Lab5 – Knowledge Distillation

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Outline

1. Knowledge Distillation
   - Introduction
   - Types of Knowledge
   - Modes of Distillation
2. Lab5 task

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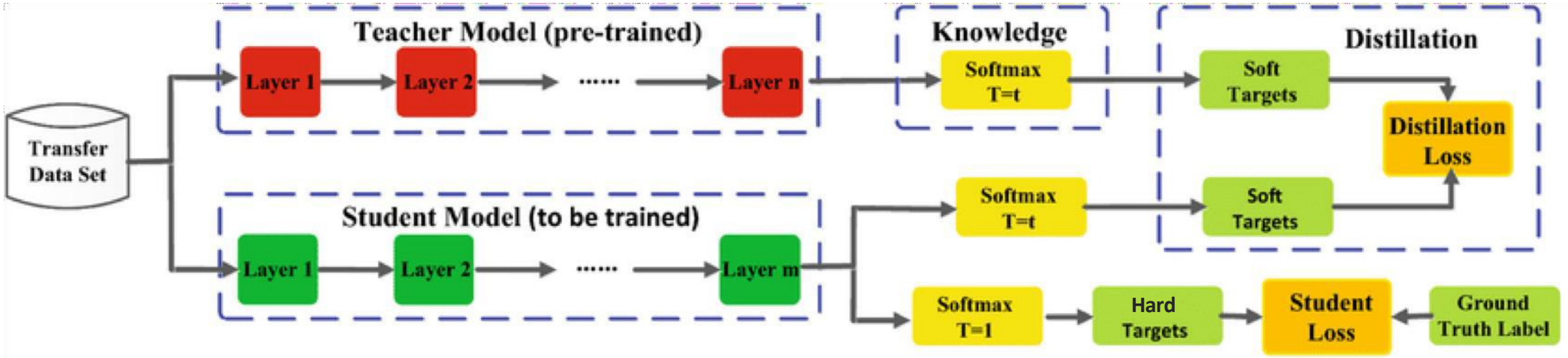
Knowledge Distillation

- A small model (student) is trained to mimic a large pre-trained model (teacher)



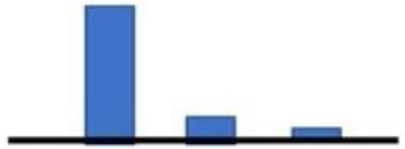
$$q_i = \frac{\exp(z_i/T)}{\sum_j \exp(z_j/T)}$$

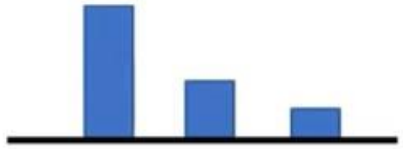
Temperature

Knowledge Distillation

- Temperature for softmax

$$y_i' = \frac{exp(y_i)}{\sum_j exp(y_j)} \xrightarrow{T = 100} y_i' = \frac{exp(y_i/T)}{\sum_j exp(y_j/T)}$$





