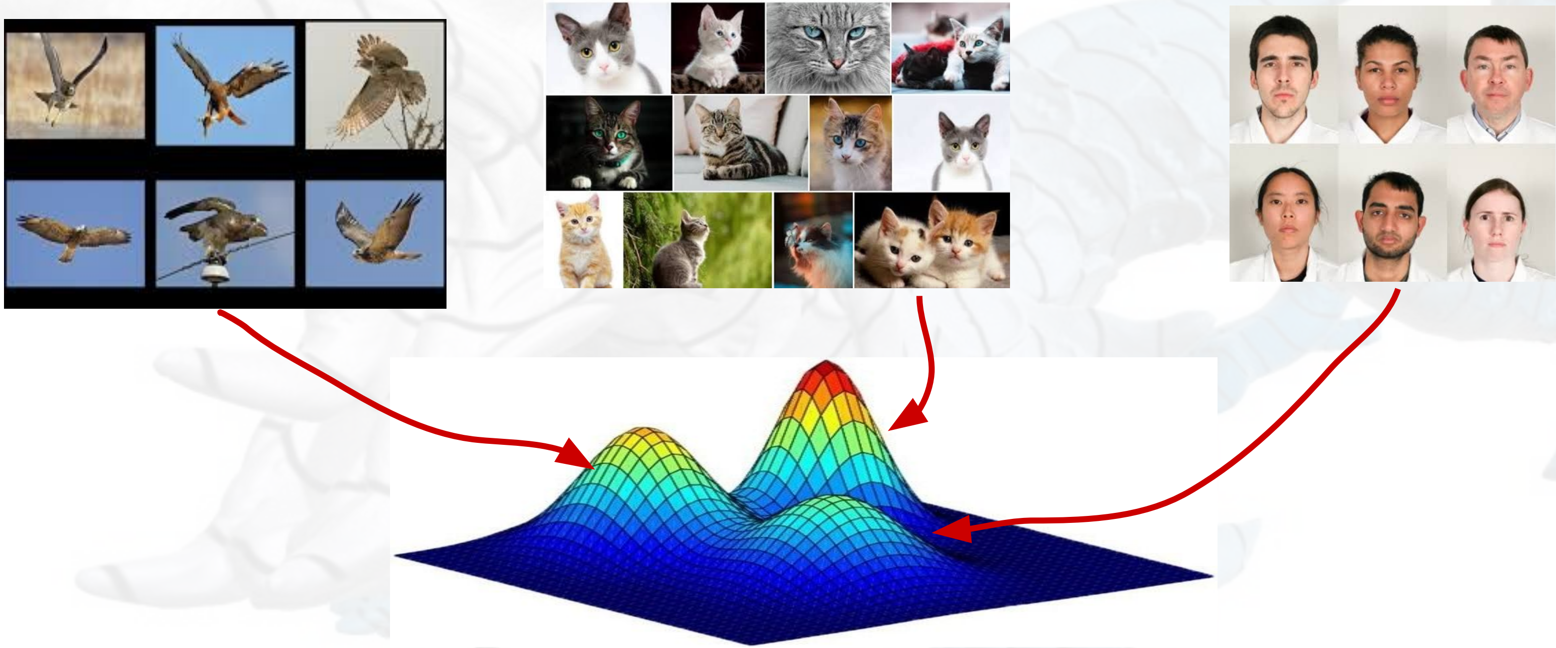
Modelos Generativos
Variational Autoencoders
VAE

