonstrate the robustness of StatA.

## I. Additional results for another realistic scenario

We present an additional scenario (Table 12) in which the number of effective classes  $K_{\text{eff}}$  is randomly selected within a range from one to the minimum between the batch size and total number of classes in the dataset ( $K_{\text{eff}} \in (1, \min(\text{batch_size}, \text{total_classes}))$ ). It can be seen as an average of the different scenarios Low, Medium and High introduced in the main paper. This new scenario is evaluated under various batch sizes (64, 128, 256, 500, 1000, 2000). We can observe that even in this challenging scenario, StatA provides stable improvements in the vast majority of cases.

Table 7. Comparison of various CLIP encoders for the batch test-time adaptation setting with a batch size of 64. Each reported accuracy is averaged over 1,000 tasks. Subscripts indicate improvement or degradation compared to zero-shot.

(a) ResNet-50.													
$K_{\rm eff}$	Method	AVERAGE	Imagenet	5117397	Aircraft	FUROSAI	StanfordCars	FoodIOI	Rels	Flowerlos	Catteen101	DID	UCFIOI
	CLIP	58.7	58.2	58.9	17.0	36.2	55.8	77.4	85.7	66.1	85.7	42.8	61.8
Very Low	Stat A	65.8 <sub>+7.1</sub>	68.2 <sub>+10.0</sub>	63.7 <sub>+4.8</sub>	21.1+4.1	43.3+7.1	71.3 <sub>+15.5</sub>	87.1 <sub>+9.7</sub>	93.1 <sub>+7.4</sub>	74.1 <sub>+8.0</sub>	90.1 <sub>+4.4</sub>	45.3 <sub>+2.5</sub>	66.2 <sub>+4.4</sub>
Low	Stat A	62.3 <sub>+3.7</sub>	65.0 <sub>+6.8</sub>	62.8+3.9	$17.8_{\pm 0.8}$	31.7 <mark>_4.5</mark>	67.1 <sub>+11.3</sub>	83.6+6.2	88.2+2.5	71.7 <sub>+5.6</sub>	89.0 <sub>+3.3</sub>	44.9+2.1	64.0 <sub>+2.2</sub>
Medium	Stat A	58.6 <sub>-0.1</sub>	61.1 <sub>+2.9</sub>	59.5 <sub>+0.6</sub>	16.4 <mark>-0.6</mark>	27.3 <mark>-8.9</mark>	62.1 <sub>+6.3</sub>	78.7 <sub>+1.3</sub>	81.4 <mark>-4.3</mark>	64.1 <mark>-2.0</mark>	87.9+2.2	$43.8_{\pm 1.0}$	62.0 <sub>+0.2</sub>
(b) ResNet-101.													
$K_{\rm eff}$	Method	Average	InseeNet	5417397	Aircraft	FUIOSAT	StationaCars	FoodIOI	Rels	Flower102	Catechiol	DID	UCFIDI
	CLIP	59.5	61.3	59.0	17.9	32.9	63.2	80.7	86.9	64.3	89.9	37.3	61.1
Very Low	StatA	66.2 <sub>+6.7</sub>	73.0+11.7	66.5 <sub>+7.5</sub>	22.5+4.6	30.4 <mark>-2.5</mark>	76.2 <sub>+13.0</sub>	89.5 <sub>+8.8</sub>	95.2 <sub>+8.3</sub>	74.6 <sub>+10.3</sub>	91.9 <sub>+2.0</sub>	42.9+5.6	65.1 <sub>+4.0</sub>
Low	Stat A	65.1 <sub>+5.6</sub>	71.2 <sub>+9.9</sub>	65.9 <sub>+6.9</sub>	20.0+2.1	29.6 <mark>_3.3</mark>	73.1 <sub>+9.9</sub>	88.1 <sub>+7.4</sub>	92.9 <sub>+6.0</sub>	74.9 <sub>+10.6</sub>	92.8 <sub>+2.9</sub>	42.9 <sub>+5.6</sub>	64.4+3.3
Medium	StatA	62.5 <sub>+3.0</sub>	67.0 <sub>+5.7</sub>	62.7 <sub>+3.7</sub>	18.6 <sub>+0.7</sub>	28.7 <mark>_4.2</mark>	69.6 <sub>+6.4</sub>	84.9+4.2	88.8 <sub>+1.9</sub>	70.1 <sub>+5.8</sub>	92.1 <sub>+2.2</sub>	40.9+3.6	63.6 <sub>+2.5</sub>
						(c) ViT-H	3/32.						
$K_{\rm eff}$	Method	AVERAGE	InageNet	5117397	Aircraft	EUROSAT	StaffordCars	Foodlol	Pets	Flowerto	Catech101	DID	UCFIOI
	CLIP	61.9	62.0	62.1	19.1	45.4	60.2	80.4	87.3	66.6	91.4	42.7	63.5
Very Low	StatA	67.3 <sub>+5.4</sub>	68.1 <sub>+6.1</sub>	65.6 <sub>+3.5</sub>	23.0+3.9	53.2 <sub>+7.8</sub>	71.9 <sub>+11.7</sub>	85.8+5.4	94.3 <sub>+7.0</sub>	74.9 <sub>+8.3</sub>	93.4 <sub>+2.0</sub>	45.2 <sub>+2.5</sub>	$64.5_{\pm 1.0}$
Low	StatA	66.4 <sub>+4.5</sub>	67.2 <sub>+5.2</sub>	65.7 <sub>+3.6</sub>	$21.9_{+2.8}$	50.1 <sub>+4.7</sub>	69.3 <sub>+9.1</sub>	84.5 <sub>+4.1</sub>	92.5 <sub>+5.2</sub>	75.3 <sub>+8.7</sub>	$93.2_{\pm 1.8}$	46.1 <sub>+3.4</sub>	64.6 <sub>+1.1</sub>
Medium	StatA	64.3 <sub>+2.4</sub>	$65.5_{+3.5}$	64.8 <sub>+2.7</sub>	$20.0_{\pm 0.9}$	45.4 <sub>0.0</sub>	65.0 <sub>+4.8</sub>	82.6+2.2	89.4 <sub>+2.1</sub>	70.6 <sub>+4.0</sub>	$92.9_{\pm 1.5}$	46.7 <sub>+4.0</sub>	64.4 <sub>+0.9</sub>
						(d) ViT-I	_/14.						
$K_{ m eff}$	Method	AVERAGE	ImagelVet	5014397	Aircraft	FuroSAI	StanfordCars	FoodIOI	<b>P</b> <sup>205</sup>	Flowerlos	catech101	DID	UCEIDI
	CLIP	72.6	73.5	67.7	32.5	60.3	76.9	90.9	93.5	79.5	95.2	53.5	74.9
Very Low	Stat A	77.3 <sub>+4.7</sub>	78.9 <sub>+5.4</sub>	71.3 <sub>+3.6</sub>	40.4 <sub>+7.9</sub>	71.4+11.1	84.4+7.5	94.2 <sub>+3.3</sub>	97.1 <sub>+3.6</sub>	82.9+3.4	97.0 <sub>+1.8</sub>	55.3 <sub>+1.8</sub>	77.1+2.2
Low	StatA	76.1 <sub>+3.5</sub>	78.2 <sub>+4.7</sub>	71.6 <sub>+3.9</sub>	38.4 <sub>+5.9</sub>	65.6 <sub>+5.3</sub>	82.4+5.5	93.1 <sub>+2.2</sub>	96.3 <sub>+2.8</sub>	82.8+3.3	96.1 <sub>+0.9</sub>	55.4 <sub>+1.9</sub>	76.8 <sub>+1.9</sub>
Medium	StatA	74.5+2.0	76.6 <sub>+3.1</sub>	$70.0_{+2.3}$	36.4 <sub>+3.9</sub>	62.6 <sub>+2.3</sub>	80.6+3.7	92.1 <sub>+1.2</sub>	$93.9_{\pm 0.4}$	80.8+1.3	$95.6_{\pm 0.4}$	$54.6_{\pm 1.1}$	77.1+2.2

