Contextual Classification with Self-Supervised Auxiliary Models for Deep Learrning

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Findings

Image classifiers improve performance through an auxiliary task derived from the original labels

- **Accuracy improves** for many SOTA architectures.
- **Converges faster**
- Training loss and joint prediction **boost performance without** adding too many **additional parameters**.
- **Predictions are more** structured (hence **explainable**) because of the auxiliary criterion.

Motivation:

- DNNs usually operate under the **closed world** paradigm
- It is difficult to estimate how **related additional tasks** are e.g., colorization, reconstruction.
- We don't want to rely on **additional annotations**!

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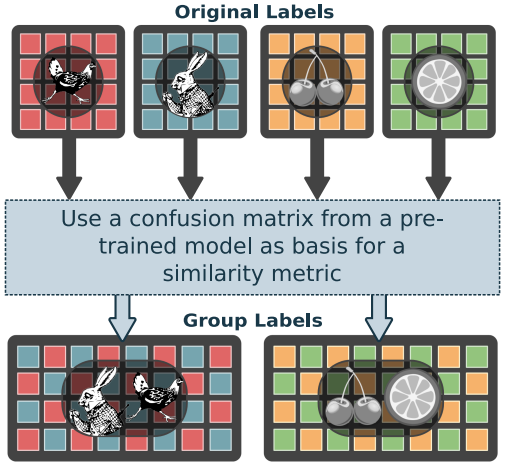
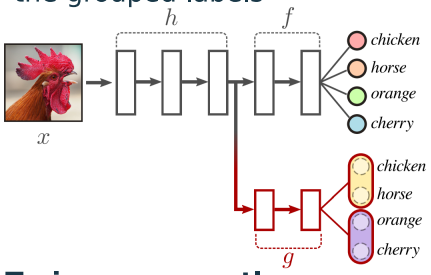
Methods

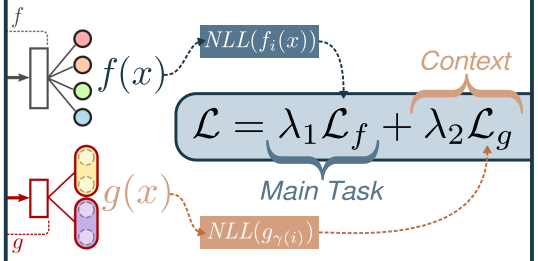
1. Use the **original labels** and **group them** (mutually exclusive and balanced)



2. Define a classifier for the original task, and an **auxiliary** one for the grouped labels

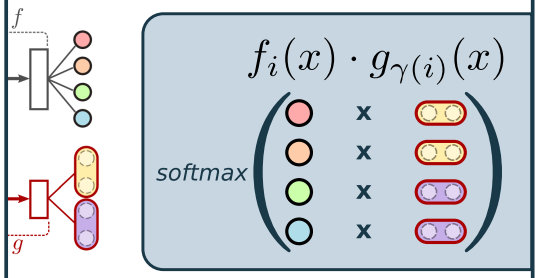


3. Train concurrently



$$\mathcal{L} = \lambda_1 \mathcal{L}_f + \lambda_2 \mathcal{L}_g$$

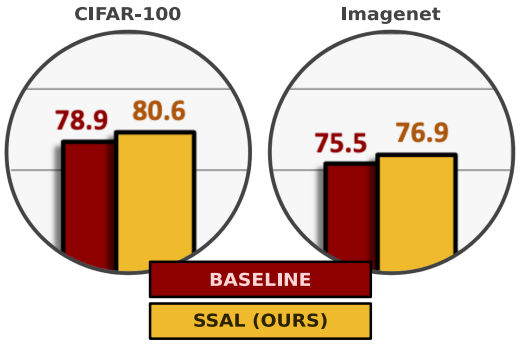
4. Joint Prediction



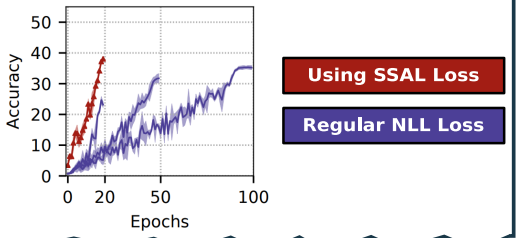
$$f_i(x) \cdot g_{\gamma(i)}(x)$$

Results

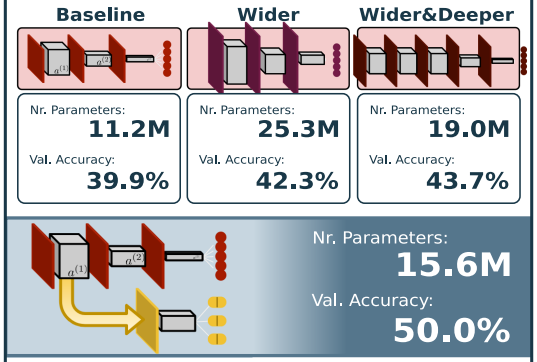
1. Higher accuracy of Resnet50 on:



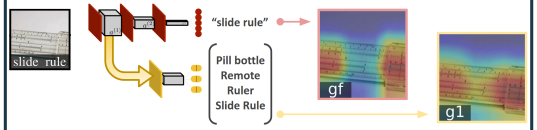
2. Same architecture, **trains faster**:



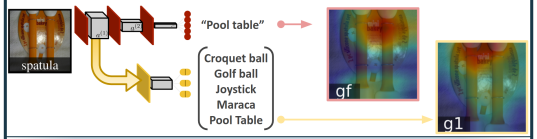
4. Ablation: more efficient use of additional parameters!



5. More structured (**explainable**) predictions thanks to the grouping objective



Common patterns from grouped labels hint at the underlying feature (even markings/numbers)



Grouped labels show large sticks followed by round objects.

Future Work:

- Cluster based grouping
- Other criteria (different than grouping)
- Add SSAL to Neural Architechture Search

Papers' website

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