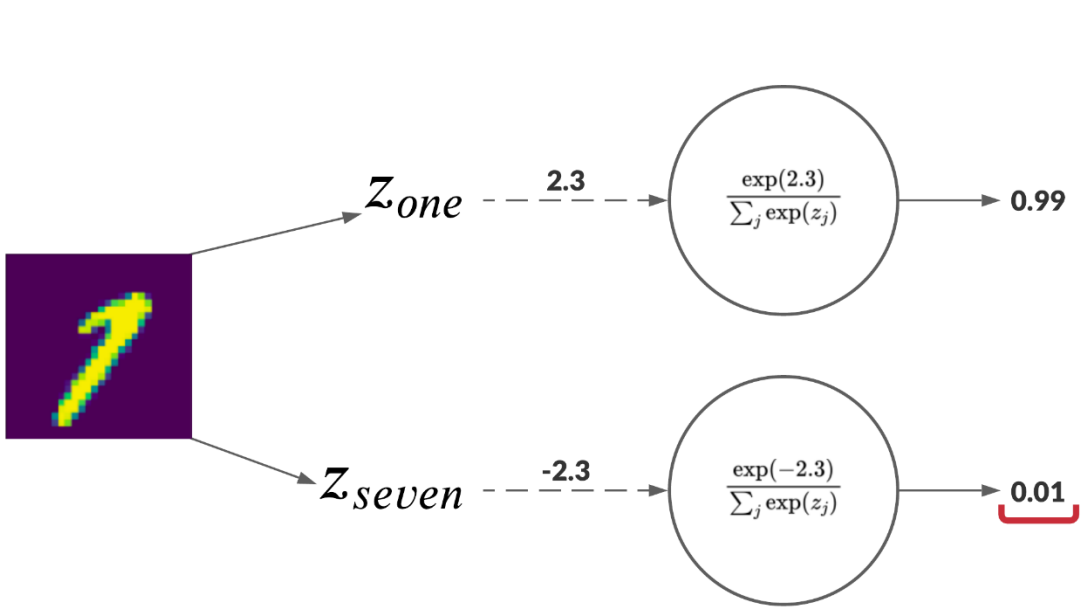
$y_1 = 100$ $y_1' = 1$ $y_1/T = 1$ $y_1' = 0.56$

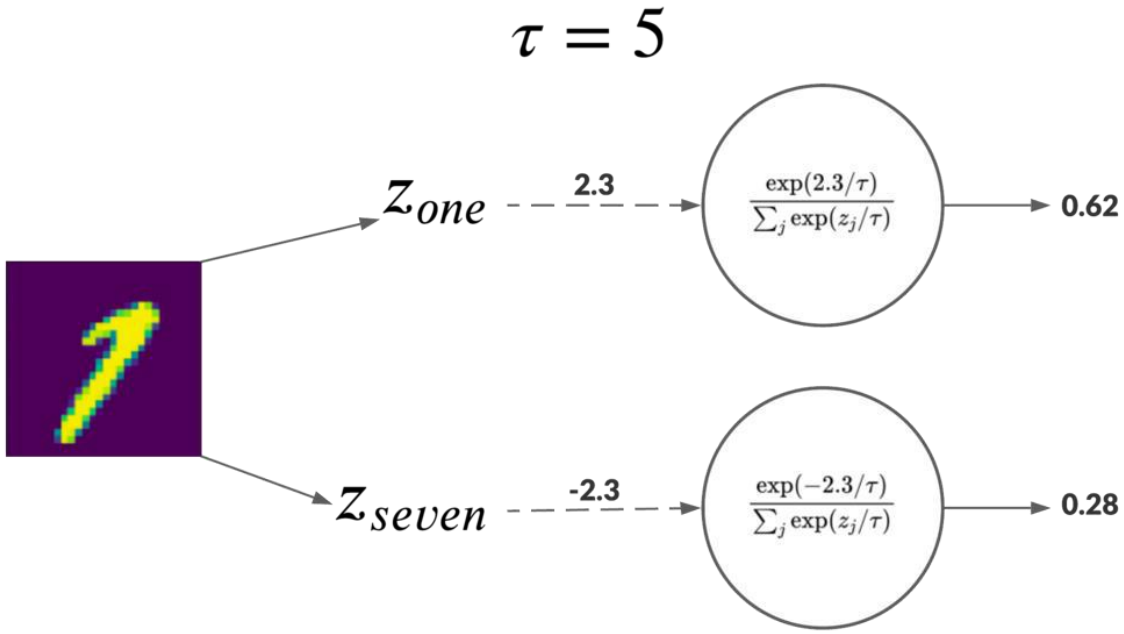
$y_2 = 10$ $y_2' \approx 0$ $y_2/T = 0.1$ $y_2' = 0.23$

