

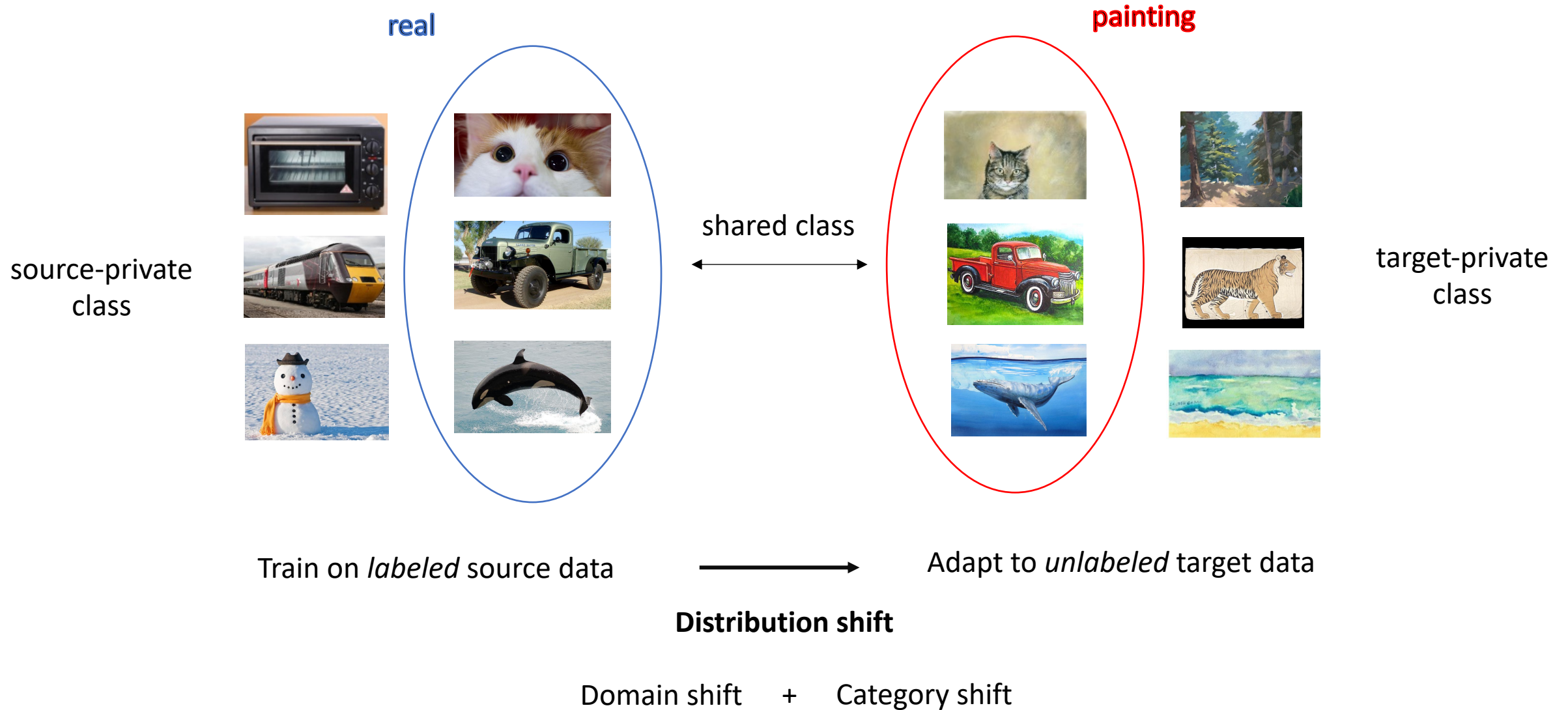
Tackling Dimensional Collapse toward Comprehensive Universal Domain Adaptation

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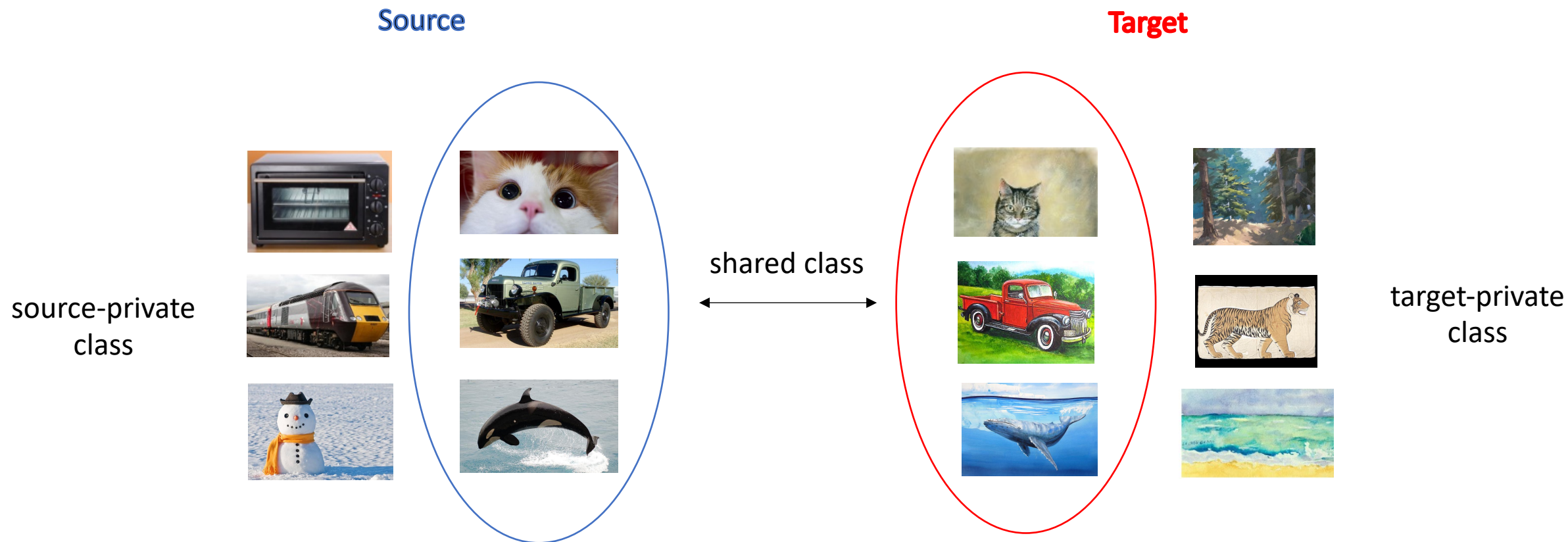
National Taiwan University