RESEARCHGROUP IPRODAM3D

Prof. Cristian López Del Alamo

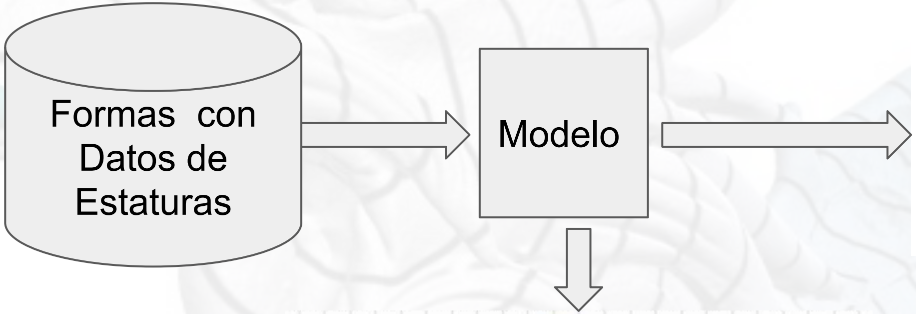
Junio 21, 2022

Generative Modelos

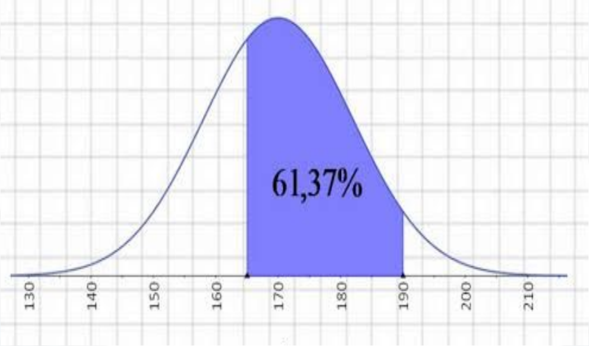


Función de distribución

Generative Modelos



Modelos Generado



Función de distribución

MODELO
DL/ML
