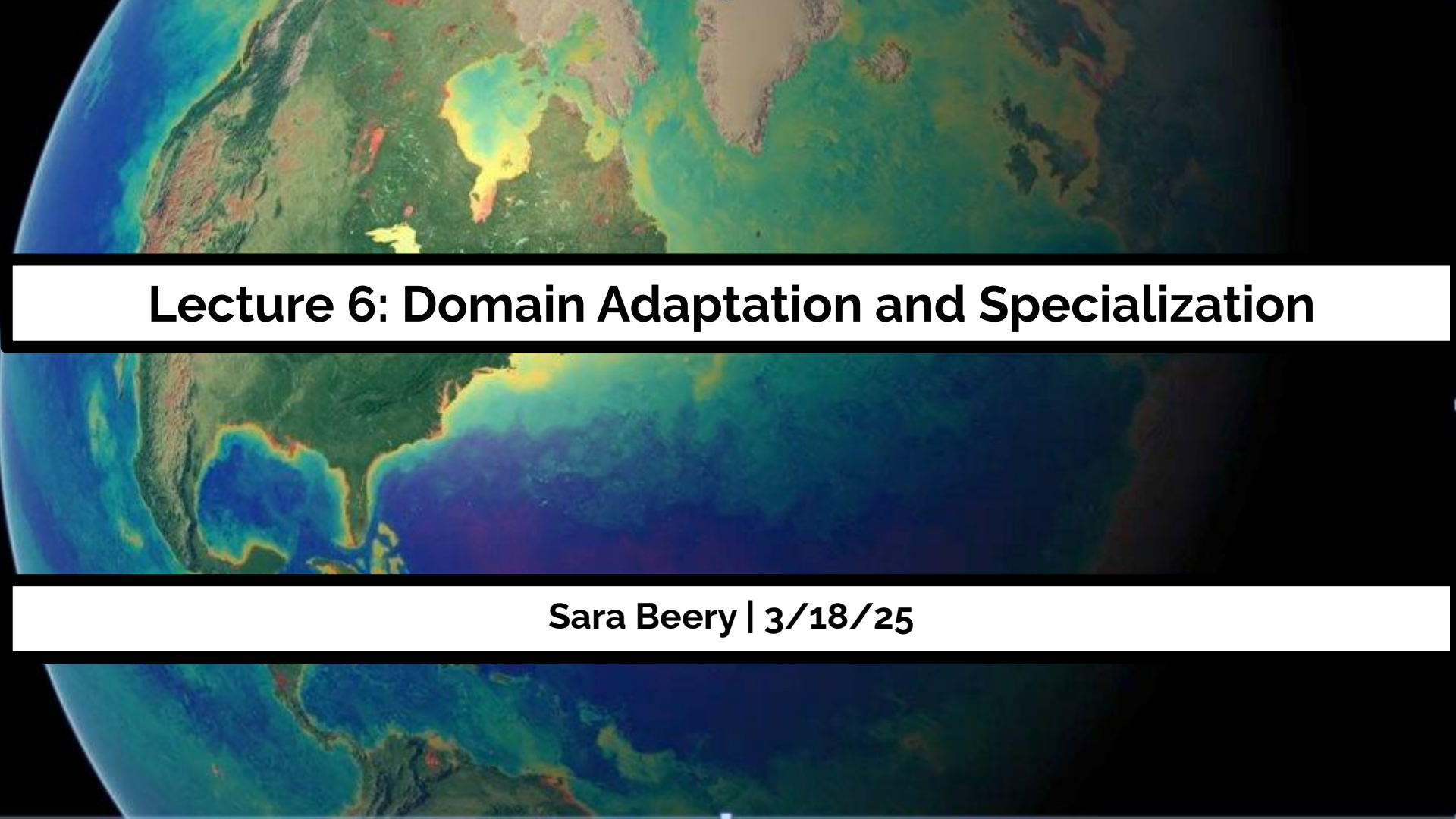