Problem setting

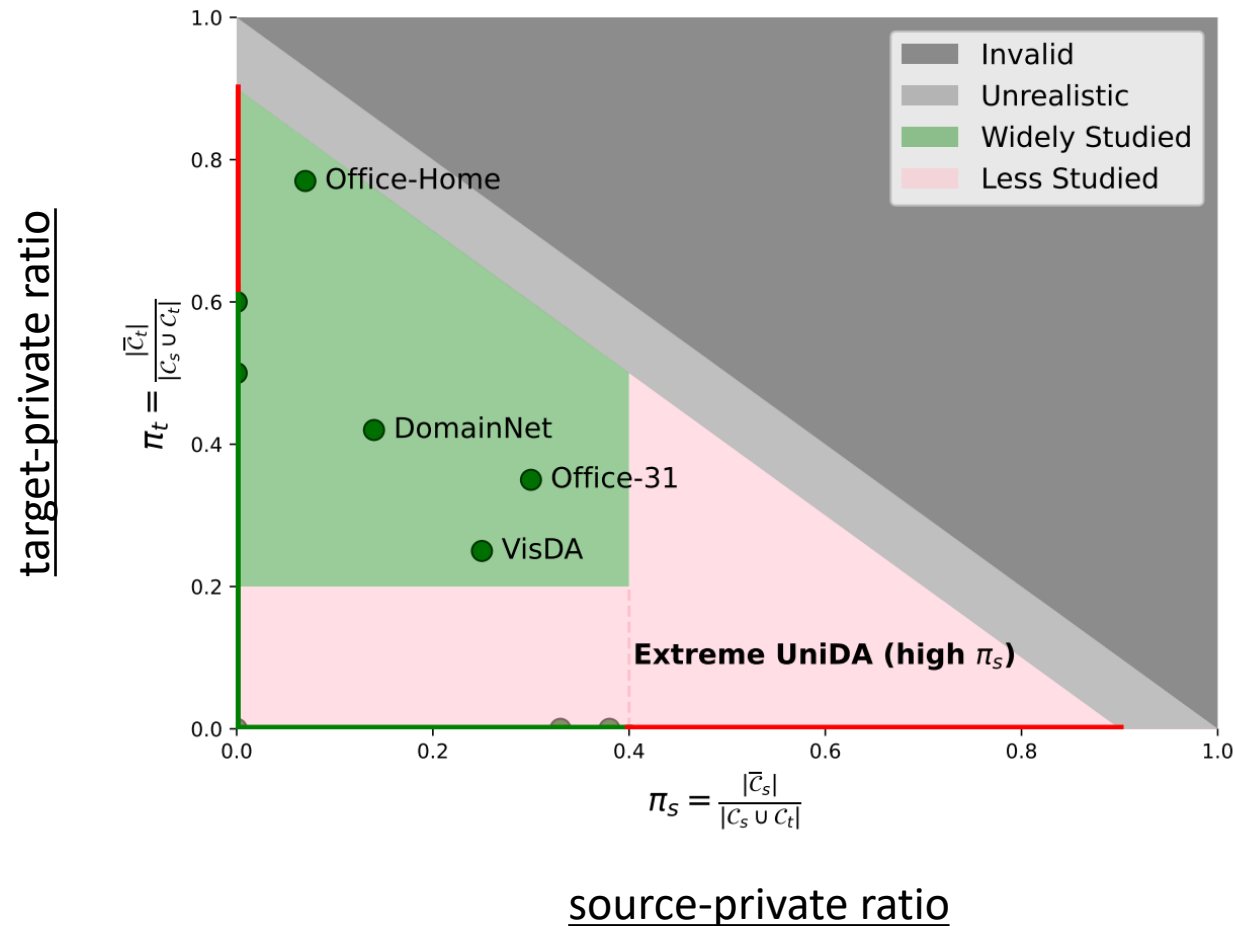


What defines a comprehensive study of UniDA?



