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- $G = (\circ, G)$

- X

- X

- $G = G_1 \times ... \times G_n$

-
    - $G_i X_i X_{j \neq i}$
- $\rightarrow$
- GG_i

- $f : X \mapsto Z$

$$\begin{array}{ccc} X & \xrightarrow{G} & X \\ f\downarrow & & f\downarrow \\ Z & \xrightarrow{G} & Z \end{array}$$

- $\rightarrow g \cdot f(x) = f(g \cdot x)$
-
  - $Z = Z_1 \times ... \times Z_n$
  - $Z_i G_i X$
  - $Z_i G_{j \neq i}$

-
- $G = G_{sequence} \times G_{segment}$
- $Z = (z_1, z_2)$
- $z_1 z_2$
- $f : W \mapsto Z z_2 G_{sequence}$

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$$\mathcal{L}(\theta, \phi, X) = \sum_{n=1}^{N} \underbrace{\mathcal{L}(\theta, \phi; x^{(n)} | \mu_2) + log\ p_\theta(\mu_2) + const.}_{} + \underbrace{\alpha \cdot log\ (i | z_2^{(i,n)})}_{}$$

$$\mathcal{L}(\theta, \phi; x^{(n)} | \mu_2) = \mathbb{E}_{q_\phi(z_1^{(n)}, z_2^{(n)} | x^{(n)})} \left[log\ p_\theta(x^{(n)} | z_1^{(n)}, z_2^{(n)}) \right]$$

$$- \mathbb{E}_{q_\phi(z_2^{(n)} | x^{(n)})} \left[D_{KL}(q_\phi(z_1^{(n)} | x^{(n)}, z_2^{(n)}) || \underbrace{p_\theta(z_1^{(n)})}_{}) \right]$$

$$- D_{KL}(q_\phi(z_2^{(n)} | x^{(n)}) || \underbrace{p_\theta(z_2^{(n)} | \mu_2)}_{})$$

$$log\ (i | z_2^{(i,n)}) = log\ p(z_2^{(i,n)} | \mu_2^{(i)}) - log(\sum_{j=1}^{M} p(z_2^{(i,n)} | \mu_2^{(j)}))$$

- μ_2
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  - $\rightarrow$
  - $g(sequence\ id) = \mu_2$
    - $\rightarrow$

$$
\begin{aligned}
\mathcal{L}(\theta, \phi, X) = & \underbrace{log\ p(x|z_1, z_2)} \\
& - \underbrace{D_{KL}(\mathcal{N}(\mu_{z_1}, \sigma_{z_1})||\mathcal{N}(0,1))}_{z_1} \\
& - \underbrace{D_{KL}(\mathcal{N}(\mu_{z_2}, \sigma_{z_2})||\mathcal{N}(\mu_2, 0.5))}_{z_2 \mu_2} \\
& + \underbrace{log\ p(\mu_2) \cdot \frac{1}{seq.\ length}}_{\mu_2}
\end{aligned}
$$

$$log\ p(sequence\ id^{(i)}|z_2^{(i,n)}) = log\ \frac{p(\mu_{z_2}^{(i,n)}|\mu_2^{(i)})}{\sum_{j=1}^{num\ seqs} p(\mu_{z_2}^{(i,n)}|\mu_2^{(j)})}$$

- $z_2^{(i)} \mu_2^{(i)}$
- $\mu_2^{(j \neq i)}$

$$\mathcal{L}^{dis}(\theta, \phi; x) = \mathcal{L}(\theta, \phi, X) + \alpha \cdot log\ p(sequence\ id|z_2)$$

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- α

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  - μ_2
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- $\mu_1 z_1$

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