$y_3 = 1$ $y_3' \approx 0$ $y_3/T = 0.01$ $y_3' = 0.21$

Soft Target

- Model prediction softened by T





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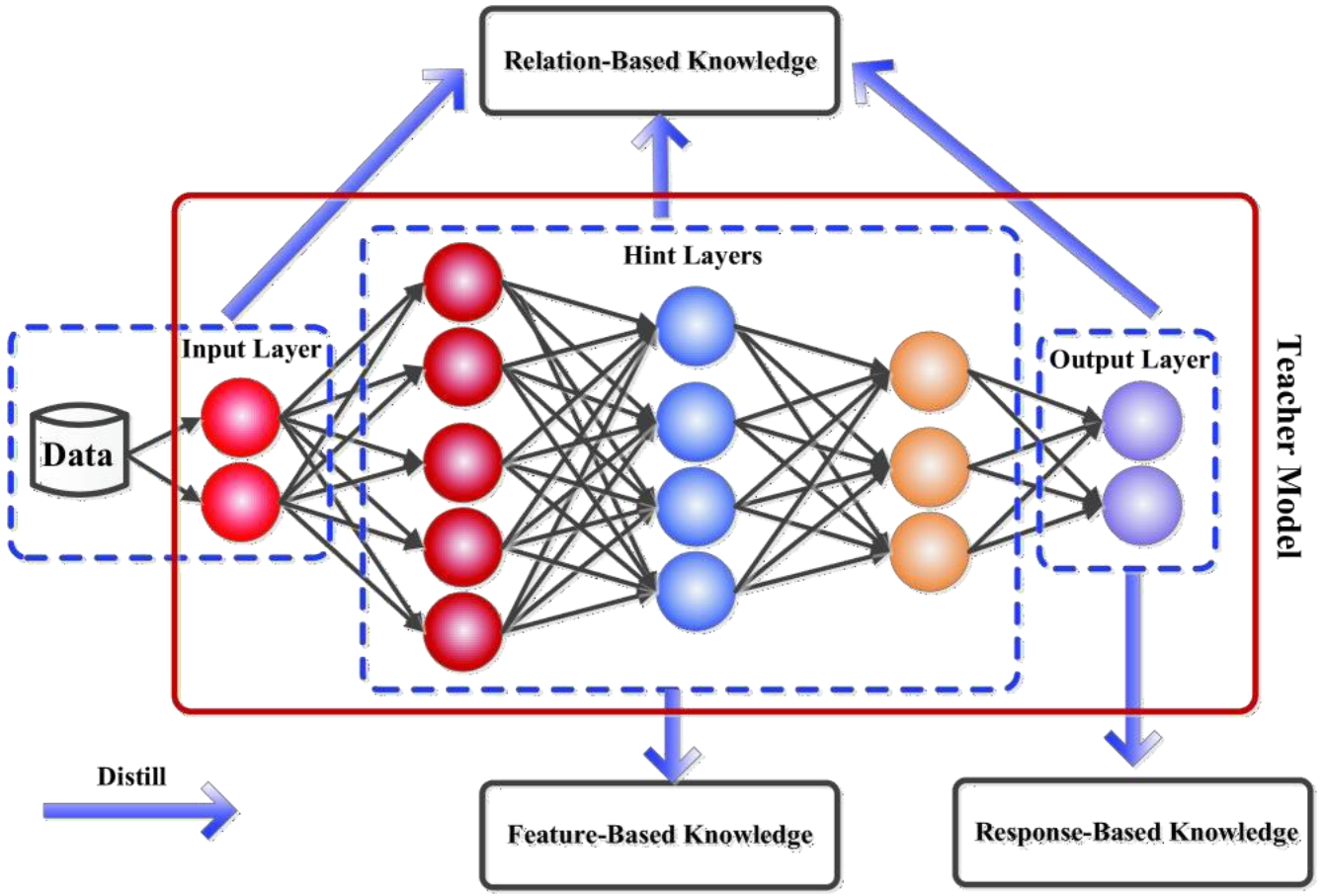