Category ratios defined by: (source-private ratio, shared ratio, target-private ratio)

Current UniDA studies are not comprehensive



An example of extreme UniDA

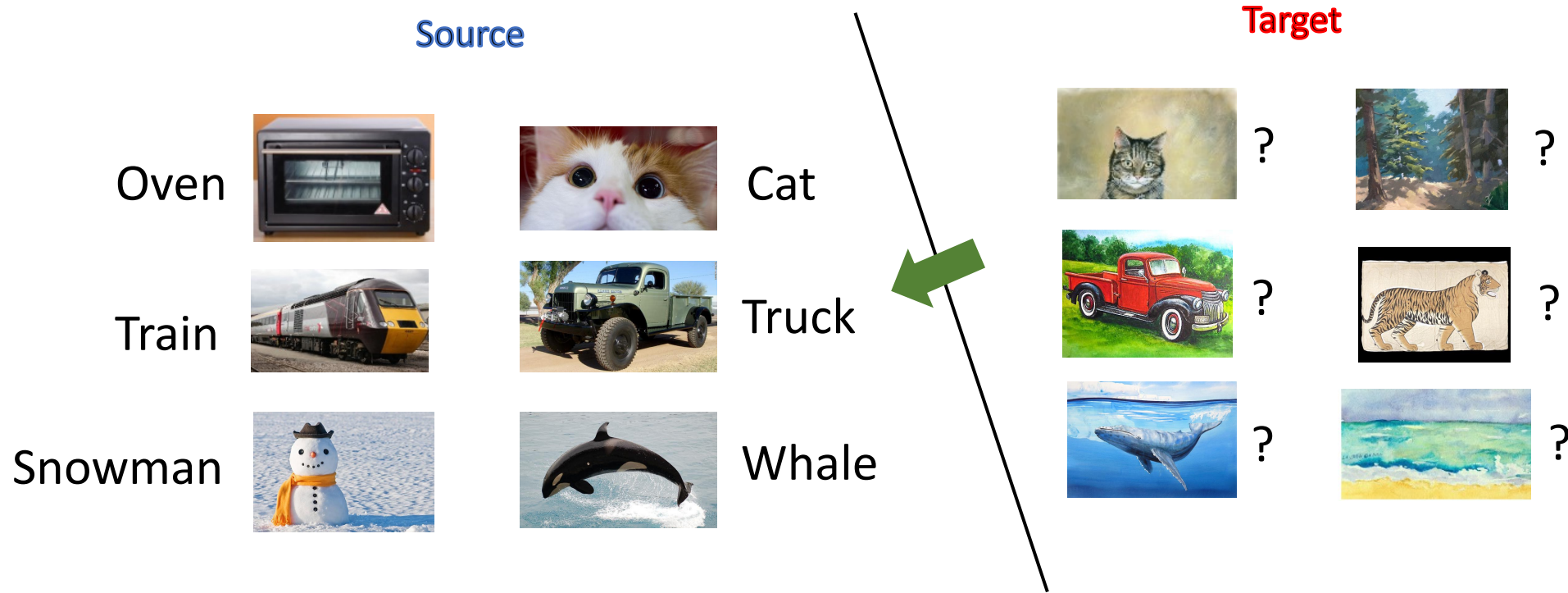


Train on large-scale Internet data



Adapt to downstream dataset

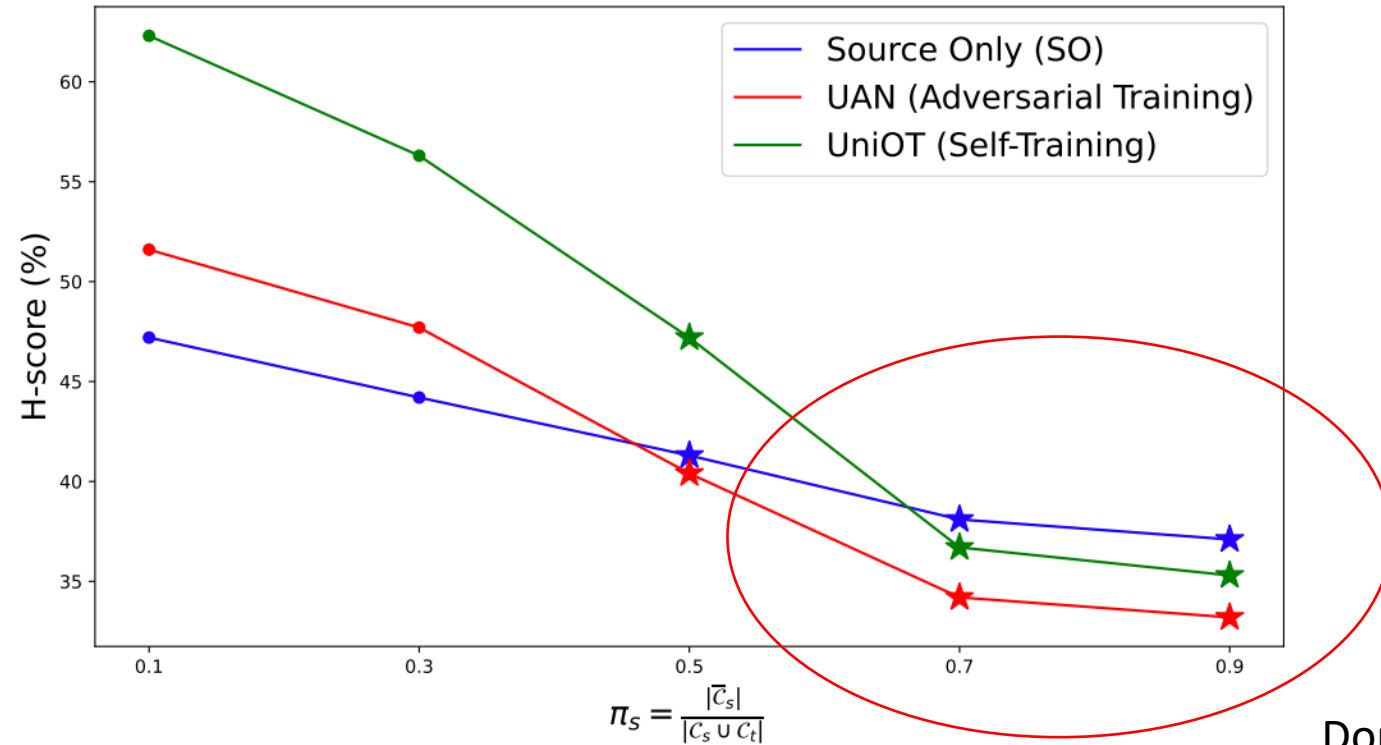
A common solution of UniDA



- Supervised loss on **source** data
- Domain-matching loss on **shared class** data

Identified using uncertainty measurement