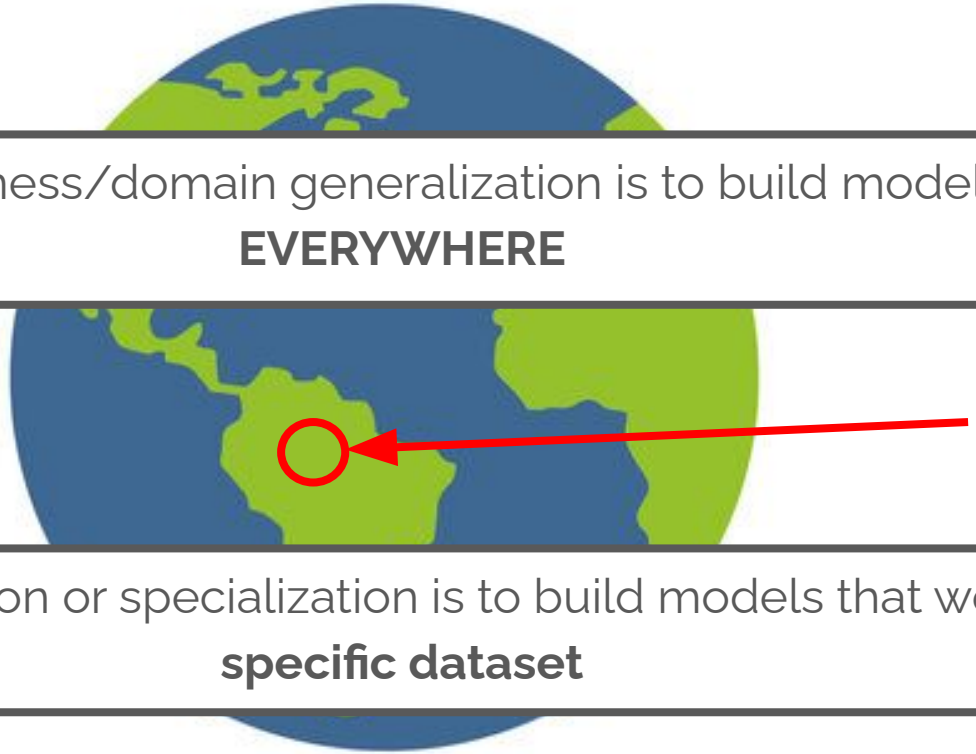