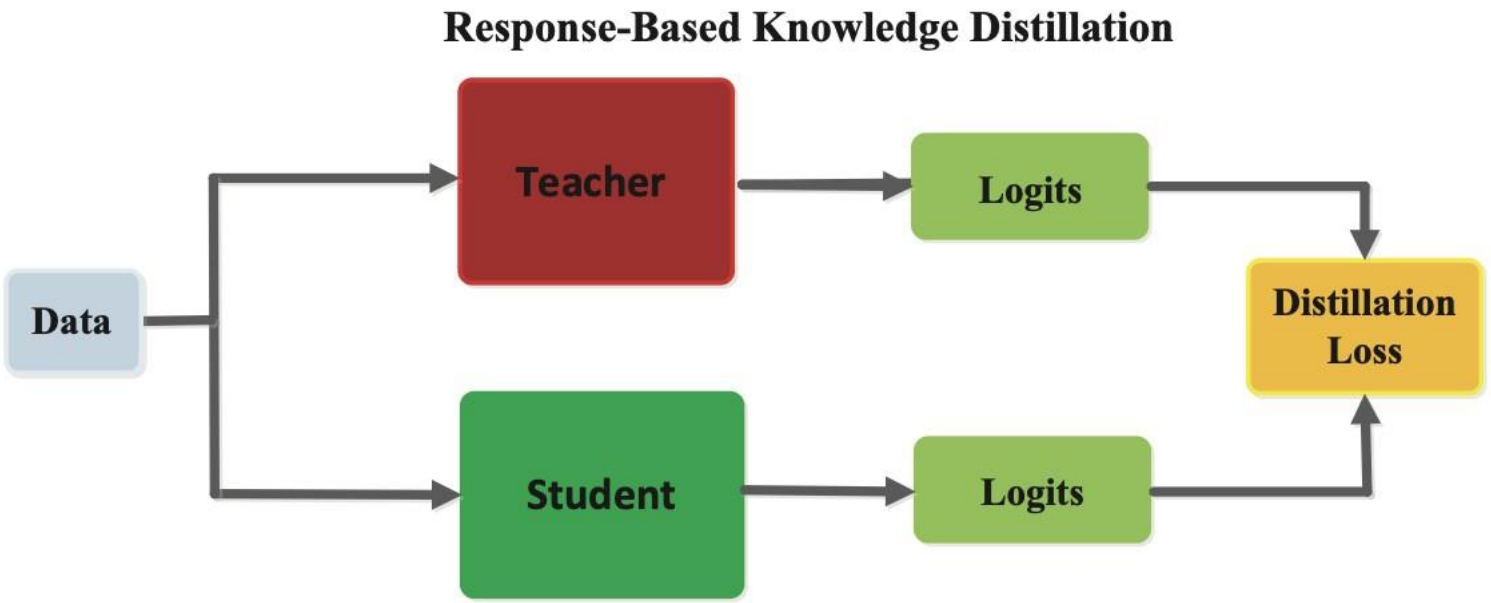
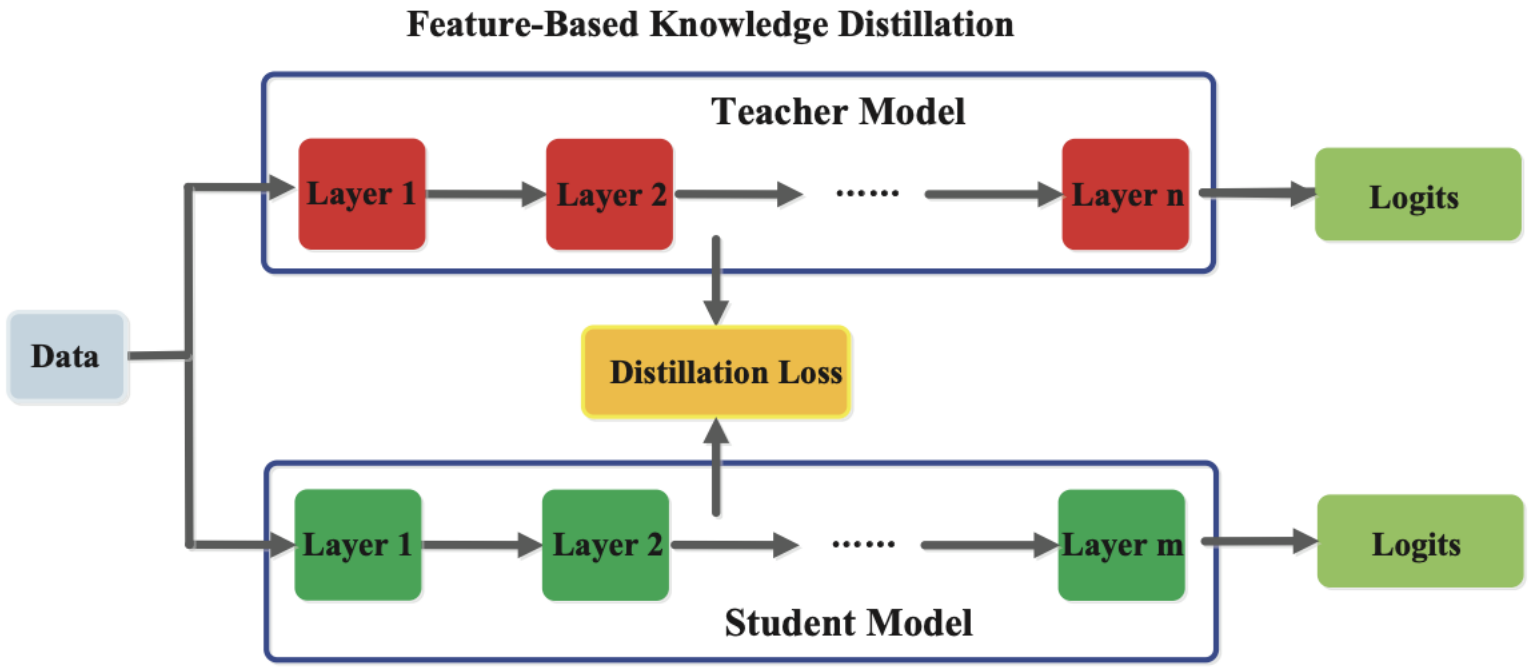
Types of Knowledge