Worse than training with source data only

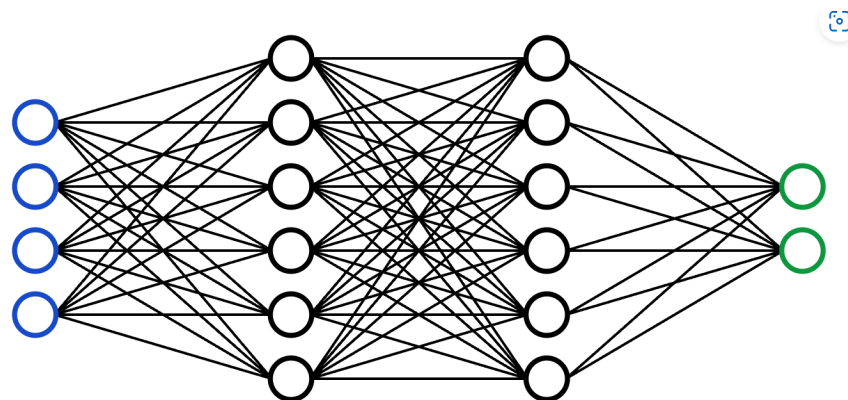
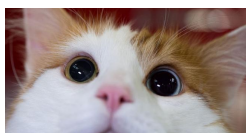


source-private ratio

Domain-matching loss
does not help!

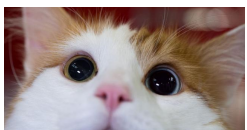
Training process

Source

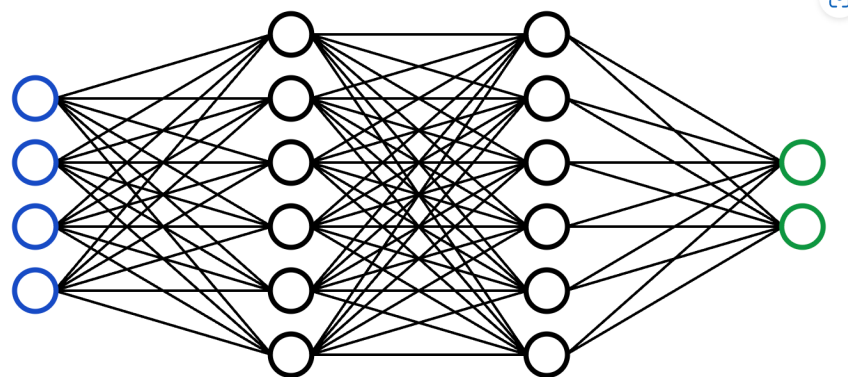


Cat, truck,

Source



Target



$$U(\mathbf{x})$$

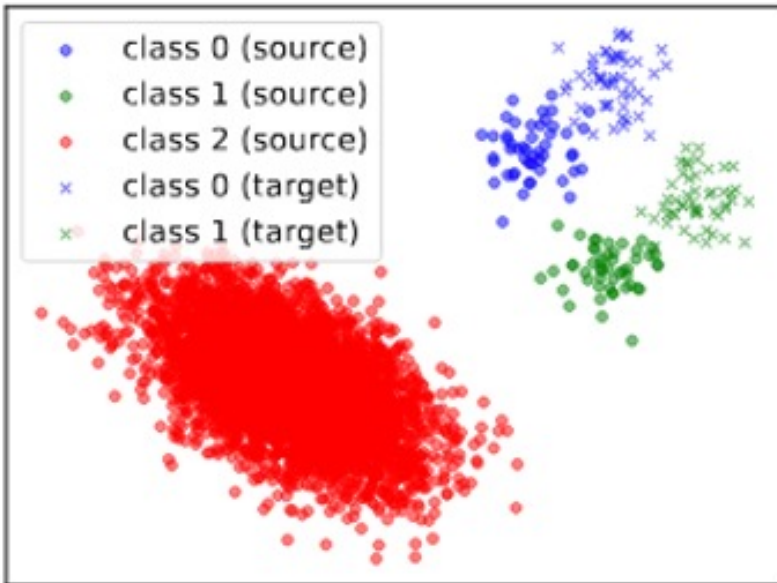
Uncertainty measurement
for domain-matching