Parámetros Θ

$\hat{Y}i$

Salida del modelo

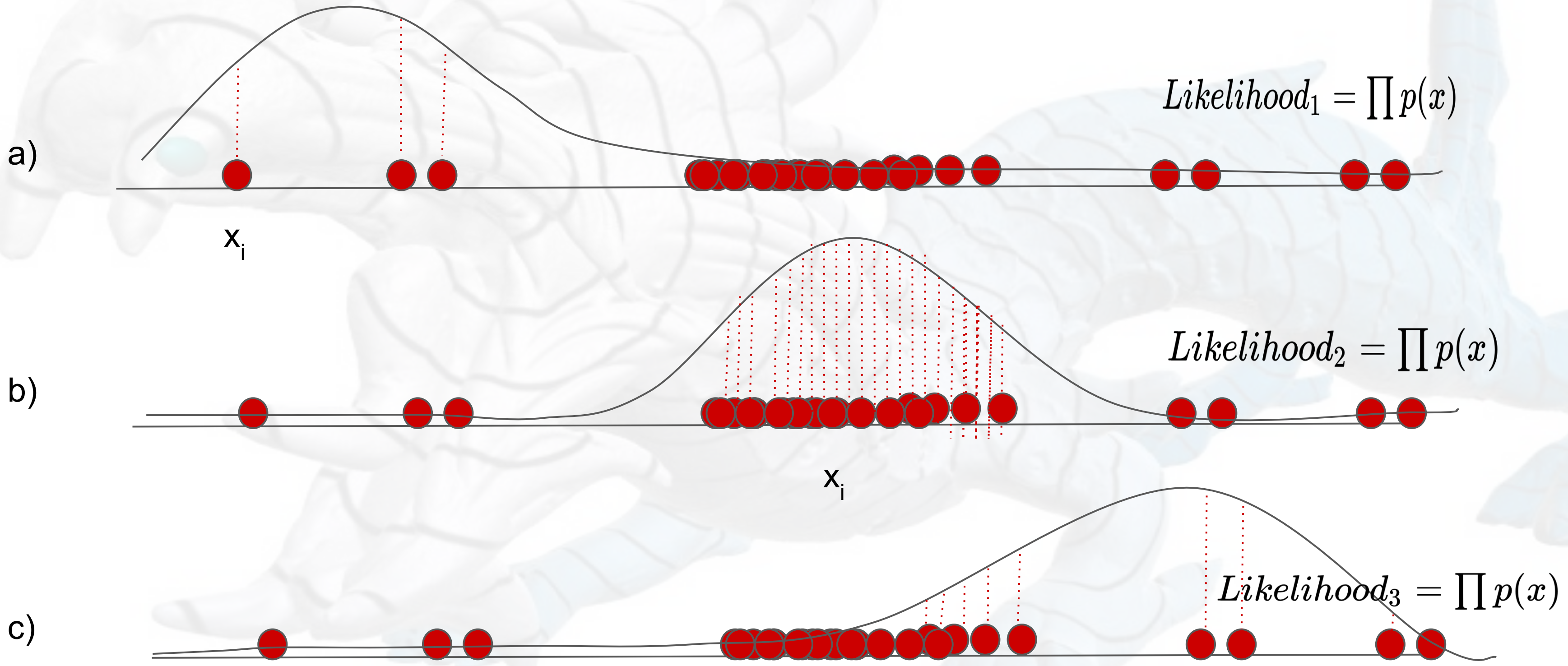
Yi

Salida Esperada

$$h(\Theta) = \underset{\Theta}{\operatorname{argmin}} \left(\| \tilde{y} - y \|_2 \right)$$

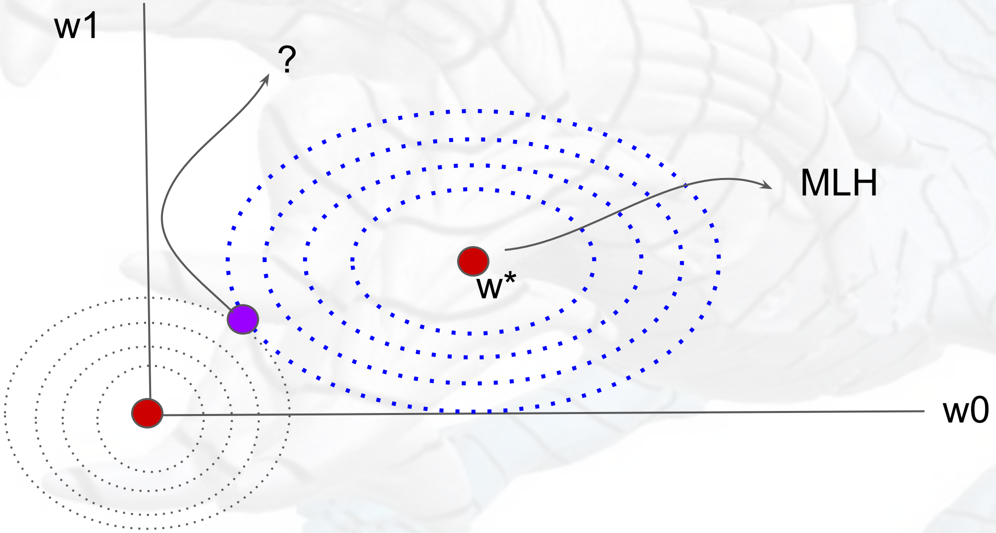
$$h(\Theta) = (½)*\Sigma(\tilde{y}i - yi)^2$$