Lecture 6: Domain Adaptation and Specialization

Sara Beery | 3/18/25

Robustness vs Specialization

The goal of robustness/domain generalization is to build models that work **EVERYWHERE**



The goal of adaptation or specialization is to build models that work well on a **specific dataset**

Questions to determine what setting we are in:

- **Do we have representative labeled data?**
  - Finetuning/few shot, Supervised domain adaptation
- **Do we have representative unlabeled data?**
  - Unsupervised DA, active approaches (soon!)
- **Do we still need our model to work everywhere *after* adapting to the dataset of interest?**
  - That's (often) referred to as continual learning.
- **What about adaptation over time? Where would that fall?**

Finetuning and few-shot learning

Which of these is an example of the same concept as the item in the box?

[Lake, Salakhutdinov, Tenenbaum, 2015]

“Deep learning”

Human learning

Representations

Models

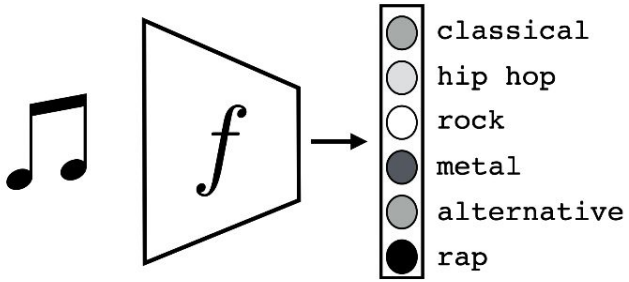
Skills

How can we give deep nets prior knowledge?

