# TransHP: Image Classification with Hierarchical Prompting

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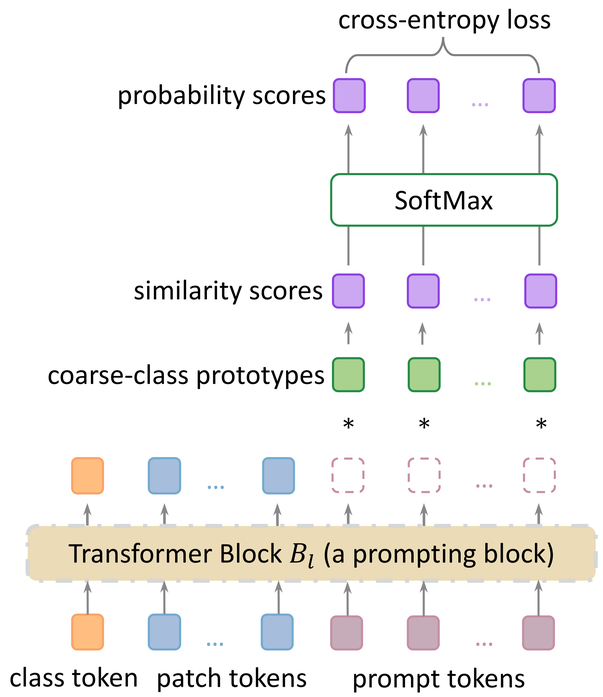
## Introduction

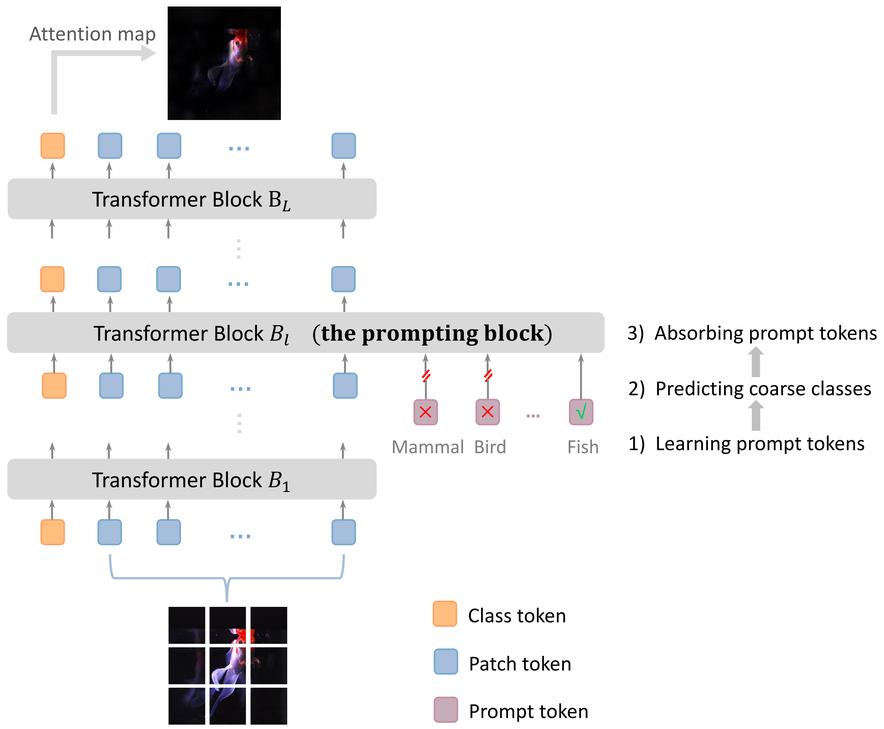
TransHP improves the **accuracy**, **data efficiency**, and **explainability** of the transformer.

- **Accuracy.** TransHP brings consistent improvement on multiple popular transformer backbones and five image classification datasets. For example, on ImageNet, TransHP improves ViT-B/16 by +2.83% top-1 accuracy.
- **Data efficiency.** While reducing the training data inevitably compromises the accuracy, TransHP maintains better resistance against the insufficient data problem. For example, when we reduce the training data of ImageNet to 10%, TransHP enlarges its improvement over the baseline to +12.69%.
- **Explainability**. Through visualization, we observe that the proposed TransHP shares some similar patterns with human visual recognition, e.g., taking an overview for coarse recognition and then focusing on some critical local regions for the subsequent recognition after prompting.