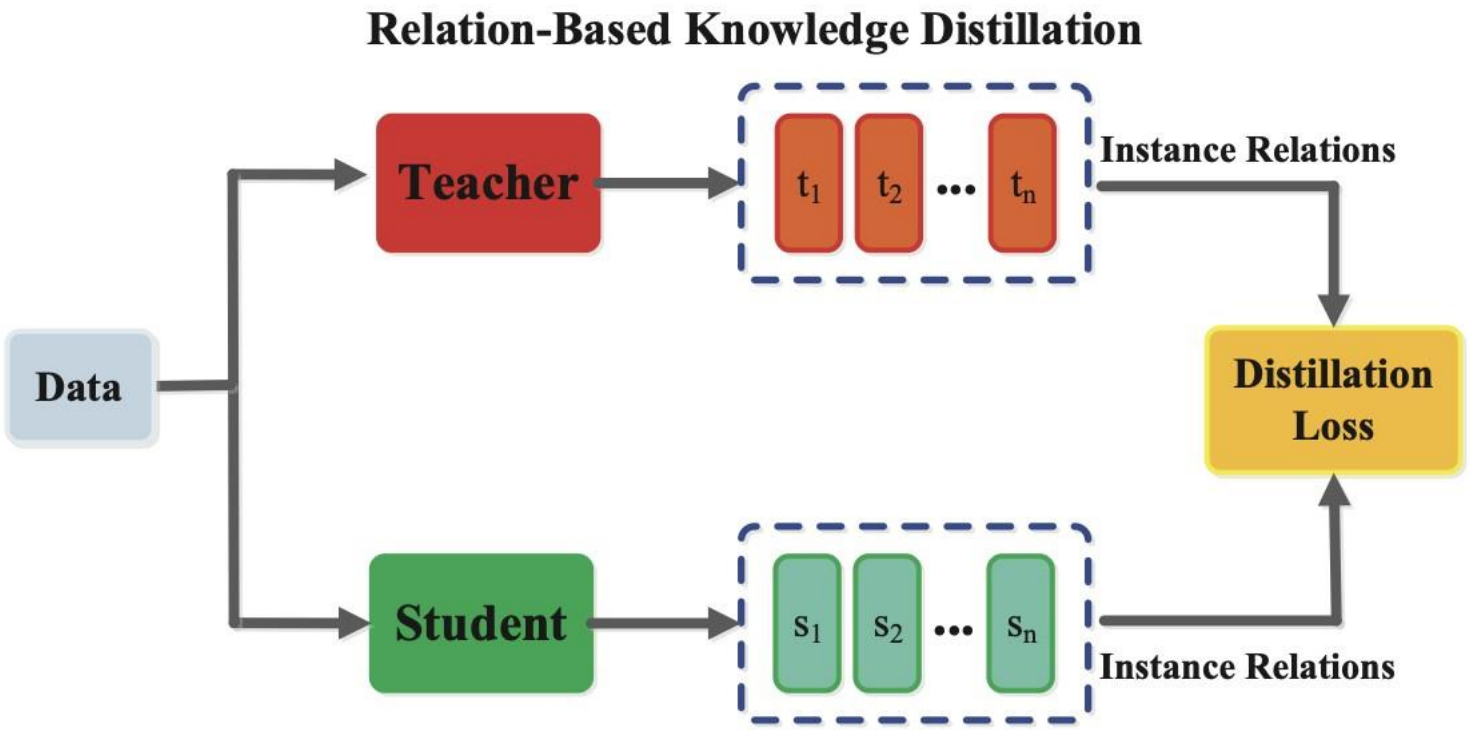
Response-Based Knowledge



Feature-Based Knowledge



Relation-Based Knowledge



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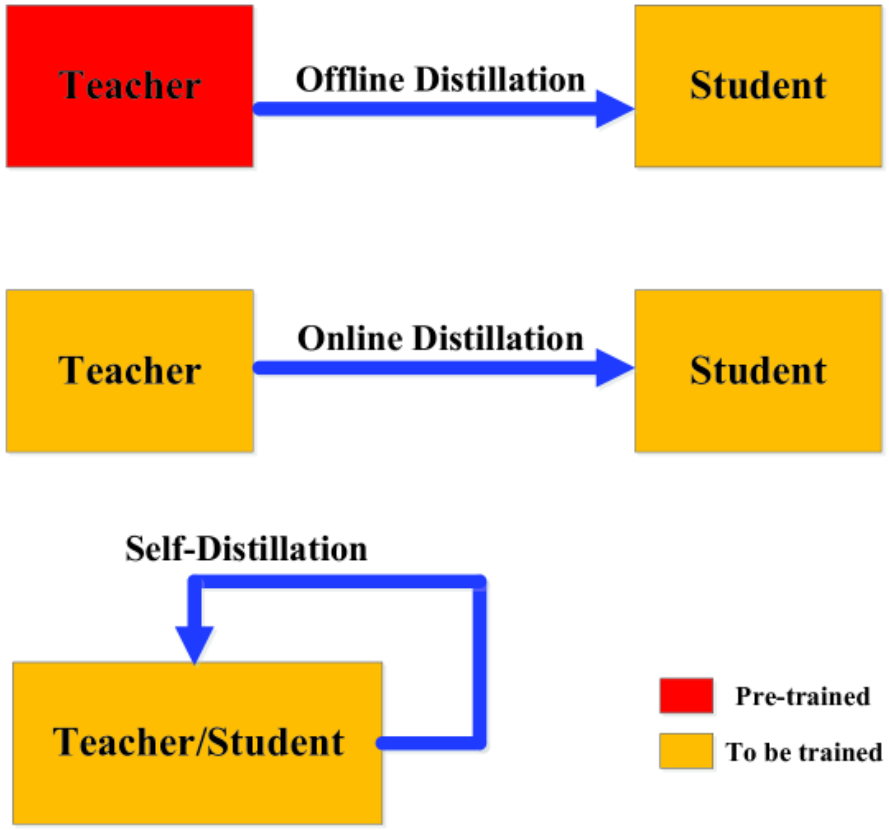
Modes of Distillation