Fine-tuning

Pretraining

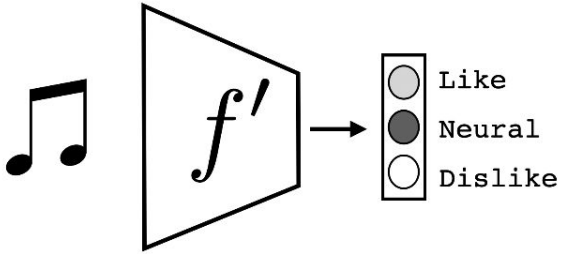
Genre recognition



A lot of data

Adapting

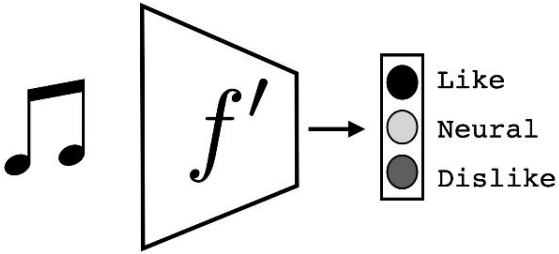
Preference prediction



A little data

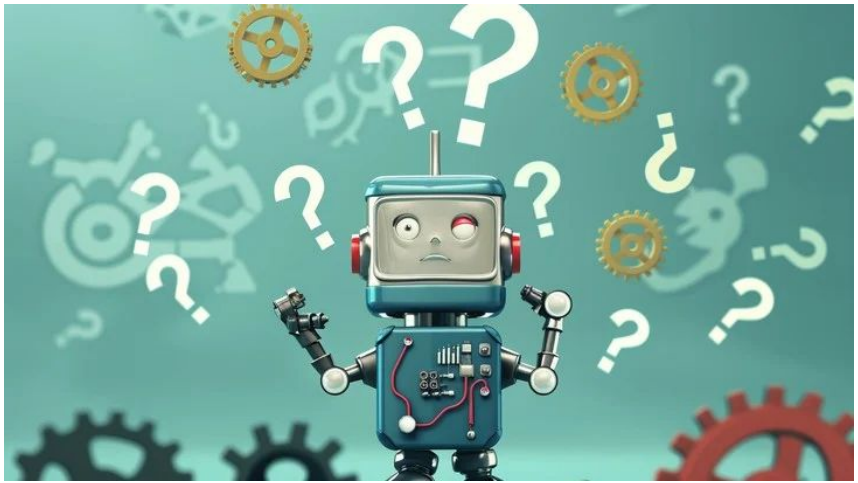
Testing

Preference prediction

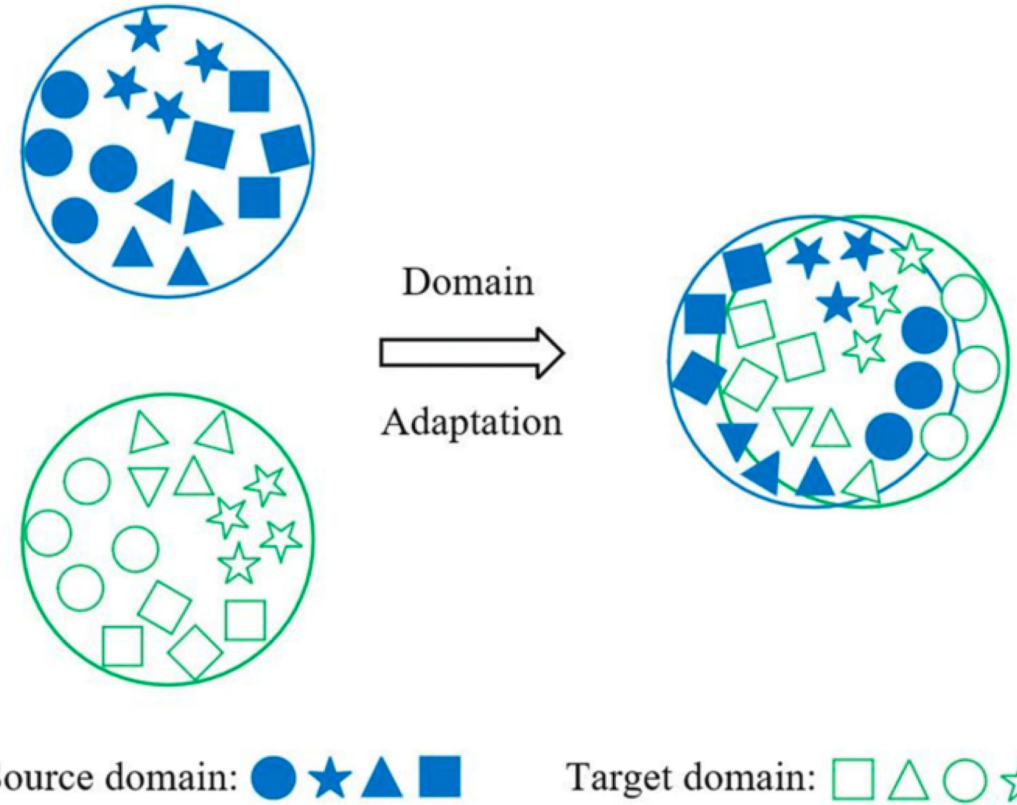


When does vanilla fine-tuning “fail”?

- Dataset isn’t representative -> bad performance
- Pretraining isn’t useful -> not so bad, maybe inefficient?
- Dataset is too small -> overfitting, lost capacity from the original model



