

# A Generative Framework for Zero-Shot Learning with Adversarial Domain Adaptation

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# Motivation

- ▶ Human can predict the **novel classes** just by **class description**.
- ▶ For examples: Zebra is a **horse like animal** with **black and white stride**.
- ▶ We can predict the unseen class zebra just by description



(a) A Zebra



(b) A Horse

- ▶ Zero-Shot Learning (ZSL) provides ability to machine to **classify novel class** (with the help of side information)

# Highlights

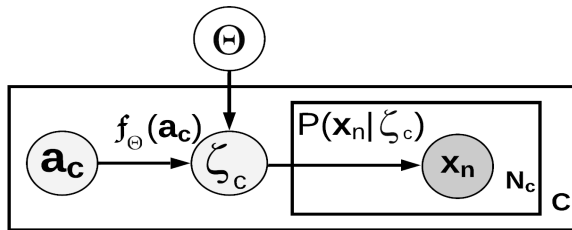
- ▶ Generative ZSL Framework
- ▶ Adversarial Domain Adaptation (ADA) to minimize domain gap between the "actual" and the "generated" distributions
- ▶ End-to-end training in the Generative Framework
- ▶ Domain adaption for the novel class

# Proposed Approach (Generative Framework )

- ▶ We model the data distribution as a mixture of individual class conditional distributions:

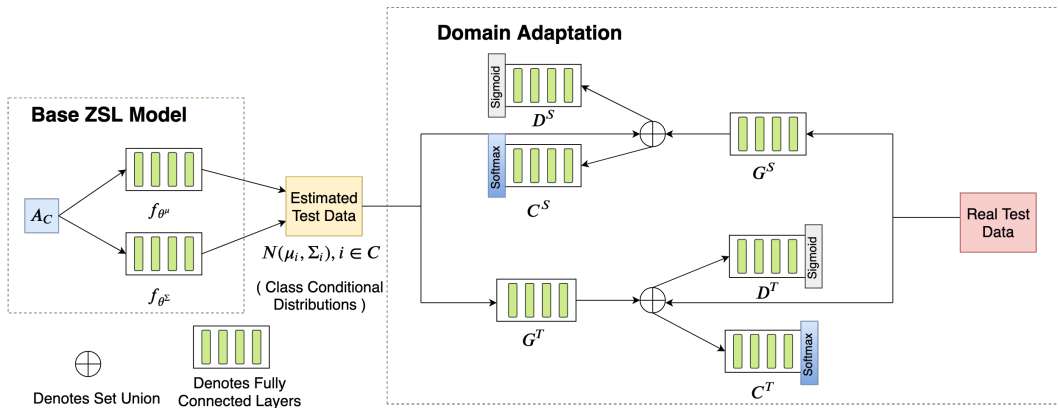
$$\mathbf{x} \sim p(\mathbf{x}|\Theta_c) \quad \forall c \in \mathcal{C}$$

- ▶ The plate notation is given by:



- ▶ Once  $\Theta$  is learnt new samples from a particular class can be generated by conditional sampling from the above distribution

# Proposed Approach (Domain Adaptation)



**Figure 2: Overall Architecture with Adversarial Domain Adaptation**

# Results (ZSL)

	<b>SUN</b>	<b>CUB</b>	<b>AWA2</b>
<b>Method</b>	<b>PS</b>	<b>PS</b>	<b>PS</b>
<b>CONSE</b>	38.8	34.3	44.5
<b>SSE</b>	51.5	43.9	61.1
<b>LATEM</b>	55.3	49.3	55.8
<b>DEVISE</b>	56.5	52.0	59.7
<b>SJE</b>	53.7	53.9	61.9
<b>ESZSL</b>	54.5	53.9	58.6
<b>SYNC</b>	56.3	55.6	46.6
<b>DEM</b>	61.9	51.7	67.1
<b>GFZSL</b>	63.1	49.2	67.0
<b>CVAE-ZSL</b>	61.7	52.1	65.8
<b>W/O ADA (Ours)</b>	<b>63.3</b>	<b>70.9</b>	<b>70.4</b>

**Table 1: Zero Shot Learning Accuracy on the SUN, CUB, and AWA2 dataset.**

# Empirical Gains from ADA

<b>Method</b>	<b>SUN</b>	<b>CUB</b>	<b>AWA2</b>
<b>DSRL</b>	56.8	48.7	72.8
<b>ALE</b>	55.7	54.5	70.7
<b>GFZSL</b>	64.2	50.5	<b>78.6</b>
<b>With ADA (Ours)</b>	<b>65.5</b>	<b>74.2</b>	<b>78.6</b>

**Table 2: Transductive Zero-Shot Learning results on the SUN, CUB, and AWA2 dataset.**

# Conclusion

- ▶ End-to-end generative framework for the ZSL.
- ▶ Handles the domain shift for the novel classes.

(For more details please visit the poster)