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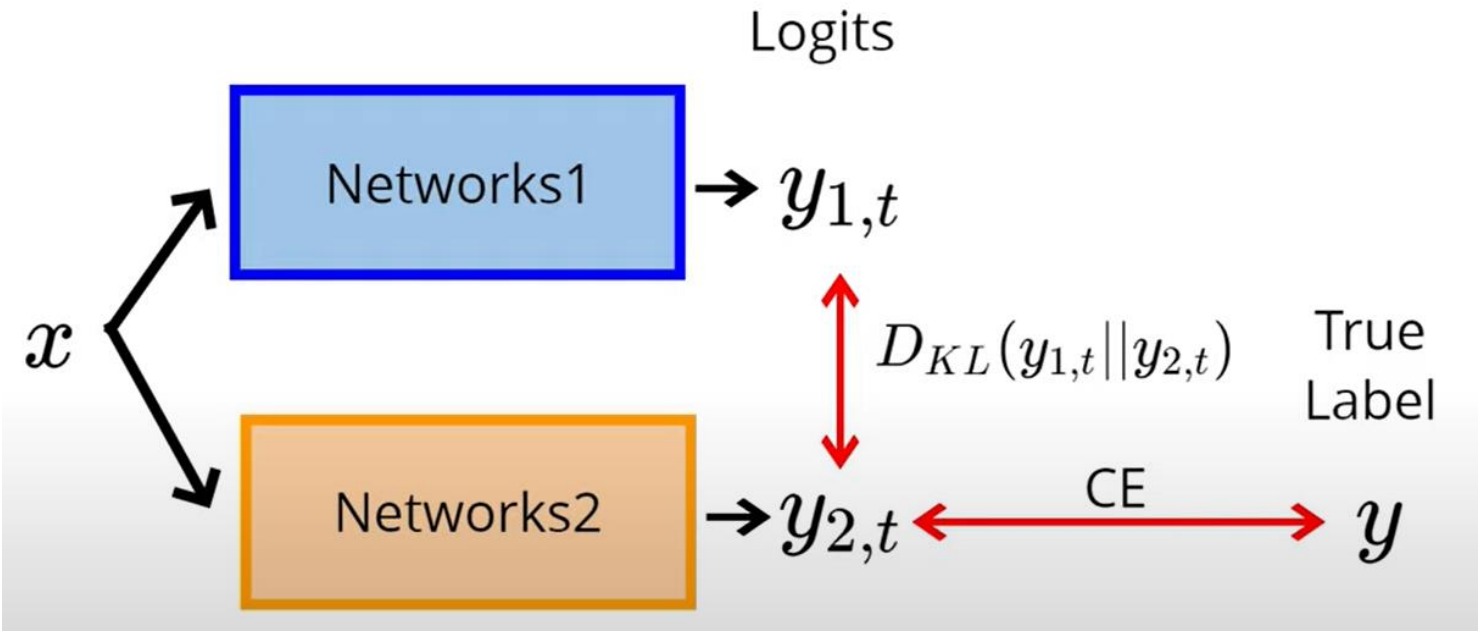
Lab5 task

