

# Model *Co-teaching* for Semi-supervised Image Classification

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CSE244A Final Project

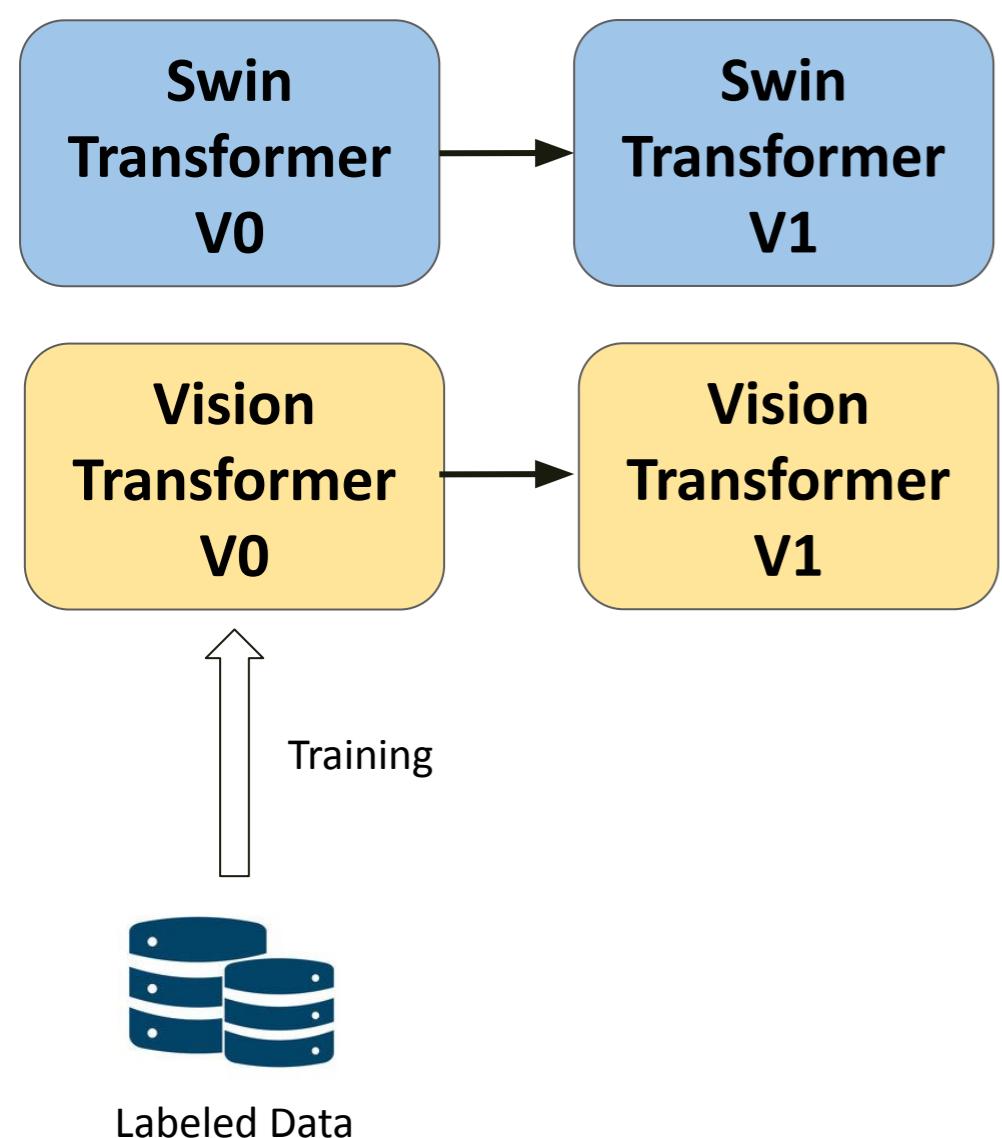
**12/03/2024**

# Challenge Overview

- Challenge Task:
  - Apply semi-supervised learning techniques to classify a custom dataset of 135 fine-grained categories (15 plants, 120 dogs).
- Dataset
  - Training Set:
    - 9854 labeled images.
    - 22,995 unlabeled images.
  - Test Set:
    - 8213 images.
- Result: Achieve >50% accuracy using both labeled and unlabeled data.