(a) ResNet-50.														
$K_{\rm eff}$	Method	AVERAGE	InageNet	5012397	Aircraft	EUROSAI	Stanford Cars	Foodlol	Pets	Flower102	Catteen101	DID	UCFIOI	
	CLIP	58.7	58.2	58.9	17.0	36.2	55.8	77.4	85.7	66.1	85.7	42.8	61.8	
Medium	$Stat \mathcal{A}$	64.1 <sub>+5.4</sub>	$65.2_{+7.0}$	61.5 <sub>+2.6</sub>	18.6 <sub>+1.6</sub>	51.2+15.0	67.2 <sub>+11.4</sub>	80.9+3.5	89.1 <sub>+3.4</sub>	70.7 <sub>+4.6</sub>	88.5+2.8	$46.8_{\pm 4.0}$	65.3 <sub>+3.5</sub>	
High	$Stat \mathcal{A}$	63.5 <sub>+4.8</sub>	65.4 <sub>+7.2</sub>	63.1 <sub>+4.2</sub>	16.5 <sub>-0.5</sub>	51.7+15.5	65.4 <sub>+9.6</sub>	81.0 <sub>+3.6</sub>	<sup>84.4</sup> -1.3	70.0 <sub>+3.9</sub>	88.3+2.6	47.2 <sub>+4.4</sub>	66.0 <sub>+4.2</sub>	
Very High	$Stat \mathcal{A}$	61.8 <sub>+3.1</sub>	63.5 <sub>+5.3</sub>	62.4 <sub>+3.5</sub>	14.8 <mark>-2.2</mark>	51.7+15.5	60.8 <sub>+5.0</sub>	77.8 <sub>+0.4</sub>	83.5 <mark>-2.2</mark>	$66.2_{\pm 0.1}$	87.9 <sub>+2.2</sub>	46.6+3.8	64.5+2.7	
(b) ResNet-101.														
$K_{\rm eff}$	Method	Average	InageNet	5117397	Aircraft	FUIOSAI	StanfordCars	Foodlol	Pets	Flowerlos	Catechilol	DID	UCFIDI	
	CLIP	59.5	61.3	59.0	17.9	32.9	63.2	80.7	86.9	64.3	89.9	37.3	61.1	
Medium	Stat A	65.0 <sub>+5.5</sub>	70.5+9.2	65.3 <sub>+6.3</sub>	20.5+2.6	33.6 <sub>+0.7</sub>	73.9+10.7	85.4 <sub>+4.7</sub>	91.1 <sub>+4.2</sub>	73.1 <sub>+8.8</sub>	92.2 <sub>+2.3</sub>	43.2+5.9	66.5+5.4	
High	$Stat \mathcal{A}$	64.3 <sub>+4.8</sub>	71.4 <sub>+10.1</sub>	66.2 <sub>+7.2</sub>	18.6 <sub>+0.7</sub>	32.8 <mark>-0.1</mark>	$72.2_{+9.0}$	85.1 <sub>+4.4</sub>	87.9 <sub>+1.0</sub>	71.9 <sub>+7.6</sub>	92.2 <sub>+2.3</sub>	42.5+5.2	66.5 <sub>+5.4</sub>	
Very High	$Stat \mathcal{A}$	62.6 <sub>+3.1</sub>	70.1 <sub>+8.8</sub>	65.4 <sub>+6.4</sub>	16.9 <mark>-1.0</mark>	32.9 <sub>0.0</sub>	$68.2_{+5.0}$	82.4+1.7	87.2 <sub>+0.3</sub>	68.7 <sub>+4.4</sub>	91.3 <sub>+1.4</sub>	41.9 <sub>+4.6</sub>	63.8 <sub>+2.7</sub>	
(c) VIT-B/32.														
						(c) ViT-E	8/32.							
K <sub>eff</sub>	Method	Average	Inase Net	5114397	Aircraft	(c) ViT-E	stationsCars	Foodlol	Rels	Flower102	Calleottol	DID	UCFIDI	
K <sub>eff</sub>	Method	AVERAGE 61.9	unage <sup>Net</sup> 62.0	5 <sup>117391</sup> 62.1	Aircraft 19.1	(c) ViT-E	3/32. 5 <sup>tanfordCats</sup> 60.2	F0061101 80.4	٩ <sup>25</sup> 87.3	Flower102 66.6	cattecth <sup>01</sup> 91.4	9 <sup>10</sup> 42.7	UCF101 63.5	
$K_{\rm eff}$ Medium	Method CLIP StatA	AVERAGE 61.9 65.9 <sub>+4.0</sub>	10000000000000000000000000000000000000	517 <sup>391</sup> 62.1 63.3 <sub>+1.2</sub>	birchaft 19.1 21.9 <sub>+2.8</sub>	(c) ViT-E $(5000 \text{ km}^{-1})$ $(5000 \text{ km}^{-1})$ (51.3 + 5.9)	3/32. 5 <sup>131604</sup> Cat <sup>5</sup> 60.2 69.3 <sub>+9.1</sub>	Food 101 80.4 82.2 <sub>+1.8</sub>	وئ <sup>ٹ</sup> 87.3 90.3 <sub>+3.0</sub>	Flower102 66.6 74.1 <sub>+7.5</sub>	cattecht01 91.4 92.6 <sub>+1.2</sub>	\$1 42.7 47.4 <sub>+4.7</sub>	10 <sup>CF101</sup> 63.5 66.1 <sub>+2.6</sub>	
K <sub>eff</sub> Medium High	Method CLIP StatA StatA	AVERAGE 61.9 65.9 <sub>+4.0</sub> 66.0 <sub>+4.1</sub>	10000000000000000000000000000000000000	62.1 63.3 <sub>+1.2</sub> 65.0 <sub>+2.9</sub>	bitchill 19.1 21.9 <sub>+2.8</sub> 20.2 <sub>+1.1</sub>	(c) ViT-E 45.4 $51.3_{+5.9}$ $51.1_{+5.7}$	3/32. <u>Station</u> 60.2 69.3 <sub>+9.1</sub> 68.5 <sub>+8.3</sub>	Food 101 80.4 82.2 <sub>+1.8</sub> 82.7 <sub>+2.3</sub>	۲ <sup>ری کی</sup> 87.3 90.3 <sub>+3.0</sub> 88.5 <sub>+1.2</sub>	Flower102 66.6 74.1 <sub>+7.5</sub> 73.7 <sub>+7.1</sub>	Cattechtol 91.4 92.6 <sub>+1.2</sub> 92.5 <sub>+1.1</sub>	42.7 47.4 <sub>+4.7</sub> 49.5 <sub>+6.8</sub>	10 <sup>CF101</sup> 63.5 66.1 <sub>+2.6</sub> 66.9 <sub>+3.4</sub>	
K <sub>eff</sub> Medium High Very High	Method CLIP StatA StatA StatA	AVERAGE 61.9 65.9 <sub>+4.0</sub> 66.0 <sub>+4.1</sub> 65.1 <sub>+3.2</sub>	62.0 65.9 <sub>+3.9</sub> 67.0 <sub>+5.0</sub> 66.6 <sub>+4.6</sub>	51 <sup>17,391</sup> 62.1 63.3 <sub>+1.2</sub> 65.0 <sub>+2.9</sub> 66.0 <sub>+3.9</sub>	hitcheft 19.1 21.9 <sub>+2.8</sub> 20.2 <sub>+1.1</sub> 18.8 <u>-0.3</u>	(c) ViT-E 45.4 $51.3_{+5.9}$ $51.1_{+5.7}$ $51.0_{+5.6}$	3/32. <u>5</u> <sup>36100</sup> <sup>40</sup> <sup>40</sup> <sup>45</sup> <u>60.2</u> <u>60.2</u> <u>69.3+9.1</u> <u>68.5+8.3</u> <u>65.1+4.9</u>	F00AIN 80.4 82.2 <sub>+1.8</sub> 82.7 <sub>+2.3</sub> 81.5 <sub>+1.1</sub>	۲.3 90.3 <sub>+3.0</sub> 88.5 <sub>+1.2</sub> 88.0 <sub>+0.7</sub>	66.6 74.1 <sub>+7.5</sub> 73.7 <sub>+7.1</sub> 70.6 <sub>+4.0</sub>	$\begin{array}{c} & & \\$	55 42.7 47.4 <sub>+4.7</sub> 49.5 <sub>+6.8</sub> 49.5 <sub>+6.8</sub>	ic <sup>tin</sup> 63.5 66.1 <sub>+2.6</sub> 66.9 <sub>+3.4</sub> 66.5 <sub>+3.0</sub>	
K <sub>eff</sub> Medium High Very High	Method CLIP StatA StatA StatA	AVERAGE 61.9 65.9+4.0 66.0+4.1 65.1+3.2	62.0 65.9 <sub>+3.9</sub> 67.0 <sub>+5.0</sub> 66.6 <sub>+4.6</sub>	62.1 63.3 <sub>+1.2</sub> 65.0 <sub>+2.9</sub> 66.0 <sub>+3.9</sub>	birth	(c) ViT-E 51.3+5.9 51.1+5.7 51.0+5.6 (d) ViT-L	3/32. 5/30 <sup>1</sup> 00 <sup>1</sup> 0 <sup>1</sup>	Fooluti 80.4 82.2 <sub>+1.8</sub> 82.7 <sub>+2.3</sub> 81.5 <sub>+1.1</sub>	۲.3 90.3 <sub>+3.0</sub> 88.5 <sub>+1.2</sub> 88.0 <sub>+0.7</sub>	66.6 74.1 <sub>+7.5</sub> 73.7 <sub>+7.1</sub> 70.6 <sub>+4.0</sub>	91.4 92.6 <sub>+1.2</sub> 92.5 <sub>+1.1</sub> 91.9 <sub>+0.5</sub>	5 <sup>10</sup> 42.7 47.4 <sub>+4.7</sub> 49.5 <sub>+6.8</sub> 49.5 <sub>+6.8</sub>	$\begin{array}{c} {}_{\text{ij}} {}_{\text{fi}} {}_{fi} {}_$	