Our hypothesis

- Representation quality is crucial
 - Affects the accuracy of uncertainty measurement
 - Affects domain-matching process

Representation quality in extreme UniDA

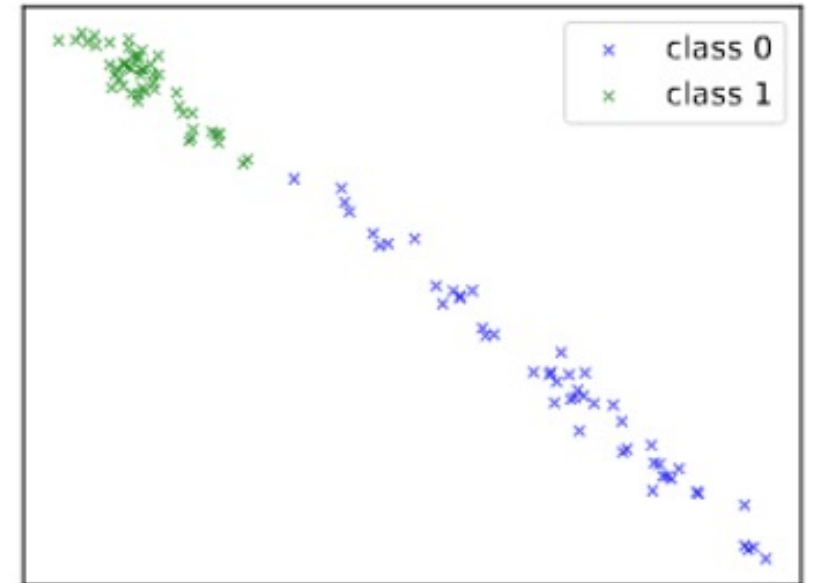
Data



Cross-entropy loss
on **source** data

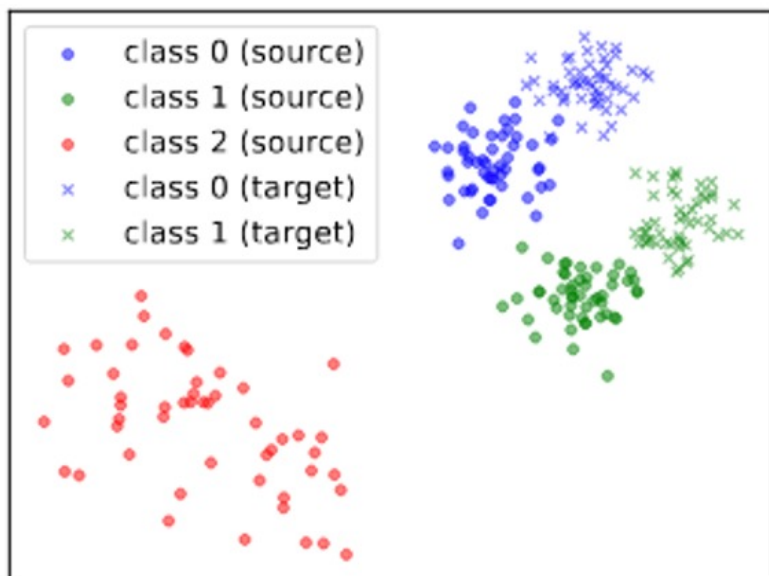