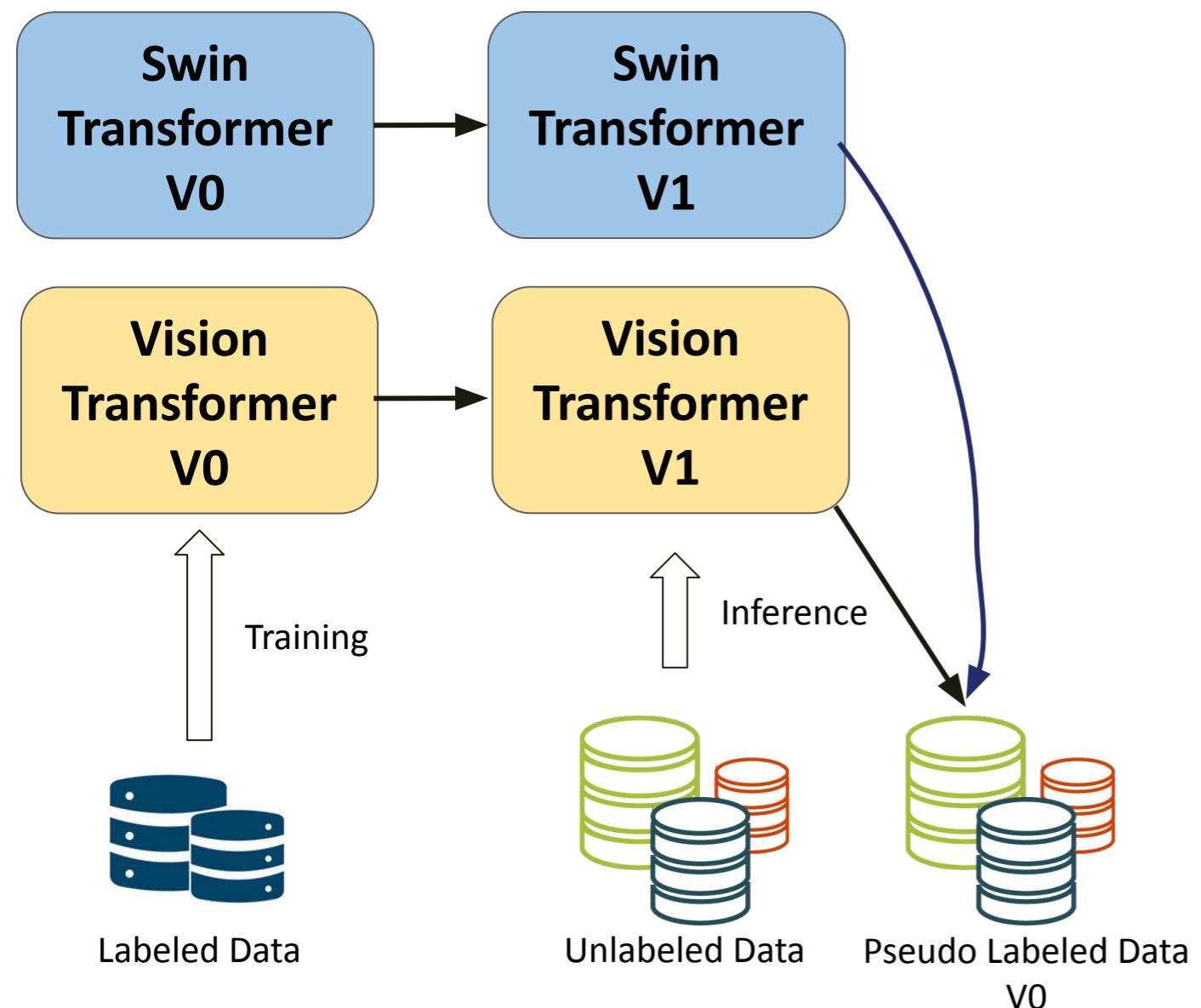
# Model Training Pipeline

## *Initialization*



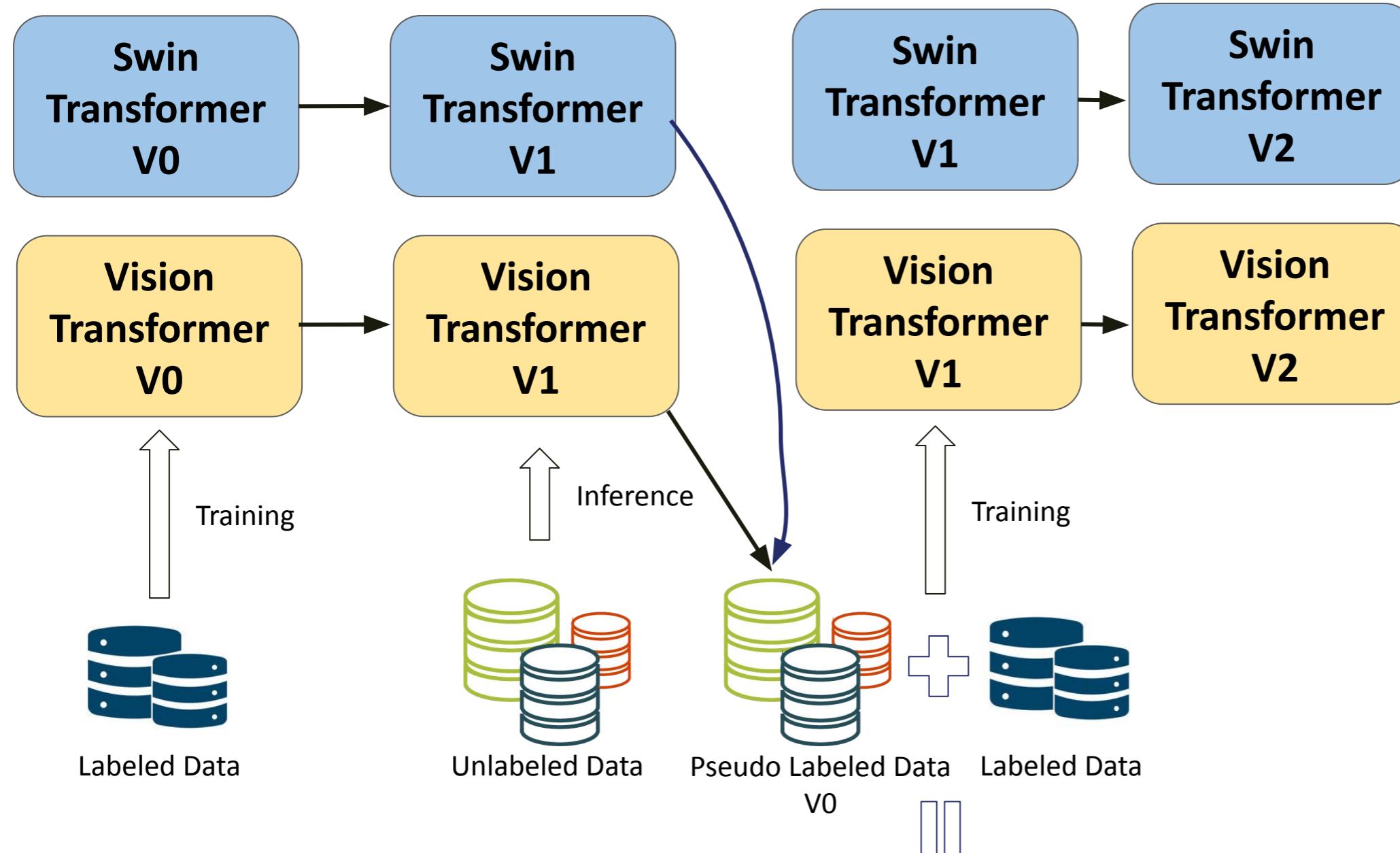
# Model Training Pipeline

## Initialization



# Model Training Pipeline

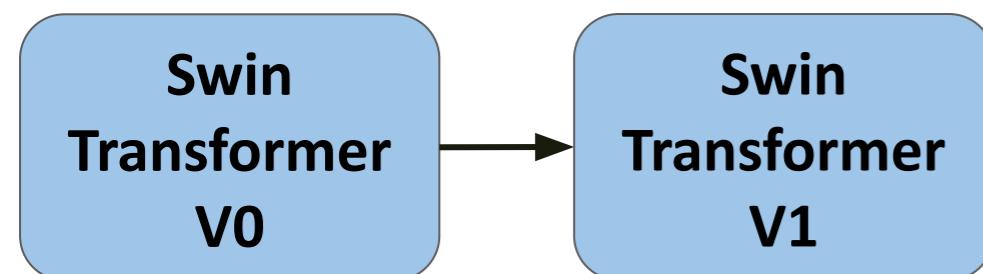
## Initialization



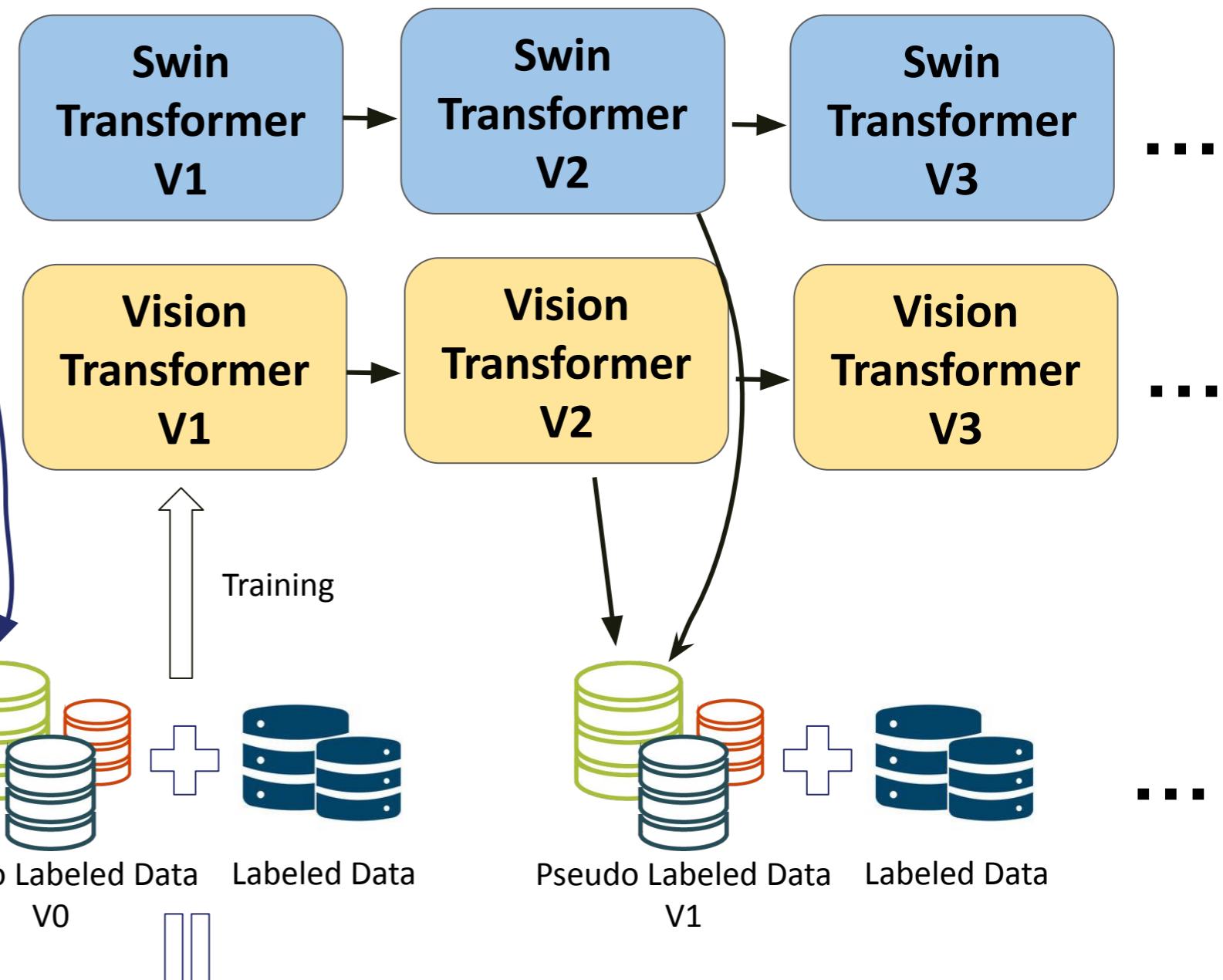
1. Train on Labeled Data only
2. Train on Mixed Labeled Data

# Model Training Pipeline

## Initialization



## Model Co-teaching



- 1. Train on Labeled Data only
- 2. Train on Mixed Labeled Data

# Experimental Setup

- **Model Selection**
  - ❖ **Model 1:** *Swin Transformer (Base)* pretrained on ImageNet, with a modified classification head.