K <sub>eff</sub> Medium High Very High K <sub>eff</sub>	Method CLIP StatA StatA StatA Method	Average 61.9 65.9+4.0 66.0+4.1 65.1+3.2	11798214 62.0 65.9+3.9 67.0+5.0 66.6+4.6	62.1 63.3 <sub>+1.2</sub> 65.0 <sub>+2.9</sub> 66.0 <sub>+3.9</sub>	hiterali 19.1 21.9 <sub>+2.8</sub> 20.2 <sub>+1.1</sub> 18.8 <sub>-0.3</sub>	(c) ViT-E $(5)^{5}$ (c) ViT-E $(5)^{5}$ (c) ViT-E $(5)^{5}$ (c) ViT-E $(1)^{5}$ (c) ViT-E $(5)^{5}$ (c) ViT-E (c) ViT-E $(5)^{5}$ (c) ViT-E (c) ViT	3/32. 5/30 <sup>1001</sup> 60.2 69.3+9.1 68.5 <sub>+8.3</sub> 65.1 <sub>+4.9</sub> //14. 5/30 <sup>1001</sup> 5/30 <sup>1001</sup>	Food 101 80.4 82.2 <sub>+1.8</sub> 82.7 <sub>+2.3</sub> 81.5 <sub>+1.1</sub>	۲.3 90.3 <sub>+3.0</sub> 88.5 <sub>+1.2</sub> 88.0 <sub>+0.7</sub>	Fio <sup>sert/R</sup> 66.6 74.1 <sub>+7.5</sub> 73.7 <sub>+7.1</sub> 70.6 <sub>+4.0</sub>	Catech <sup>101</sup> 91.4 92.6 <sub>+1.2</sub> 92.5 <sub>+1.1</sub> 91.9 <sub>+0.5</sub>	51 <sup>D</sup> 42.7 47.4 <sub>+4.7</sub> 49.5 <sub>+6.8</sub> 49.5 <sub>+6.8</sub>	UCFUN 63.5 66.1 <sub>+2.6</sub> 66.9 <sub>+3.4</sub> 66.5 <sub>+3.0</sub>	
K <sub>eff</sub> Medium High Very High K <sub>eff</sub>	Method CLIP StatA StatA StatA Method CLIP	AVERAGE 61.9 65.9+4.0 66.0+4.1 65.1+3.2 AVERAGE 72.6	62.0 65.9 <sub>+3.9</sub> 67.0 <sub>+5.0</sub> 66.6 <sub>+4.6</sub>	62.1 63.3 <sub>+1.2</sub> 65.0 <sub>+2.9</sub> 66.0 <sub>+3.9</sub> 67.7	bircraft 19.1 21.9 <sub>+2.8</sub> 20.2 <sub>+1.1</sub> 18.8 <sub>-0.3</sub> bircraft 32.5	(c) ViT-E $(5)^{5}$ Vi $(5)^{5}$ Vi $(45.4)^{5}$ (c) $(1+5.7)^{5}$ $(51.0_{+5.6})^{5}$ (c) ViT-L $(1+5.7)^{5}$ Vi $(1+5.7)^{5}$ Vi	3/32. 50001004Cats 60.2 69.3+9.1 68.5+8.3 65.1+4.9 /14. 50001004Cats 76.9	500 <sup>11</sup> 80.4 82.2 <sub>+1.8</sub> 82.7 <sub>+2.3</sub> 81.5 <sub>+1.1</sub> 50 <sup>0101</sup> 90.9	۲ <sup>25</sup> 87.3 90.3 <sub>+3.0</sub> 88.5 <sub>+1.2</sub> 88.0 <sub>+0.7</sub> ۲ <sup>25</sup> 93.5	Fio <sup>ster</sup> 66.6 74.1 <sub>+7.5</sub> 73.7 <sub>+7.1</sub> 70.6 <sub>+4.0</sub> Fio <sup>ster</sup>	Catechini 91.4 92.6 <sub>+1.2</sub> 92.5 <sub>+1.1</sub> 91.9 <sub>+0.5</sub> Catechini Catechini	5170 42.7 47.4 <sub>+4.7</sub> 49.5 <sub>+6.8</sub> 49.5 <sub>+6.8</sub> 5170 53.5	UCFUN 63.5 66.1 <sub>+2.6</sub> 66.9 <sub>+3.4</sub> 66.5 <sub>+3.0</sub> UCFUN 10FUN 74.9	
$K_{\rm eff}$ Medium High Very High $K_{\rm eff}$ Medium	Method CLIP StatA StatA StatA Method CLIP StatA	AVERAGE 61.9 65.9+4.0 66.0+4.1 65.1+3.2 AVERAGE 72.6 72.6 76.0+3.4	62.0 65.9 <sub>+3.9</sub> 67.0 <sub>+5.0</sub> 66.6 <sub>+4.6</sub> 73.5 76.2 <sub>+2.7</sub>	62.1 63.3 <sub>+1.2</sub> 65.0 <sub>+2.9</sub> 66.0 <sub>+3.9</sub> 67.7 69.4 <sub>+1.7</sub>	birtraft 19.1 21.9 <sub>+2.8</sub> 20.2 <sub>+1.1</sub> 18.8 <sub>-0.3</sub> birtraft 32.5 39.1 <sub>+6.6</sub>	(c) ViT-E $(5)^{5}$ Vi $(5)^{5}$ Vi $(5)^{5}$ Vi $(5)^{5}$ Vi $(5)^{5}$ Vi (1+5,7) (1+5,	3/32. 5000 000 000 000 000 000 000 000 000 00	500 <sup>11</sup> 80.4 82.2 <sub>+1.8</sub> 82.7 <sub>+2.3</sub> 81.5 <sub>+1.1</sub> 50 <sup>010</sup> 90.9 91.7 <sub>+0.8</sub>	۲ <sup>25</sup> 87.3 90.3 <sub>+3.0</sub> 88.5 <sub>+1.2</sub> 88.0 <sub>+0.7</sub> 93.5 94.8 <sub>+1.3</sub>	Fio <sup>se</sup> 66.6 74.1 <sub>+7.5</sub> 73.7 <sub>+7.1</sub> 70.6 <sub>+4.0</sub> Fio <sup>se</sup> 79.5 81.9 <sub>+2.4</sub>	$\begin{array}{c} & & & \\ & & & \\ & & & \\$	570 42.7 47.4 <sub>+4.7</sub> 49.5 <sub>+6.8</sub> 49.5 <sub>+6.8</sub> 570 53.5 56.9 <sub>+3.4</sub>	$\begin{array}{c} & & \\ & & \\ & & \\ & & \\ \hline & & \\ & &$	
$K_{\rm eff}$ Medium High Very High $K_{\rm eff}$ Medium High	Method CLIP StatA StatA StatA Method CLIP StatA StatA	AVERAGE 61.9 65.9+4.0 66.0+4.1 65.1+3.2 AVERAGE 72.6 72.6 72.6 76.0+3.4 76.3+3.7	62.0 65.9 <sub>+3.9</sub> 67.0 <sub>+5.0</sub> 66.6 <sub>+4.6</sub> 73.5 76.2 <sub>+2.7</sub> 77.2 <sub>+3.7</sub>	62.1 63.3 <sub>+1.2</sub> 65.0 <sub>+2.9</sub> 66.0 <sub>+3.9</sub> 66.0 <sub>+3.9</sub> 67.7 69.4 <sub>+1.7</sub> 70.9 <sub>+3.2</sub>	bircher 19.1 21.9 <sub>+2.8</sub> 20.2 <sub>+1.1</sub> 18.8 <sub>-0.3</sub> 20.2 <sub>+1.1</sub> 18.8 <sub>-0.3</sub> 32.5 39.1 <sub>+6.6</sub> 36.8 <sub>+4.3</sub>	(c) ViT-E $(5)^{ViT-E}$ $(5)^{ViT-E}$ $(5)^{ViT-E}$ $(5)^{ViT-E}$ $(1)^{ViT$	$\begin{array}{c} 3/32.\\ \\ \underline{\text{Symbol}}^{\text{Color}} & \underline{\text{Symbol}}^{\text{Color}} \\ \hline & \underline{\text{60.2}} \\ \hline & \underline{\text{60.2}} \\ \hline & \underline{\text{60.3}} \\ \underline{\text{60.2}} \\ \underline{\text{60.3}} \\ \underline{\text{60.2}} \\ \underline{\text{60.3}} \\ \text$	$\begin{array}{c} & & \\ & & \\ & & \\ \hline & & \\ & &$	۲ <sup>25</sup> 87.3 90.3 <sub>+3.0</sub> 88.5 <sub>+1.2</sub> 88.0 <sub>+0.7</sub> 93.5 94.8 <sub>+1.3</sub> 94.3 <sub>+0.8</sub>	Fio <sup>sent</sup> 66.6 74.1 <sub>+7.5</sub> 73.7 <sub>+7.1</sub> 70.6 <sub>+4.0</sub> 70.6 <sub>+4.0</sub> 79.5 81.9 <sub>+2.4</sub> 81.9 <sub>+2.4</sub>	$\begin{array}{c} & & & \\ & & & \\ &$	570 42.7 47.4 <sub>+4.7</sub> 49.5 <sub>+6.8</sub> 49.5 <sub>+6.8</sub> 53.5 53.5 56.9 <sub>+3.4</sub> 58.7 <sub>+5.2</sub>	$\begin{array}{c} & & \\ & & \\ & & \\ & & \\ \hline & & \\ & &$	