Target representation



Representation quality in non-extreme UniDA

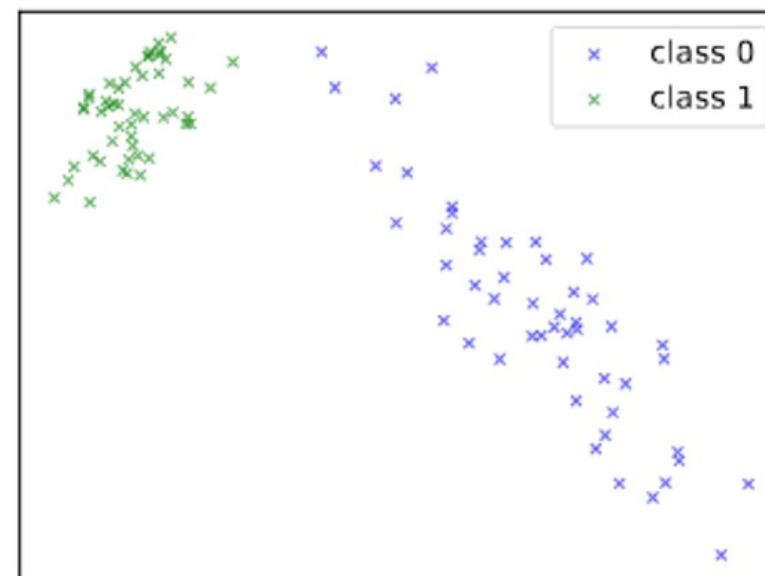
Data



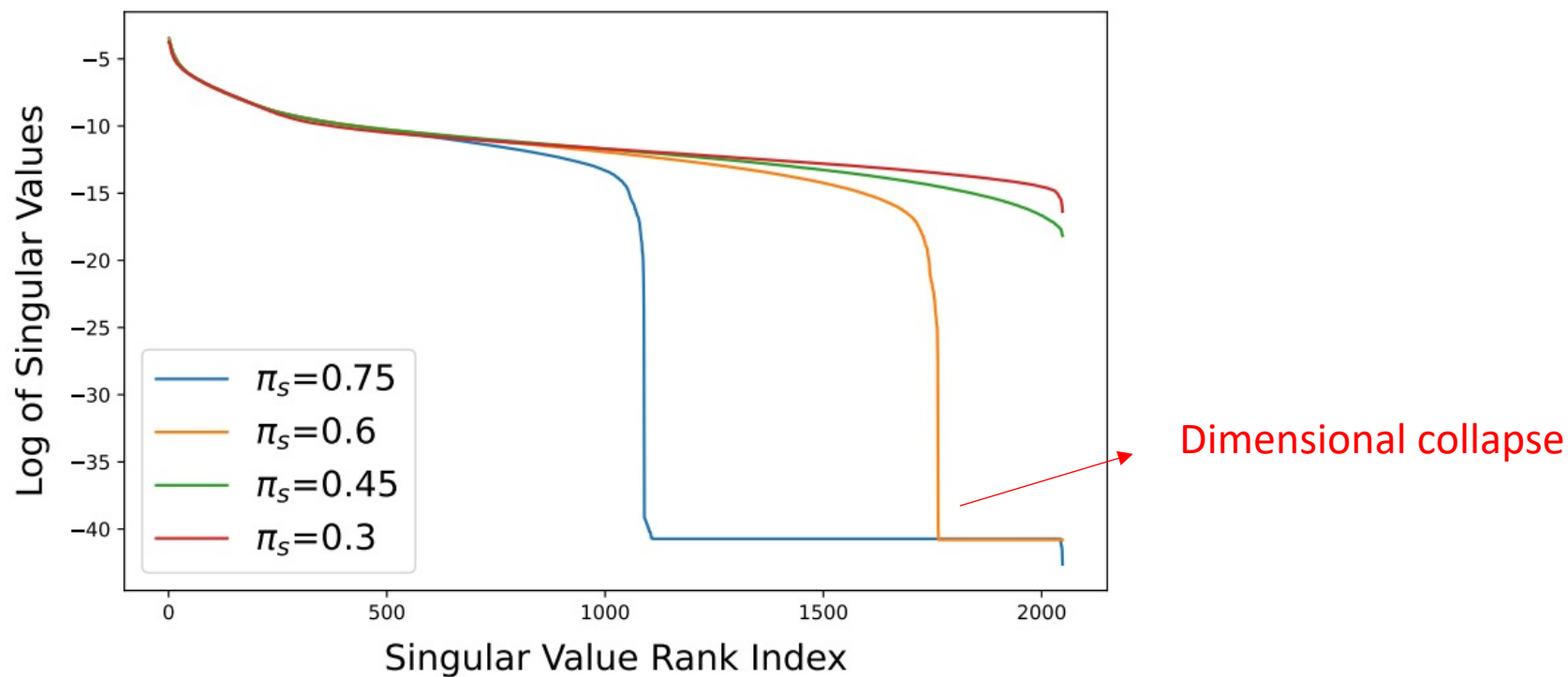
Cross-entropy loss
on **source** data



Target representation

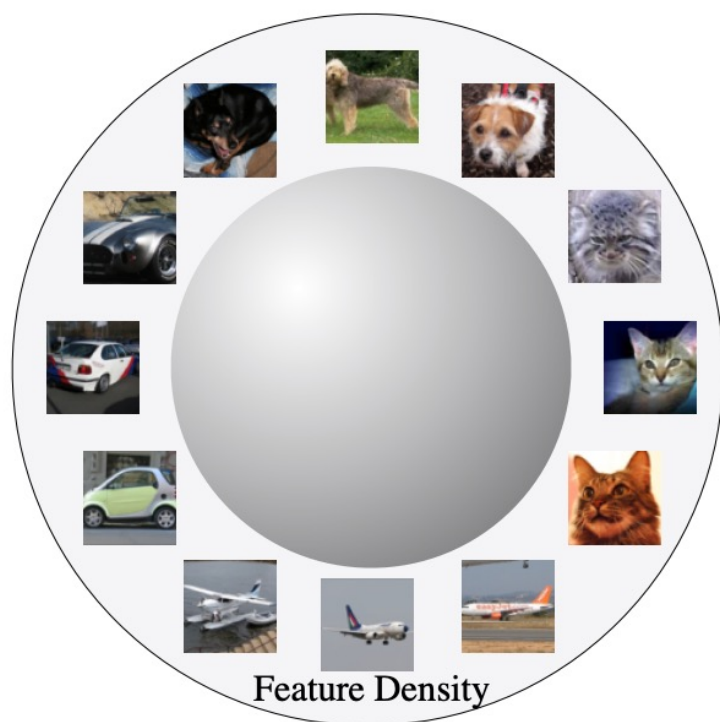


Representation quality (high-dimensional)