Supervised domain adaptation

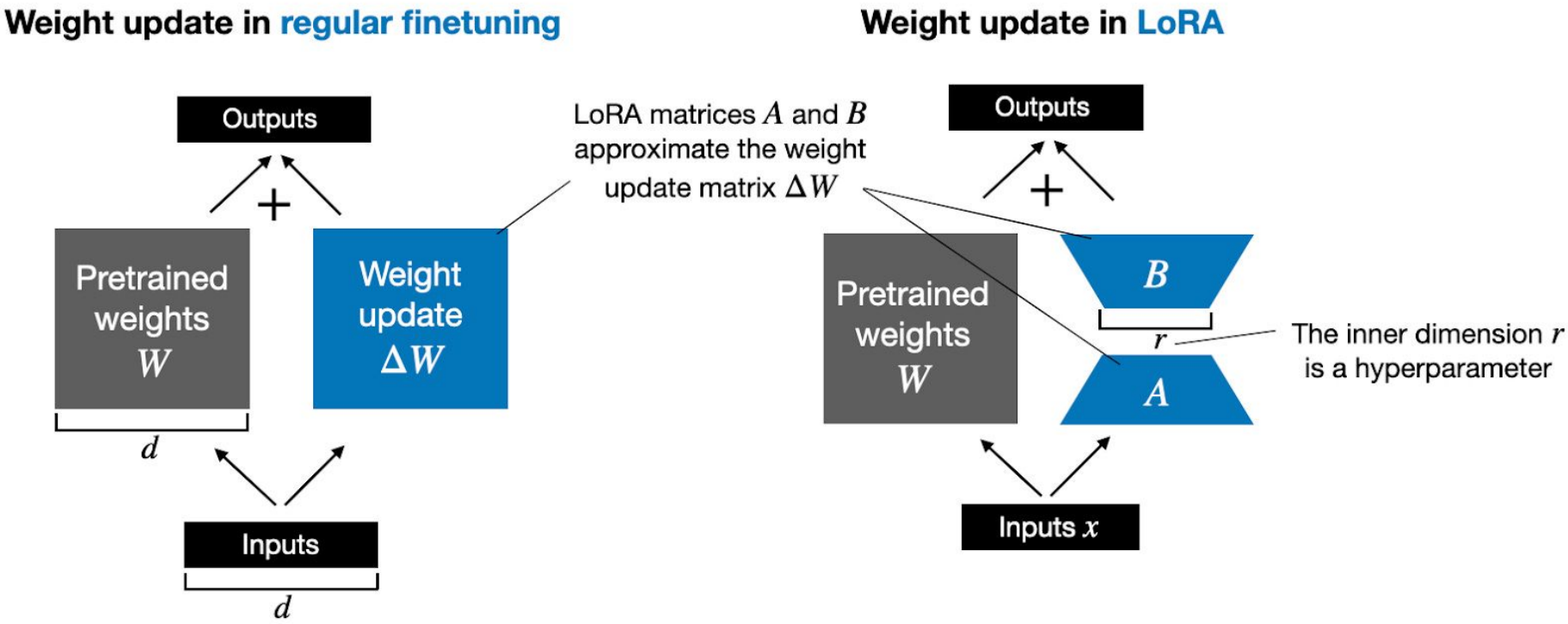


Examples:

- Co-training
- DANN (adversarial)
- CORAL (correlation alignment)
- ...can be semi-supervised

https://link.springer.com/article/10.1007/s10489-022-03709-8

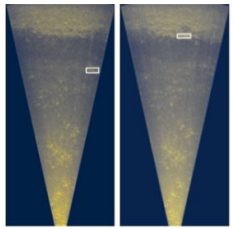
LORA: Low-rank finetuning

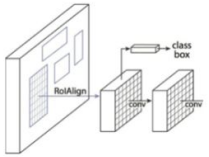


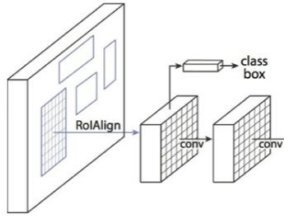
https://magazine.sebastianraschka.com/p/practical-tips-for-finetuning-llms