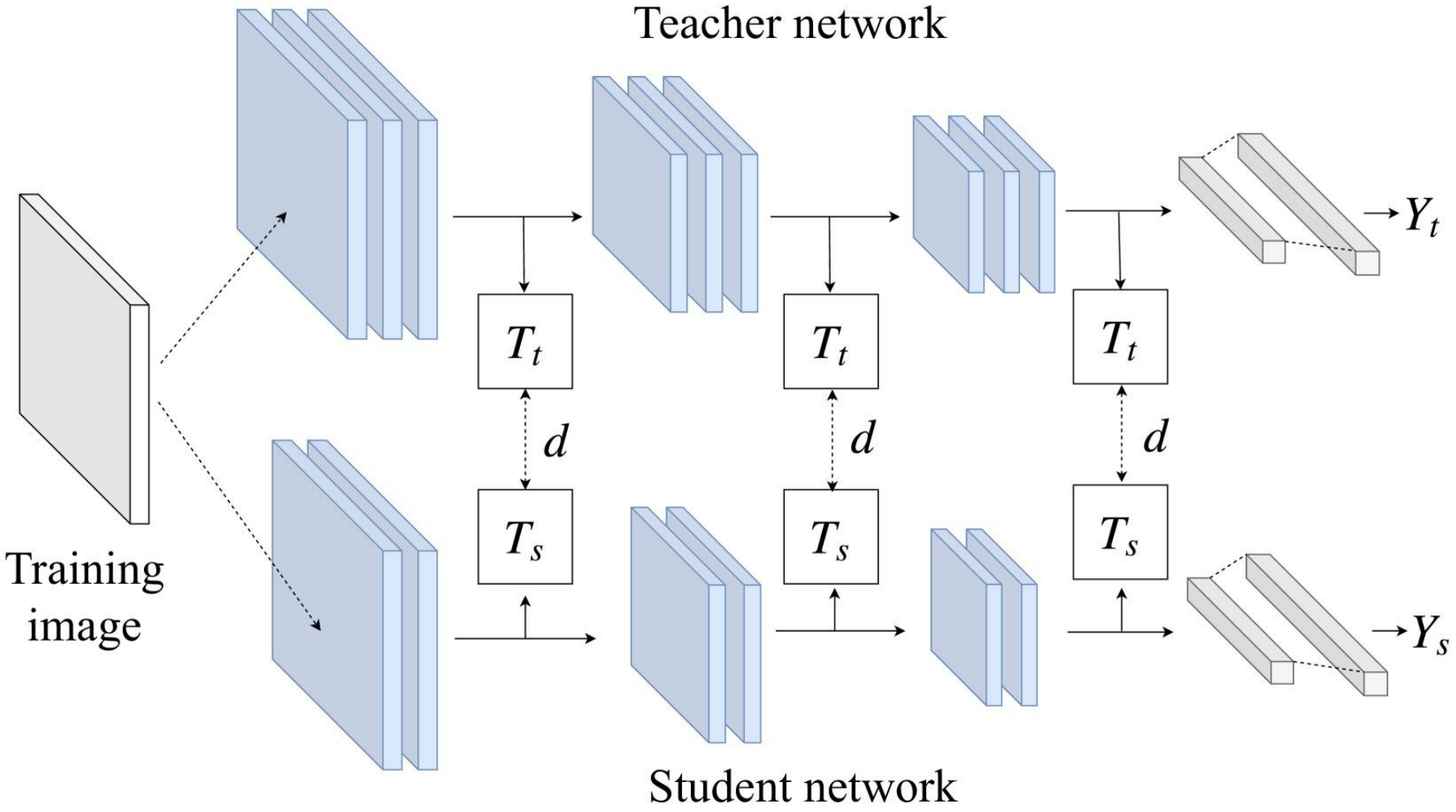
- Teacher: ResNet34
- Student: ResNet18
- Dataset: Cifar10
  - Response-based distillation (35%, accuracy≥0.8 got 30%, the more improvement the higher score **compare with student from scratch**)
  - Feature-based distillation (35%, same as above)
  - Report (30%)
- Colab link
- **StudentID_lab5.ipynb**

Response-Based Knowledge



$$q_i = \frac{\exp(z_i/T)}{\sum_j \exp(z_j/T)} \qquad L = \alpha T^2 L^{(soft)} + (1-\alpha)L^{(hard)}$$

Feature-Based Knowledge



Reference

- [2006.05525] Knowledge Distillation: A Survey (arxiv.org)
- [1904.01866] A Comprehensive Overhaul of Feature Distillation (arxiv.org)
- [1503.02531] Distilling the Knowledge in a Neural Network(arxiv.org)

Thanks for listening