Table 8. Comparison of various CLIP encoders for the batch test-time adaptation setting with a batch size of 1,000. Each reported accuracy is averaged over 1,000 tasks. Subscripts indicate improvement or degradation compared to zero-shot.

Table 9. Comparison of various CLIP encoders for the batch test-time adaptation setting on whole datasets. Each reported accuracy is averaged over 1,000 tasks. Subscripts indicate improvement or degradation compared to zero-shot.

(a) ResNet-50.													
$K_{\rm eff}$	Method	AVERAGE	InageNet	5114397	Aircraft	EUROSAI	StatlordCars	Foodlol	Rels	Flowerlos	Cattech101	DID	UCFIOI
	CLIP	58.7	58.2	58.9	17.0	36.2	55.8	77.4	85.7	66.1	85.7	42.8	61.8
All	$Stat \mathcal{A}$	62.4 <sub>+3.7</sub>	60.4+2.2	64.3 <sub>+5.4</sub>	16.0 <mark>-1.0</mark>	50.5 <sub>+14.3</sub>	58.2 <sub>+2.4</sub>	77.9 <sub>+0.5</sub>	87.7 <sub>+2.0</sub>	67.7 <sub>+1.6</sub>	87.3 <sub>+1.6</sub>	48.5+5.7	67.5 <sub>+5.7</sub>
(b) ResNet-101.													
$K_{\rm eff}$	Method	Average	Inage Net	5117397	Aircraft	Euro <sup>SAI</sup>	StanfordCars	FoodIOI	Petts	Flowerlos	Callechiol	DID	UCFIDI
	CLIP	59.5	61.3	59.0	17.9	32.9	63.2	80.7	86.9	64.3	89.9	37.3	61.1
All	Stat A	63.6 <sub>+4.1</sub>	64.4 <sub>+3.1</sub>	64.9 <sub>+5.9</sub>	$18.3_{\pm 0.4}$	43.3 + 10.4	$66.2_{+3.0}$	81.9 <sub>+1.2</sub>	88.8 <sub>+1.9</sub>	69.1 <sub>+4.8</sub>	91.5 <sub>+1.6</sub>	$42.9_{+5.6}$	67.8 <sub>+6.7</sub>
						(c) ViT-B	8/32.						
$K_{\rm eff}$	Method	AVERAGE	ImageNet	5117397	Aircraft	Euro <sup>SAI</sup>	StanfordCars	FoodIOL	Repair	Flowertor	Callection	DID	UCFIDI
	CLIP	61.9	62.0	62.1	19.1	45.4	60.2	80.4	87.3	66.6	91.4	42.7	63.5
All	StatA	65.5 <sub>+3.7</sub>	64.6 <sub>+2.6</sub>	$67.1_{+5.0}$	$19.7_{\pm 0.6}$	54.3 <sub>+8.9</sub>	62.5 <sub>+2.3</sub>	81.4 <sub>+1.0</sub>	89.2 <sub>+1.9</sub>	71.5 <sub>+4.9</sub>	91.5 <sub>+0.1</sub>	$50.8_{\pm 8.1}$	68.4 <sub>+4.9</sub>
						(d) ViT-L	./14.						
$K_{\rm eff}$	Method	Average	ImageNet	5117397	Aircraft	FUIDSAT	StanfordCars	FoodIO	Pets	Flowerlos	Callechiol	DID	UCFIDI
	CLIP	72.6	73.5	67.7	32.5	60.3	76.9	90.9	93.5	79.5	95.2	53.5	74.9
All	Stat A	76.7 <sub>+4.1</sub>	76.9 <sub>+3.4</sub>	72.8+5.1	35.4+2.9	76.7 <sub>+16.4</sub>	78.0 <sub>+1.1</sub>	91.8 <sub>+0.9</sub>	94.6 <sub>+1.1</sub>	81.8+2.3	95.0 <sub>-0.2</sub>	59.7 <sub>+6.2</sub>	81.3+6.4