Unsupervised Domain Adaptation

Unlabeled target

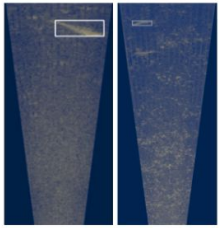


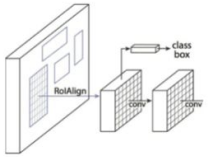


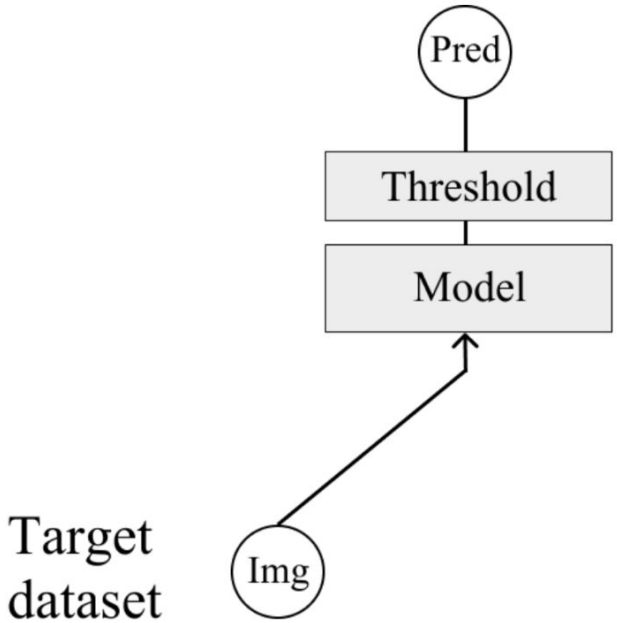


UDA model

Labeled source






Pred
Threshold
Model
Target
dataset
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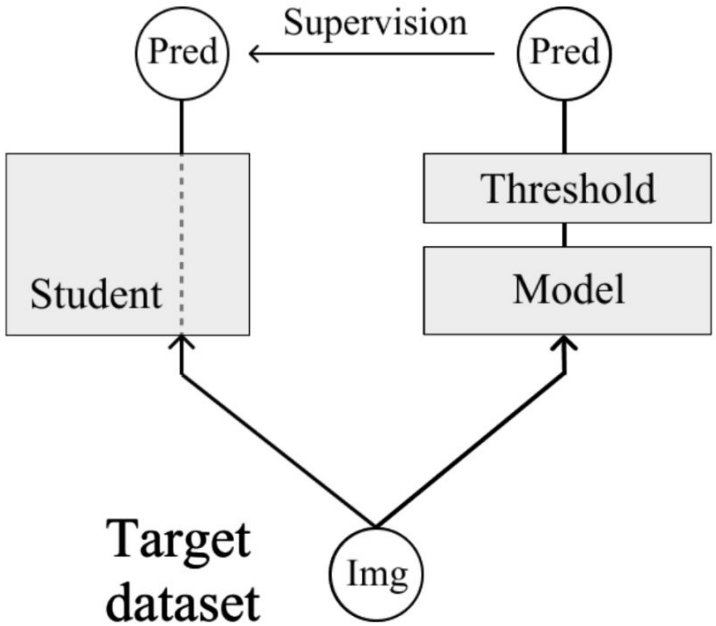
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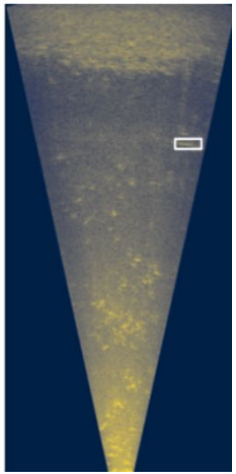

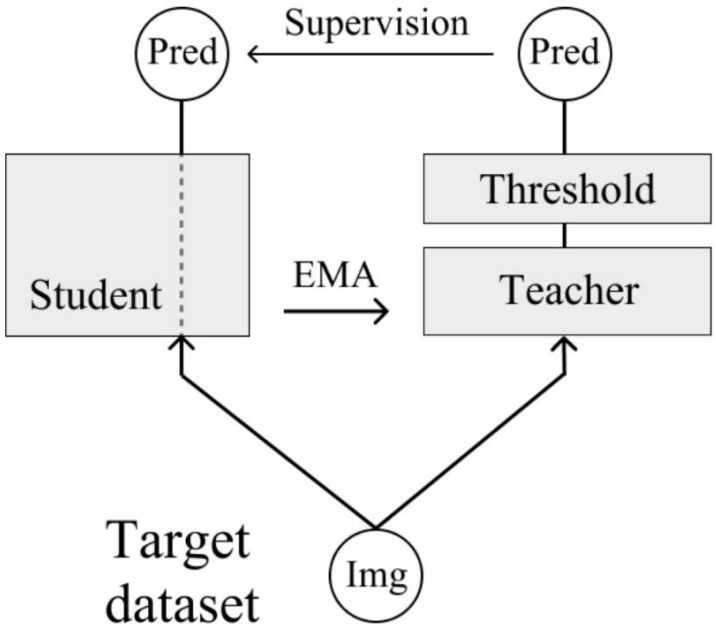
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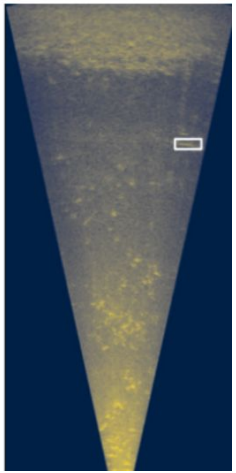