  - ❖ **Model 2:** *Vision Transformer (ViT-B/16)* pretrained on ImageNet, with a modified classification head.
- **Training Parameters**
  - ❖ **Epochs:** 10 dynamic iterations involving pseudo-labeling.
  - ❖ **Optimizer:** AdamW with weight decay of 1e-4.
  - ❖ **Learning Rate:** Initial learning rate of 1e-4 with cosine annealing warm restarts.
  - ❖ **Loss Function:** Cross-entropy with label smoothing (0.1) and class weights to handle imbalanced data.
  - ❖ **Batch Size:** 256
- **Dynamic Accuracy Threshold**
  - ❖ **Pseudo-label Threshold:** Starts at 0.8 and decreases by 0.02 per epoch to include more predictions dynamically.

# Final Result

9	CamelliaWang-1		0.9427
10	Yanqing Liu		0.9384
...	...		...

## Potential Improvements

- ❖ **Larger Model:** employ visual transformers with larger model size
- ❖ **Optimized Training Framework:** probing other diverse training paradigm such as wake-sleep training
- ❖ **Data Augmentation:** use data augmentation strategies to labeled&unlabeled data such as crop, rotate to improve training accuracy
- ❖ ... ...

# Task Distribution

- ❖ **Yanqing Liu:** Methodology, Vision Transformer Training
- ❖ **Zhonghui Li:** Methodology, Slides, Report
- ❖ **Haoqin Tu:** Data preprocess, Data Labeling

*Thanks!*

*Q&A*