(a) ResNet-50.													
Scenario	Method	AVERAGE	InageNet	5117397	Aircraft	EUROSAL	StanfordCars	Foodlol	Rets	Flowerto	catech101	DID	UCFIOI
	CLIP	58.7	58.2	58.9	17.0	36.2	55.8	77.4	85.7	66.1	85.7	42.8	61.8
Low	StatA	58.4 <mark>-0.3</mark>	54.6 <b>-3.6</b>	56.6 <mark>-2.3</mark>	15.1 <mark>-1.9</mark>	39.7 <sub>+</sub> 3.5	57.6 <sub>+1.8</sub>	79.4 <sub>+2.0</sub>	85.1 <mark>-0.6</mark>	60.7 <mark>-5.4</mark>	87.8 <sub>+</sub> 2.1	44.4+ <b>1.6</b>	61.7 <mark>-0.1</mark>
Medium	StatA	62.8 <sub>+4.1</sub>	59.6 <sub>+1.4</sub>	60.8 <sub>+1.9</sub>	17.7 <sub>+0.7</sub>	43.5+ <b>7.3</b>	65.9 <sub>+10.1</sub>	84.5 <sub>+</sub> 7.1	90.6 <sub>+<b>4.9</b></sub>	68.1 <sub>+2.0</sub>	<sup>89.3</sup> + <b>3.6</b>	45.5 <sub>+2.7</sub>	64.5 <sub>+2.7</sub>
High	StatA	64.3 <sub>+5.6</sub>	64.7 <sub>+6.5</sub>	62.6 <sub>+3.7</sub>	18.5+ <b>1.5</b>	43.6 <sub>+7.4</sub>	68.5 <sub>+12.7</sub>	85.8 <sub>+</sub> 8.4	92.2 <sub>+6.5</sub>	70.1 <sub>+<b>4.0</b></sub>	<sup>89.8</sup> +4.1	45.9 <sub>+3.1</sub>	65.2 <sub>+3.4</sub>
Separate	StatA	65.1 <sub>+6.4</sub>	66.6 <sub>+<b>8.4</b></sub>	62.6 <sub>+3.7</sub>	19.8 <sub>+2.8</sub>	44.3 <sub>+</sub> 8.1	69.5 <sub>+13.7</sub>	85.6 <sub>+8.2</sub>	93.8+ <b>8.1</b>	71.9 <sub>+5.8</sub>	90.2 <sub>+4.5</sub>	46.0 <sub>+</sub> 3.2	65.3 <sub>+3.5</sub>
(b) ResNet-101.													
Scenario	Method	AVERAGE	InageNet	5417397	Aircraft	EuroSAT	StanfordCars	Foodioi	Pets	Flowerlo2	Catech101	DID	UCFION
	CLIP	59.5	61.3	59.0	17.9	32.9	63.2	80.7	86.9	64.3	89.9	37.3	61.1
Low	StatA	61.3 <sub>+1.8</sub>	60.5 <mark>-0.8</mark>	59.3 <sub>+0.3</sub>	16.9 <mark>-1.0</mark>	32.7 <mark>-0.2</mark>	65.5 <sub>+2.3</sub>	<sup>84.9</sup> + <b>4.2</b>	91.0 <sub>+<b>4.1</b></sub>	67.8 <sub>+3.5</sub>	92.2 <sub>+2.3</sub>	41.1+ <b>3.8</b>	62.8 <sub>+1.7</sub>
Medium	StatA	64.6 <sub>+5.1</sub>	66.1 <sub>+</sub> <b>4.8</b>	64.2 <sub>+5.2</sub>	<sup>19.7</sup> +1.8	<sup>33.3</sup> +0.4	72.2 <sub>+9.0</sub>	<sup>88.1</sup> +7.4	<sup>94.1</sup> +7.2	72.1 <sub>+</sub> 7.8	93.2 <sub>+</sub> 3.3	42.9+ <b>5.6</b>	65.2 <sub>+4.1</sub>
High	StatA	65.7 <sub>+6.2</sub>	70.5 <sub>+</sub> 9.2	65.9 <sub>+6.9</sub>	20.6 <sub>+2.7</sub>	33.5 <sub>+0.6</sub>	<sup>74.1</sup> +10.9	88.7 <sub>+</sub> 8.0	<sup>94.4</sup> +7.5	73.1 <sub>+<b>8.8</b></sub>	93.4 <sub>+</sub> 3.5	43.0 <sub>+5.7</sub>	65.7 <sub>+<b>4.6</b></sub>
Separate	Stat A	65.8 <sub>+6.3</sub>	71.4+ <b>10.1</b>	65.7 <sub>+6.7</sub>	22.1+ <b>4.2</b>	32.2 <b>-0.7</b>	<sup>74.9</sup> +11.7	<sup>88.5</sup> +7.8	94.2 <sub>+</sub> 7.3	73.9 <sub>+</sub> <b>9.6</b>	93.4 <sub>+</sub> 3.5	41.9 <sub>+<b>4.6</b></sub>	65.7 <sub>+<b>4.6</b></sub>
(c) ViT-B/32.													
						(0) 111	<i>132</i> .						
Scenario	Method	AVERAGE	InageNet	SURSAL	Aircraft	Euroshi E	StanfordCars	Foodlol	Pols	Flowertor	Cateoth01	DID	UCFIOI
Scenario	Method	AVERAGE 61.9	un <sup>ageNet</sup> 62.0	sut <sup>1391</sup> 62.1	Aircraft 19.1	(c) VII I fill <sup>05/Å</sup> 45.4	station Cars	F00d101 80.4	<b>૧<sup>૭%</sup></b> 87.3	Flower102 66.6	catection 91.4	51D 42.7	U <sup>CF101</sup> 63.5
Scenario	Method CLIP StatA	AVERAGE 61.9 63.9 <sub>+2.0</sub>	17000000000000000000000000000000000000	5UN <sup>391</sup> 62.1 62.7+ <b>0.6</b>	hit <sup>craft</sup> 19.1	(c) VII I <sup>510</sup> <sup>51.0</sup> +5.6	50.2 5001000 60.2 61.8+1.6	80.4 82.6 <sub>+2.2</sub>	۶ <sup>ریخ</sup> 87.3 91.0 <sub>+</sub> <b>3.</b> 7	Flower102 66.6 69.0 <sub>+2.4</sub>	Callection 91.4 92.9 <sub>+1.5</sub>	51 <sup>10</sup> 42.7 46.4 <sub>+3.7</sub>	63.5 64.4 <sub>+0.9</sub>
Scenario Low Medium	Method CLIP StatA StatA	AVERAGE 61.9 63.9 <sub>+2.0</sub> 65.8 <sub>+3.9</sub>	three text 62.0 61.4-0.6 64.6+2.6	5017397 62.1 62.7 <sub>+0.6</sub> 64.8 <sub>+2.7</sub>	hitcraft 19.1 19.2 <sub>+0.1</sub> 21.4 <sub>+2.3</sub>	(c) VII I <sup>(1)</sup> <sup>(1)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>(2)</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup> <sup>()</sup>	50.2 60.2 61.8+1.6 68.1+7.9	80.4 82.6 <sub>+2.2</sub> 84.4 <sub>+4.0</sub>	۲ <sup>20%</sup> 87.3 91.0 <sub>+3.7</sub> 92.8 <sub>+</sub> 5.5	Flower 66.6 69.0 <sub>+2.4</sub> 72.5 <sub>+5.9</sub>	Callection 91.4 92.9 <sub>+1.5</sub> 93.5 <sub>+2.1</sub>	42.7 46.4 <sub>+</sub> 3.7 46.4 <sub>+</sub> 3.7	UCF101 63.5 64.4 <sub>+0.9</sub> 65.5 <sub>+2.0</sub>
Scenario Low Medium High	Method CLIP StatA StatA StatA	AVERAGE 61.9 63.9 <sub>+2.0</sub> 65.8 <sub>+3.9</sub> 66.4 <sub>+4.6</sub>	62.0 61.4 <u>-0.6</u> 64.6 <sub>+2.6</sub> 66.9 <sub>+4.9</sub>	5UN <sup>391</sup> 62.1 62.7 <sub>+0.6</sub> 64.8 <sub>+2.7</sub> 64.9 <sub>+2.8</sub>	bitcoli 19.1 19.2+0.1 21.4+2.3 22.0+2.9	$(c) \sqrt{111}$ $(c) \sqrt{1111}$ $(c) \sqrt{11111}$ $(c) \sqrt{111111}$ $(c) \sqrt{111111}$ $(c) \sqrt{111111}$ $(c) \sqrt{111111}$ $(c) \sqrt{111111}$ $(c) \sqrt{1111111}$ $(c) \sqrt{111111111}$ $(c) 111111111111111111111111111111111111$	5132. 5131004Cars 60.2 61.8+1.6 68.1+7.9 69.9+9.7	80.4 80.4 82.6 <sub>+2.2</sub> 84.4 <sub>+4.0</sub> 84.6 <sub>+4.2</sub>	\$\$ <sup>\$\$</sup> 87.3 91.0 <sub>+</sub> 3.7 92.8 <sub>+</sub> 5.5 93.2 <sub>+</sub> 5.9	Ro <sup>sue102</sup> 66.6 69.0 <sub>+2.4</sub> 72.5 <sub>+5.9</sub> 73.5 <sub>+6.9</sub>	91.4 93.5+2.1 93.7+2.3	5 <sup>5</sup> 42.7 46.4 <sub>+</sub> 3.7 46.4 <sub>+</sub> 3.7 46.3 <sub>+</sub> 3.6	63.5 64.4 <sub>+0.9</sub> 65.5 <sub>+2.0</sub> 65.6 <sub>+2.1</sub>
Scenario Low Medium High Separate	Method CLIP StatA StatA StatA StatA	AVERAGE 61.9 63.9 <sub>+2.0</sub> 65.8 <sub>+3.9</sub> 66.4 <sub>+4.6</sub> 65.9 <sub>+4.0</sub>	62.0 61.4 <u>0.6</u> 64.6 <sub>+2.6</sub> 66.9 <sub>+4.9</sub> 67.0 <sub>+5.0</sub>	62.1 62.7+0.6 64.8+2.7 64.9+2.8 63.8+1.7	19.1 19.2 19.2 19.2 10.4 10.4 10.4 10.4 10.4 10.4 10.4 10.4	(c) VII I 51.0+5.6 49.9+4.5 50.1+4.7 44.9-0.5	53. 53. 53. 60.2 61.8+1.6 68.1+7.9 69.9+9.7 70.4+10.2	80.4 80.4 82.6 <sub>+2.2</sub> 84.4 <sub>+4.0</sub> 84.6 <sub>+4.2</sub> 84.1 <sub>+3.7</sub>	\$2.8 \$7.3 91.0 <sub>+</sub> 3.7 92.8 <sub>+</sub> 5.5 93.2 <sub>+</sub> 5.9 92.8 <sub>+</sub> 5.5	€00 <sup>xet102</sup> 66.6 69.0 <sub>+</sub> 2.4 72.5 <sub>+</sub> 5.9 73.5 <sub>+</sub> 6.9 74.6 <sub>+</sub> 8.0	91.4 93.5+2.1 93.7+2.3 94.0+2.6	42.7 46.4 <sub>+</sub> 3.7 46.4 <sub>+</sub> 3.7 46.3 <sub>+</sub> 3.6 45.1 <sub>+</sub> 2.4	5.5+2.0 65.5+2.1 65.0+1.5