Concepto: Máxima Verosimilitud : $\max \prod p(x)$



maximum log Likelihood

$$max - log - likelihood => arg\theta mix\frac{1}{2}||y_i - f(x,\theta)||_2$$



maximum a posteriori

likelihood

priori

$$p(\theta|x, y) = \frac{p(y|\theta,x) * p(\theta)}{p(x)}$$

posteriori

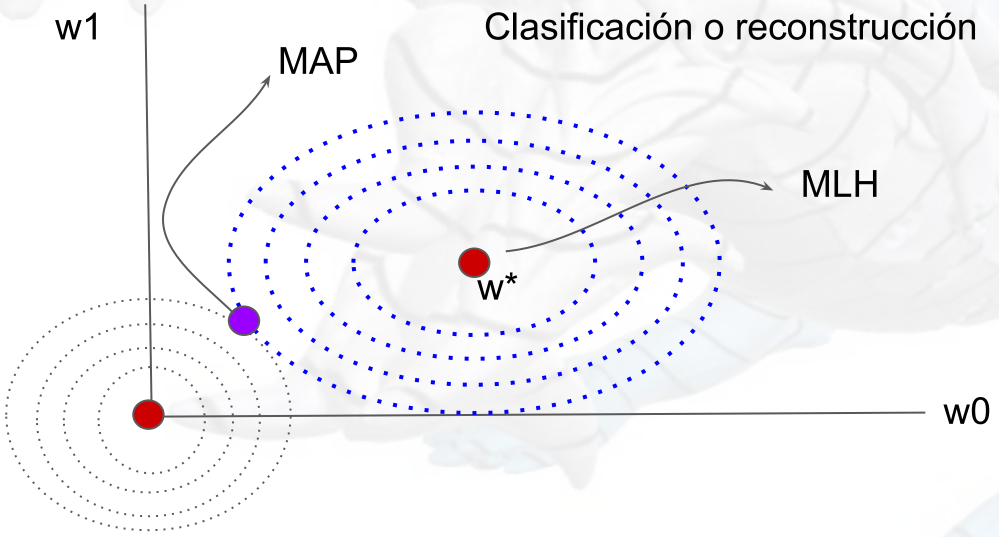
evidence

maximum a posteriori

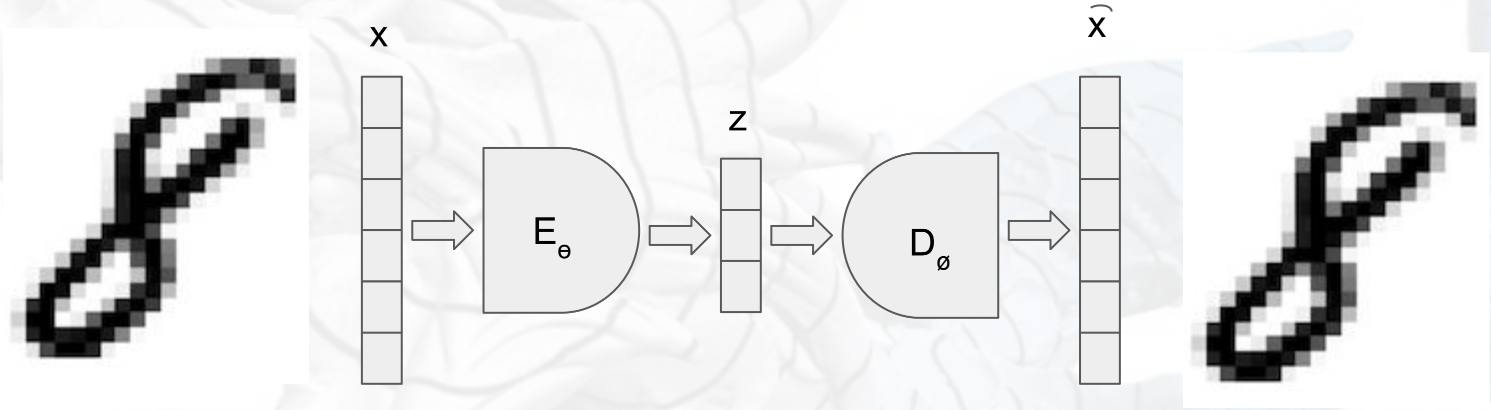
$$max - posteriori => arg\theta mix \quad \frac{1}{2}||y_i - f(x,\theta)||_2 + \frac{\lambda}{2}||\theta||_2$$

Clasificación o reconstrucción

Regularización



Autoencoders



$$Sea \quad x \quad \in \mathcal{R}^n, E(.) : \mathcal{R}^n \rightarrow \mathcal{R}^d \quad y \quad D(.) : \mathcal{R}^d \rightarrow \mathcal{R}^n$$

