ADL: train segmentation model on all public datasets

## Team members

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## Motivation

The motivation behind this task is to tackle the challenge of training an image segmentation model on diverse public datasets with varying labeling schemes. By creating separate output heads for each dataset, we aim to preserve the unique labeling characteristics of individual datasets without sacrificing valuable supervision signals. This approach allows us to leverage the rich information contained in different datasets while ensuring accurate segmentation results tailored to each dataset's specific classes.

## Data

<https://www.cityscapes-dataset.com/dataset-overview/>

<https://groups.csail.mit.edu/vision/datasets/ADE20K/>

<https://www.mapillary.com/dataset/vistas>

## Methods

* Data Preparation: Gather and preprocess all available public datasets with diverse labeling schemes. Maintain the integrity of dataset labels without converting them into a common scheme. Develop a data loader that ensures each batch contains at least one image from every dataset.
* Model Design: Construct an image segmentation model with separate output heads for each dataset to handle diverse labeling schemes. Use a shared backbone for feature extraction and individual heads for dataset-specific segmentation predictions. Implement a mechanism to mask out losses from other datasets during backpropagation.
* Training Strategy: Sample batches that encompass images from multiple datasets to prevent imbalanced gradient updates. Employ gradient accumulation to handle large batch sizes that exceed GPU memory capacity. Dynamically mask out losses from irrelevant datasets during the calculation of the total loss for a batch.
* Evaluation and Refinement: Evaluate the model performance using validation datasets from each public dataset separately. Fine-tune the model based on performance metrics and adjust training strategies as needed to improve segmentation accuracy across diverse datasets.