Scenario Low Medium High Separate	Method CLIP StatA StatA StatA StatA	AVERAGE 61.9 63.9 <sub>+2.0</sub> 65.8 <sub>+3.9</sub> 66.4 <sub>+4.6</sub> 65.9 <sub>+4.0</sub>	1710 <sup>102</sup> 1710 <sup>102</sup> 62.0 61.4_0.6 64.6+2.6 66.9+4.9 67.0+5.0	62.1 62.7+0.6 64.8+2.7 64.9+2.8 63.8+1.7	biccipit 19.1 19.2+0.1 21.4+2.3 22.0+2.9 22.9+3.8	(c)  VII I $(c)  VII I $ $(c)  VII I$	60.2           61.8+1.6           68.1+7.9           69.9+9.7           70.4+10.2           //14.	80.4 80.4 82.6 <sub>+2.2</sub> 84.4 <sub>+4.0</sub> 84.6 <sub>+4.2</sub> 84.1 <sub>+3.7</sub>	\$ <sup>\$\$</sup> 87.3 91.0 <sub>+3.7</sub> 92.8 <sub>+</sub> 5.5 93.2 <sub>+</sub> 5.9 92.8 <sub>+</sub> 5.5	Fio <sup>ster</sup> 66.6 69.0 <sub>+2.4</sub> 72.5 <sub>+5.9</sub> 73.5 <sub>+6.9</sub> 74.6 <sub>+8.0</sub>	2.34 <sup>20</sup> /10 <sup>1</sup> 91.4 92.9 <sub>+1.5</sub> 93.5 <sub>+2.1</sub> 93.7 <sub>+2.3</sub> 94.0 <sub>+2.6</sub>	5 <sup>1</sup> 42.7 46.4 <sub>+3.7</sub> 46.4 <sub>+3.7</sub> 46.3 <sub>+3.6</sub> 45.1 <sub>+2.4</sub>	63.5 64.4 <sub>+0.9</sub> 65.5 <sub>+2.0</sub> 65.6 <sub>+2.1</sub> 65.0 <sub>+1.5</sub>
Scenario Low Medium High Separate Scenario	Method CLIP StatA StatA StatA StatA	AVERAGE 61.9 63.9 <sub>+2.0</sub> 65.8 <sub>+3.9</sub> 66.4 <sub>+4.6</sub> 65.9 <sub>+4.0</sub>	10000000000000000000000000000000000000	62.1 62.7+0.6 64.8+2.7 64.9+2.8 63.8+1.7 5400000	hirensi 19.1 19.2+0.1 21.4+2.3 22.0+2.9 22.9+3.8	$(c) \text{ VII I} \\ (c)  VII I$	532. 53000000000000000000000000000000000000	500 101 101 100 100 100 100 100 100 100	ve <sup>e5</sup> 87.3 91.0 <sub>+3.7</sub> 92.8 <sub>+5.5</sub> 93.2 <sub>+5.9</sub> 92.8 <sub>+5.5</sub>	Forwer102 66.6 69.0+2.4 72.5+5.9 73.5+6.9 74.6+8.0	Calech <sup>(III)</sup> 91.4 92.9 <sub>+1.5</sub> 93.5 <sub>+2.1</sub> 93.7 <sub>+2.3</sub> 94.0 <sub>+2.6</sub>	5 <sup>10</sup> 42.7 46.4 <sub>+3.7</sub> 46.4 <sub>+3.7</sub> 46.3 <sub>+3.6</sub> 45.1 <sub>+2.4</sub>	UCHINI 63.5 64.4+0.9 65.5+2.0 65.6+2.1 65.0+1.5 UCHINI
Scenario Low Medium High Separate Scenario	Method CLIP StatA StatA StatA StatA Method CLIP	AVERAGE 61.9 63.9 <sub>+2.0</sub> 65.8 <sub>+3.9</sub> 66.4 <sub>+4.6</sub> 65.9 <sub>+4.0</sub> AVERAGE 72.6	10000000000000000000000000000000000000	62.1 62.7+0.6 64.8+2.7 64.9+2.8 63.8+1.7 64.9+2.8 63.8+1.7 64.9+2.8 63.8+1.7	hirenal 19.1 19.2+0.1 21.4+2.3 22.0+2.9 22.9+3.8 hirenal 32.5	$(c) \text{ VII I } \\ (c) $	532. 5300 60.2 61.8+1.6 68.1+7.9 69.9+9.7 70.4+10.2 //14. 5000 76.9	500 <sup>3101</sup> 80.4 82.6 <sub>+2.2</sub> 84.4 <sub>+4.0</sub> 84.6 <sub>+4.2</sub> 84.1 <sub>+3.7</sub> 50 <sup>03101</sup> 50 <sup>03101</sup>	۲       87.3       91.0+3.7       92.8+5.5       93.2+5.9       92.8+5.5       93.5	€00×02102 €00×2.4 72.5+5.9 73.5+6.9 74.6+8.0 €00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×0210 ₹00×020 ₹00×0210 ₹00×0200 ₹00×00 ₹00×000 ₹00×000 ₹00×000 ₹00×000 ₹00×000 ₹00×000	2.312-2011 2.312-2011 91.4 92.9+1.5 93.5+2.1 93.7+2.3 94.0+2.6 0 2.312-2011 2.312	50 42.7 46.4 <sub>+3.7</sub> 46.4 <sub>+3.7</sub> 46.3 <sub>+3.6</sub> 45.1 <sub>+2.4</sub> 50 53.5	UCHIN 63.5 64.4+0.9 65.5+2.0 65.6+2.1 65.0+1.5 UCHIN 10CHIN 74.9
Scenario Low Medium High Separate Scenario Low	Method CLIP StatA StatA StatA StatA Method CLIP StatA	AVERAGE 61.9 63.9 <sub>+2.0</sub> 65.8 <sub>+3.9</sub> 66.4 <sub>+4.6</sub> 65.9 <sub>+4.0</sub> AVERAGE 72.6 74.3 <sub>+1.7</sub>	10000000000000000000000000000000000000	62.1 62.7 64.8 7 64.9 7 8 63.8 1.7 64.9 7 8 63.8 1.7 6 7.7 6 8.2 40.5	bircraft 19.1 19.2+0.1 21.4+2.3 22.0+2.9 22.9+3.8 bircraft 32.5 34.1+1.6	$(c) \text{ VII I} \\ (c)  VII I$	60.2           61.8+1.6           68.1+7.9           69.9+9.7           70.4+10.2           //14.           5000000000000000000000000000000000000	80.4 80.4 82.6+2.2 84.4+4.0 84.6+4.2 84.1+3.7 500000 90.9 90.9 92.0+1.1	۲           87.3           91.0+3.7           92.8+5.5           93.2+5.9           92.8+5.5           93.5           93.5           95.0+1.5	€00×02102 €00×2.4 72.5+5.9 73.5+6.9 74.6+8.0 €00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×02102 ₹00×0210 ₹00×0200	2.312-2011 2.312-2011 91.4 92.9+1.5 93.5+2.1 93.7+2.3 94.0+2.6 95.2 95.2 95.6+0.4	50 42.7 46.4 <sub>+3.7</sub> 46.4 <sub>+3.7</sub> 46.3 <sub>+3.6</sub> 45.1 <sub>+2.4</sub> 51 53.5 55.4 <sub>+1.9</sub>	$\begin{array}{c} & & \\ & & \\ & & \\ & & \\ \hline & & \\ & &$
Scenario Low Medium High Separate Scenario Low Medium	Method CLIP StatA StatA StatA StatA Method CLIP StatA StatA	AVERAGE 61.9 $63.9_{+2.0}$ $65.8_{+3.9}$ $66.4_{+4.6}$ $65.9_{+4.0}$ AVERAGE 72.6 $74.3_{+1.7}$ $76.0_{+3.4}$	10000000000000000000000000000000000000	$\begin{array}{c} & & \\ & & \\ & & \\ & & \\ \hline 62.7 \\ + 0.6 \\ \hline 62.7 \\ + 0.6 \\ \hline 64.8 \\ + 2.7 \\ \hline 64.9 \\ + 2.8 \\ \hline 63.8 \\ + 1.7 \\ \hline \\ 63.8 \\ + 1.7 \\ \hline \\ 65.7 \\ \hline 68.2 \\ + 0.5 \\ \hline 70.6 \\ + 2.9 \end{array}$	hirersh 19.1 19.2+0.1 21.4+2.3 22.0+2.9 22.9+3.8 hirersh 32.5 34.1+1.6 38.3+5.8	$(c) \text{ VII I I} \\ (c) \text{ VII I I I} \\ (c) \text{ VII I I I} \\ (c)  VII I I I I I I I I I I I I I I I I I $	532. 538,000,000,000,000,000,000,000,000,000,0	$\begin{array}{c} & & & \\$	۲           87.3           91.0+3.7           92.8+5.5           93.2+5.9           92.8+5.5           93.5           95.0+1.5           96.3+2.8	€00×00 <sup>10</sup> 100 <sup>10</sup>	$\begin{array}{c} & & \\$	50 42.7 46.4 <sub>+3.7</sub> 46.4 <sub>+3.7</sub> 46.3 <sub>+3.6</sub> 45.1 <sub>+2.4</sub> 53.5 53.5 55.4 <sub>+1.9</sub> 55.6 <sub>+2.1</sub>	$\begin{array}{c} & & \\ & & \\ & & \\ \hline \hline & & \\ \hline & & \\ \hline & & \\ \hline & & \\ \hline \hline & & \\ \hline & & \\ \hline & & \\ \hline \hline & & \\ \hline & & \\ \hline \hline \\ \hline & & \\ \hline \hline \\ \hline & & \\ \hline \hline \\ \hline \\$
Scenario Low Medium High Separate Scenario Low Medium High	Method CLIP StatA StatA StatA StatA Method CLIP StatA StatA StatA	AVERAGE 61.9 63.9 <sub>+2.0</sub> 65.8 <sub>+3.9</sub> 66.4 <sub>+4.6</sub> 65.9 <sub>+4.0</sub> AVERAGE 72.6 74.3 <sub>+1.7</sub> 76.0 <sub>+3.4</sub> 76.4 <sub>+3.8</sub>	10000000000000000000000000000000000000	$\begin{array}{c} & & \\$	bircraft 19.1 19.2+0.1 21.4+2.3 22.0+2.9 22.9+3.8 bircraft 32.5 34.1+1.6 38.3+5.8 39.6+7.1	$(c) \text{ VII I I} \\ (c) \text{ VII I I I} \\ (c) \text{ VII I I I} \\ (c)  VII I I I I I I I I I I I I I I I I I $	60.2           61.8+1.6           68.1+7.9           69.9+9.7           70.4+10.2           //14.           5000000000000000000000000000000000000	$\begin{array}{c} & & & \\$	۲.3         91.0+3.7         92.8+5.5         93.2+5.9         92.8+5.5         93.5         93.5         95.0+1.5         96.3+2.8         96.5+3.0	Forwer102           66.6           69.0+2.4           72.5+5.9           73.5+6.9           74.6+8.0           Forwer102           79.5           80.2+0.7           81.5+2.0           81.9+2.4	$\begin{array}{c} & & \\$	50 42.7 46.4 <sub>+3.7</sub> 46.4 <sub>+3.7</sub> 46.3 <sub>+3.6</sub> 45.1 <sub>+2.4</sub> 53.5 55.4 <sub>+1.9</sub> 55.6 <sub>+2.1</sub> 55.5 <sub>+2.0</sub>	$\begin{array}{c} & & \\ & & \\ & & \\ & & \\ \hline \hline & & \\ \hline \hline & & \\ \hline & & \\ \hline & & \\ \hline \hline & & \\ \hline \hline \\ \hline & & \\ \hline \hline \\ \hline \\$