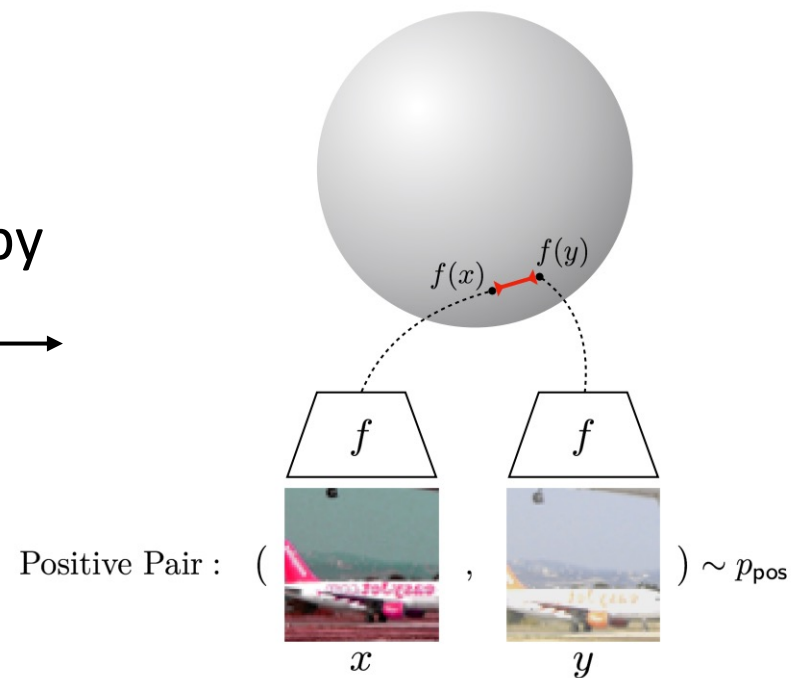


How to address DC in target representation *without labels*?