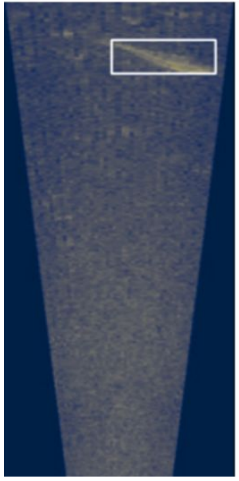

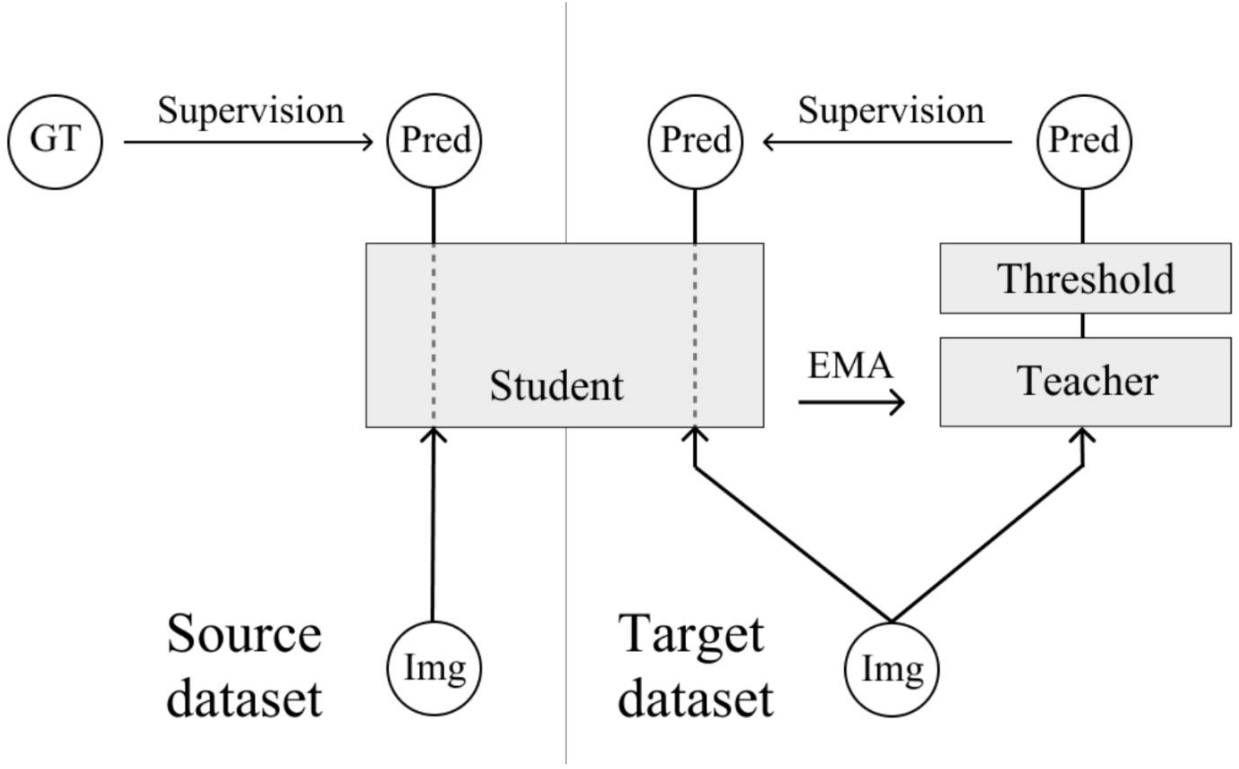
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Threshold
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Source dataset
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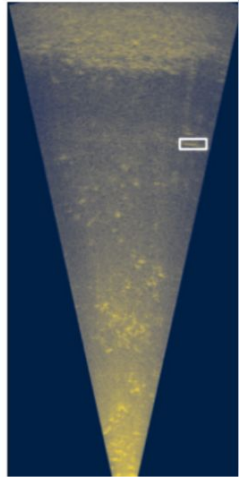
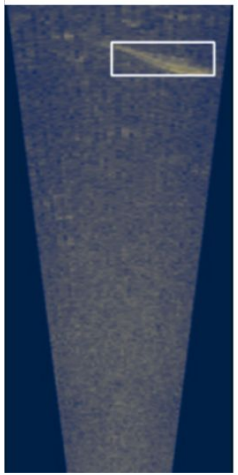
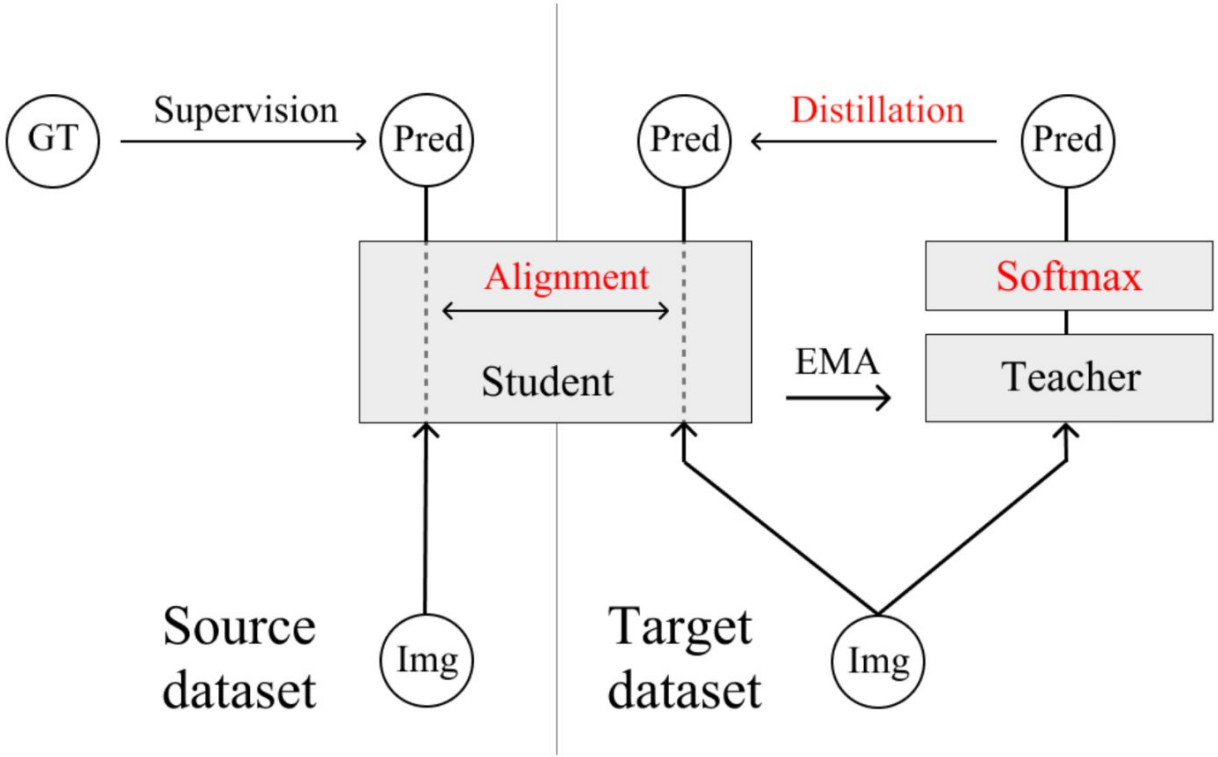
Target dataset
Img



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Supervision
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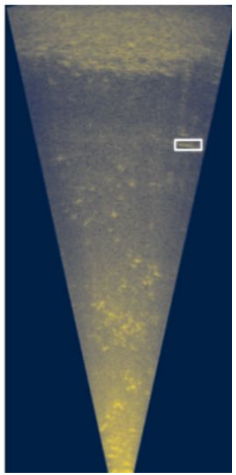
Source dataset
Img
Target dataset
Img



Why don't we just label some data?

We will talk all about incorporating feedback into models at training, testing, and deployment starting the week of 4/8!