Table 10. Comparison of various CLIP encoders for the online test-time adaptation setting with a batch size of 128. Each reported accuracy is averaged over 100 tasks. Subscripts indicate improvement or degradation compared to zero-shot.

$K_{\rm eff}$	Method	AVERAGE	ImageNet	5111391	Aircraft	FUIOSAI	StanfordCars	Foodlol	Pers	Flowerlos	CallectilOl	DID	UCFIOI	
	CLIP	65.2	66.6	62.5	24.7	48.3	65.6	85.9	89.1	70.7	93.2	43.5	67.5	
Medium	StatA	68.5 <sub>+3.3</sub>	72.0 <sub>+5.4</sub>	66.5 <sub>+4.0</sub>	26.6 <sub>+1.9</sub>	48.2 <mark>-0.1</mark>	72.7 <sub>+7.1</sub>	88.7 <sub>+2.8</sub>	92.1 <sub>+3.0</sub>	75.4 <sub>+4.7</sub>	93.7 <sub>+0.5</sub>	47.7 <sub>+4.2</sub>	70.0+2.5	
High	StatA	66.3 <sub>+1.1</sub>	69.4 <sub>+2.8</sub>	64.9+2.4	23.6-1.1	47.2 <mark>-1.1</mark>	68.0 <sub>+2.4</sub>	87.0 <sub>+1.1</sub>	88.2 <mark>_0.9</mark>	72.0+1.3	94.0 <sub>+0.8</sub>	46.9+3.4	68.2 <sub>+0.7</sub>	
	(b) Batch Size: 256.													
$K_{\rm eff}$	Method	AVERAGE	InnageNet	5114391	Aircraft	FUIOSAT	StatfordCars	Foollol	P <sup>215</sup>	Flowerto	Catech101	DID	UCFIDI	
	CLIP	65.2	66.6	62.5	24.7	48.3	65.6	85.9	89.1	70.7	93.2	43.5	67.5	
Medium	StatA	69.5 <sub>+4.3</sub>	72.0+5.4	66.7 <sub>+4.2</sub>	27.1+2.4	56.0 <sub>+7.7</sub>	74.1+8.5	88.9 <sub>+3.0</sub>	92.9 <sub>+3.8</sub>	76.0 <sub>+5.3</sub>	93.6 <sub>+0.4</sub>	47.0+3.5	70.5+3.0	
High	StatA	68.1 <sub>+2.9</sub>	71.1 <sub>+4.5</sub>	66.3 <sub>+3.8</sub>	24.2 <mark>-0.5</mark>	55.5 <sub>+7.2</sub>	70.6+5.0	87.6 <sub>+1.7</sub>	88.9 <mark>-0.2</mark>	73.7+3.0	94.1 <sub>+0.9</sub>	47.0+3.5	69.9 <sub>+2.4</sub>	
		1			(0	c) Batch Si	ze: 500.							
$K_{\rm eff}$	Method	Average	Image. Net	51/1297	Aircraft	FuroSAI	StanfordCars	FoodIOI	P <sup>255</sup>	Flower102	Callechiol	DID	UCFIDI	
	CLIP	65.2	66.6	62.5	24.7	48.3	65.6	85.9	89.1	70.7	93.2	43.5	67.5	
Medium	StatA	69.8 <sub>+4.5</sub>	71.5+4.9	65.5 <sub>+3.0</sub>	27.8+3.1	59.3 <sub>+11.0</sub>	74.9+9.3	88.3+2.4	93.1 <sub>+4.0</sub>	76.8 <sub>+6.1</sub>	93.1 <mark>-0.1</mark>	47.1+3.6	69.9 <sub>+2.4</sub>	
High	StatA	69.3 <sub>+4.1</sub>	72.1+5.5	67.3+4.8	25.1+0.4	60.0+11.7	72.3+6.7	88.2+2.3	90.3+1.2	75.5+4.8	93.8+0.6	47.2+3.7	70.7+3.2	