## A Prompting Block in TransHP

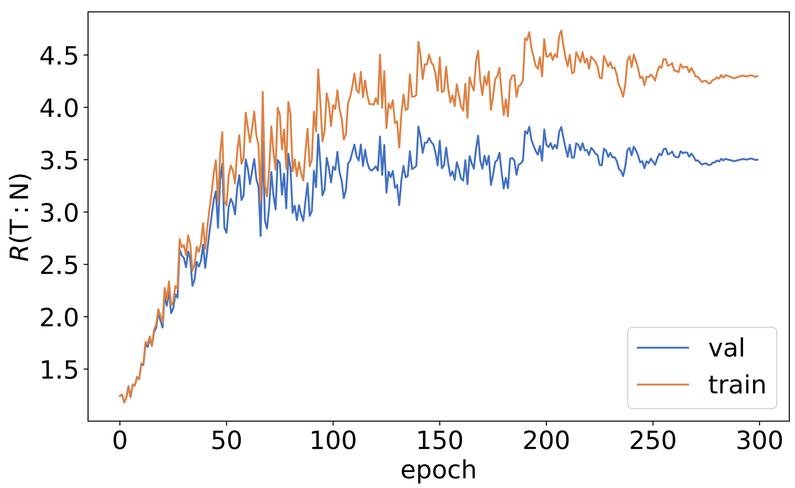



## Transformer with Hierarchical Prompting




## TransHP Focuses on the Target Prompt

- TransHP gradually focuses on the predicted coarse class when absorbing the prompts, yielding an autonomous selection.




## Experiments

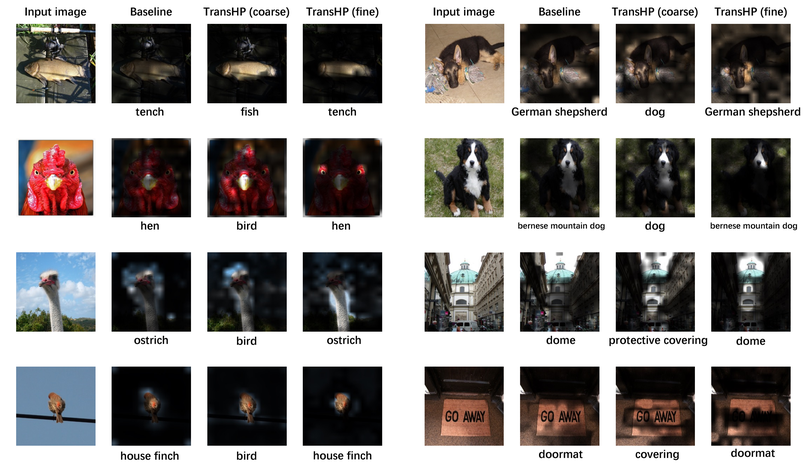
- TransHP improves the accuracy.

| Accuracy (%) | ImageNet | iNat-2018 | iNat-2019 | CIFAR-100 | DeepFashion |
|---|---|---|---|---|---|
| Baseline | 76.21 | 63.01 | 69.31 | 84.98 | 88.54 |
| Guided | 76.05 | 63.11 | 69.66 | 85.10 | 88.32 |
| HiMulConE | 77.52 | 63.46 | 70.87 | 85.43 | 88.87 |
| TransHP | **78.65** | **64.21** | **71.62** | **86.85** | **89.93** |

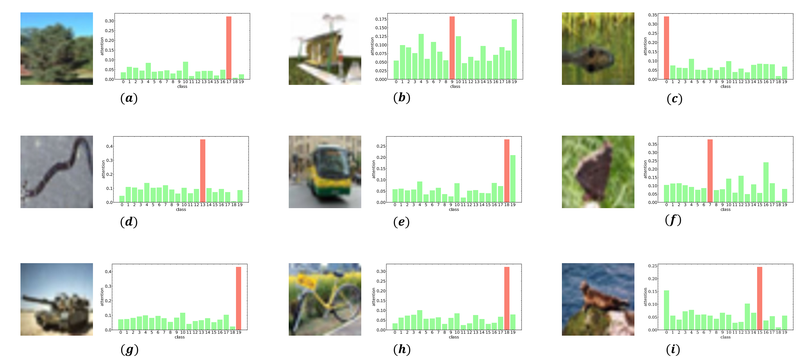
- TransHP improves data efficiency.

| Accuracy (%) | 100% | 50% | 20% | 10% |
|---|---|---|---|---|
| Baseline | 76.21 | 67.87 | 44.60 | 25.24 |
| Guided | 76.05 | 67.74 | 45.02 | 25.67 |
| HiMulConE | 77.52 | 69.23 | 48.50 | 30.76 |
| TransHP | **78.65** | **70.74** | **53.71** | **37.93** |

- TransHP improves model explainability.




- Autonomous prompt selection of TransHP.




## Contacting

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