- *Uniformity* in self-supervised learning literature

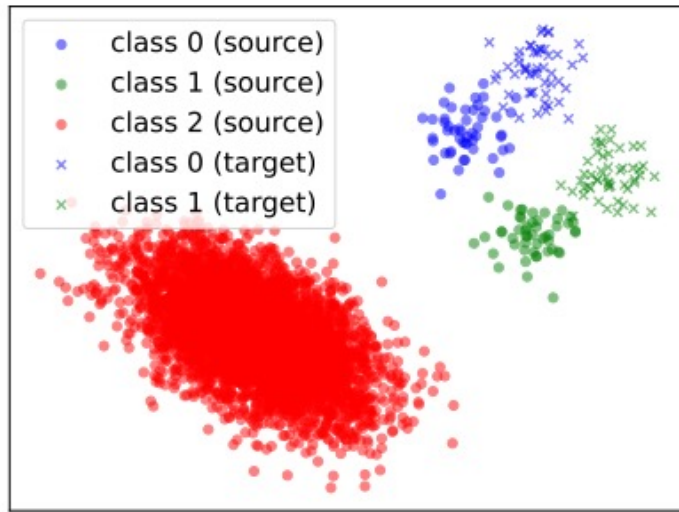


mitigate DC caused by

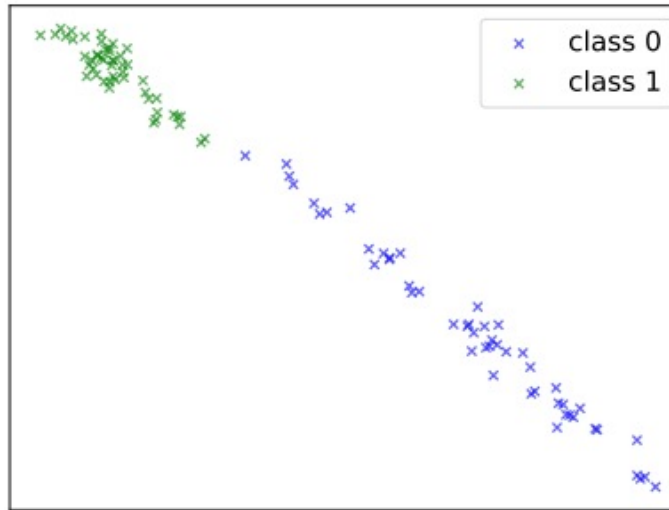


The role of uniformity in UniDA

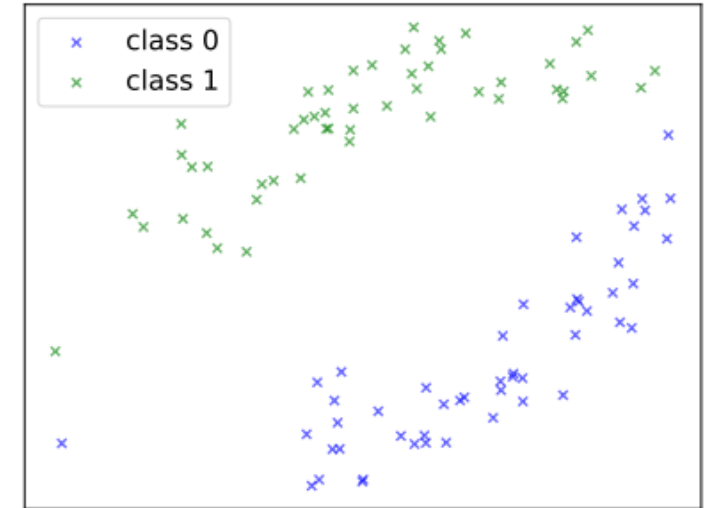
Data



Target representation

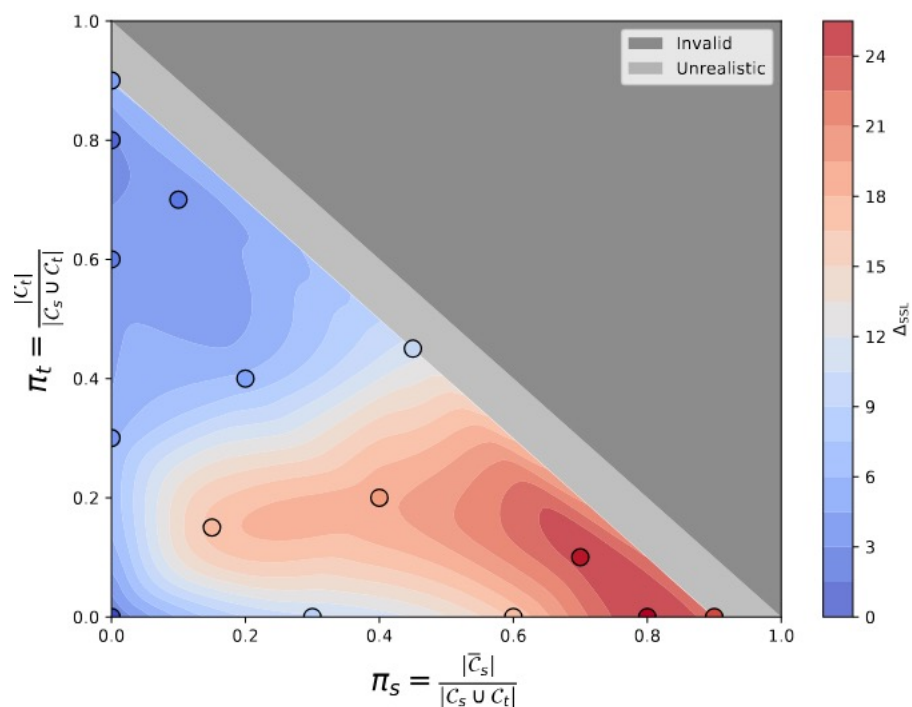


Cross-entropy loss on **source** data

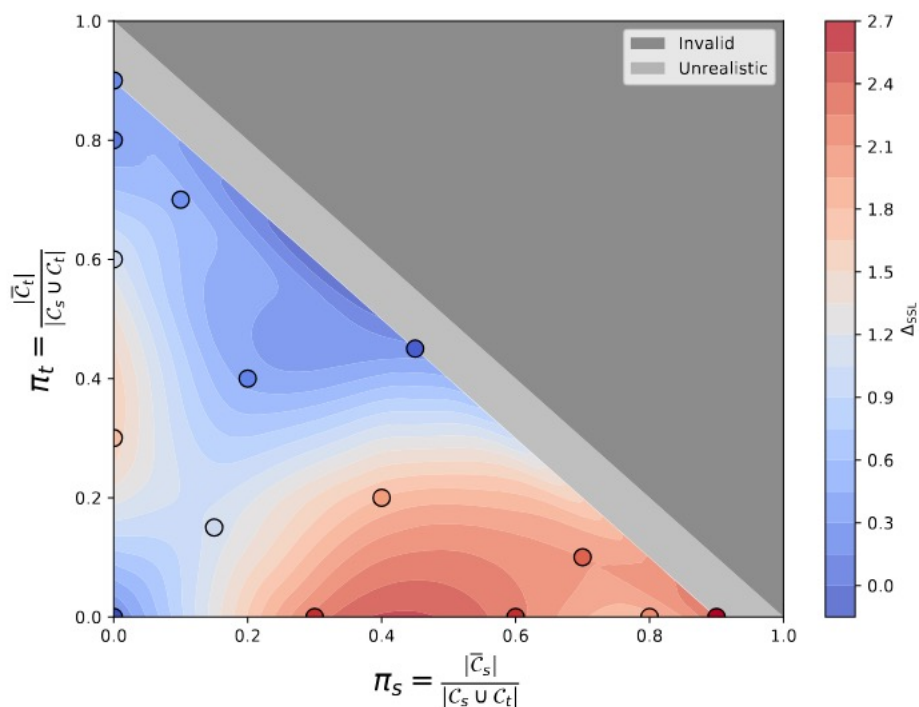


Cross-entropy loss on **source** data
+
Uniformity loss on **unlabeled target** data

SSL improves extreme UniDA by a large margin



(a) Adversarial Training (UAN)



(b) Self-Training (UniOT)

- DC is severe in extreme UniDA
- SSL addresses DC

Takeaways

- Representation quality matters for effective domain-matching
- Representation is affected by category shift
- SSL serves as an easy starting point to address DC in UniDA