Table 11. Comparison of different batch sizes with the ViT-B/16 backbone. Each reported accuracy is averaged over 1,000 tasks.

(a) Batch Size: 128.

Table 12. Comparison of different batch sizes. Scenario with  $K_{\text{eff}} \in (1, \min(\text{batch_size}, \#\text{total_classes}))$ . The best average accuracy for each configuration is highlighted in **bold**, while the second-best is indicated with <u>underline</u>. Subscripts indicate improvement or degradation compared to zero-shot. Each reported performance is averaged over 1,000 tasks.

	(a) Batch Size: 64.													
Method	AVERAGE	InnageNet	5117397	Aircraft	EUROSAI	Stanford Cars	FoodIOI	P <sup>215</sup>	Flowerlox	Catechiol	DID	UCFIOI		
CLIP	65.2	66.6	62.5	24.7	48.3	65.6	85.9	89.1	70.7	93.2	43.5	67.5		
StatA	66.9 <sub>+1.7</sub>	68.7 <sub>+2.1</sub>	64.8+2.3	24.1 <b>-0.6</b>	50.6 <sub>+2.3</sub>	68.9 <sub>+3.3</sub>	87.1 <sub>+1.2</sub>	90.8 <sub>+1.7</sub>	72.1+1.4	93.8 <sub>+0.6</sub>	46.6 <sub>+3.1</sub>	68.7 <sub>+1.2</sub>		
	(b) Batch Size: 128.													
Method	AVERAGE	InnageNet	5117397	Aircraft	EUROSAT	Stanford Cars	Foodlol	2 <sup>215</sup>	Flowertor	Catech101	DID	UCFIDI		
CLIP	65.2	66.6	62.5	24.7	48.3	65.6	85.9	89.1	70.7	93.2	43.5	67.5		
$\operatorname{Stat} \mathcal{A}$	66.8 <sub>+1.6</sub>	68.6 <sub>+2.0</sub>	64.3 <sub>+1.8</sub>	23.6 <mark>-1.1</mark>	$53.3_{+5.0}$	67.5 <sub>+1.9</sub>	86.9 <sub>+1.0</sub>	91.1 <sub>+2.0</sub>	71.5 <sub>+0.8</sub>	93.8 <sub>+0.6</sub>	46.9+3.4	67.9 <sub>+0.4</sub>		
	(c) Batch Size: 256.													
Method	AVERAGE	InageNet	5117391	Aircraft	EUROSAL	StanfordCars	FoodIOI	Refe	Flowerlos	Catech101	DID	UCFION		
CLIP	65.2	66.6	62.5	24.7	48.3	65.6	85.9	89.1	70.7	93.2	43.5	67.5		
Stat A	67.3 <sub>+2.1</sub>	68.2 <sub>+1.6</sub>	64.1 <sub>+1.6</sub>	24.1 <mark>-0.6</mark>	$55.3_{+7.0}$	$66.3_{\pm 0.7}$	87.4 <sub>+1.5</sub>	91.9 <sub>+2.8</sub>	73.2 <sub>+2.5</sub>	93.8 <sub>+0.6</sub>	47.4 <sub>+3.9</sub>	68.7 <sub>+1.2</sub>		
				(0	l) Batch Si	ze: 500.								
Method	AVERAGE	InageNet	SUNADI	Aircraft	FUIOSAT	StanfordCars	Foodlol	Rets	Flower102	Catechiol	DID	UCFIOI		
CLIP	65.2	66.6	62.5	24.7	48.3	65.6	85.9	89.1	70.7	93.2	43.5	67.5		
$\operatorname{Stat} \mathcal{A}$	67.6 <sub>+2.3</sub>	68.1 <sub>+1.5</sub>	64.2 <sub>+1.7</sub>	24.9+0.2	54.5 <sub>+6.2</sub>	67.2 <sub>+1.6</sub>	87.5+1.6	92.5 <sub>+3.4</sub>	74.2+3.5	93.5 <sub>+0.3</sub>	47.1+3.6	69.4 <sub>+1.9</sub>		
				(e	) Batch Siz	ze: 1000.								
Method	AVERAGE	InageNet	SUN397	Aircraft	EHOSAI	StanfordCars	FoodIOI	Refe	Flower102	catech101	DID	UCFION		
CLIP	65.2	66.6	62.5	24.7	48.3	65.6	85.9	89.1	70.7	93.2	43.5	67.5		
Stat A	68.0 <sub>+2.8</sub>	67.5 <sub>+0.9</sub>	$65.2_{\pm 2.7}$	$25.4_{\pm 0.7}$	55.0 <sub>+6.7</sub>	68.0 <sub>+2.4</sub>	87.2 <sub>+1.3</sub>	93.0 <sub>+3.9</sub>	75.3 <sub>+4.6</sub>	93.3 <sub>+0.1</sub>	47.8+4.3	70.7+3.2		
				(f	) Batch Siz	e: 2000.								
Method	Average	InageNet	5117397	Aircraft	FUIOSAT	StanfordCars	FoodIDI	Repa	Flowerto	CallectilOl	DID	UCFIDI		
CLIP	65.2	66.6	62.5	24.7	48.3	65.6	85.9	89.1	70.7	93.2	43.5	67.5		
StatA	68.7 <sub>+3.5</sub>	68.1 <sub>+1.5</sub>	66.1 <sub>+3.6</sub>	$26.3_{\pm 1.6}$	56.7 <sub>+8.4</sub>	69.6 <sub>+4.0</sub>	86.7 <sub>+0.8</sub>	93.0 <sub>+3.9</sub>	77.0 <sub>+6.3</sub>	93.3 <sub>+0.1</sub>	47.4+3.9	71.5 <sub>+4.0</sub>		