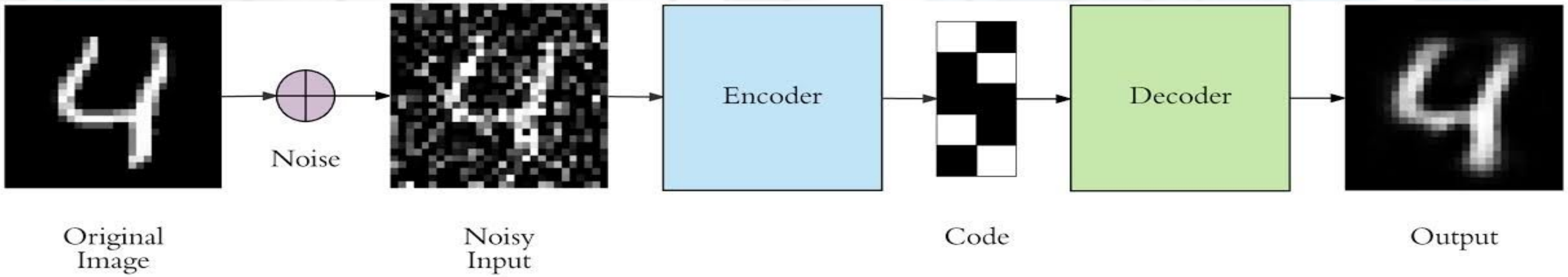
$$\hat{x} = D(E(x)) \quad tal \quad que, \quad argmin_\theta \quad ||x - \hat{x}||^2$$

Recuerde

$$\boxed{max - log - likelihood => arg\theta mix \frac{1}{2}||y_i - f(x, \theta)||_2}$$

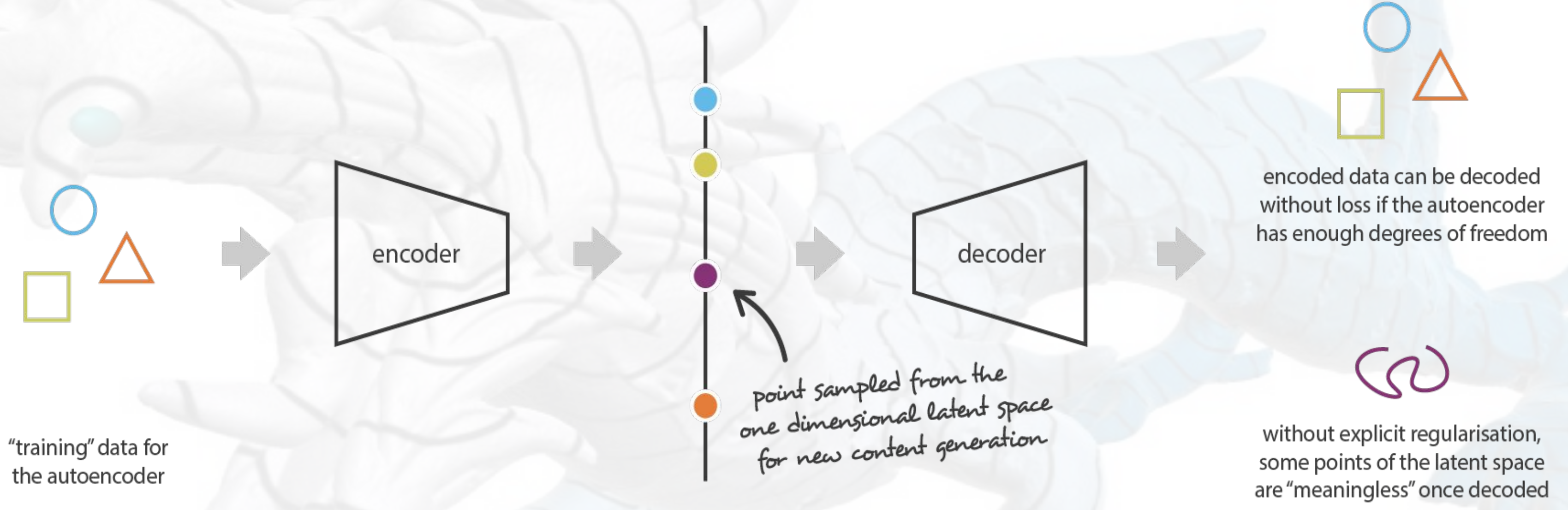
Autoencoders

Denoising autoencoder $argmin_\theta \quad ||(x-\hat{x})||^2, \quad \hat{x}=D(z), z=E(x+\mathcal{N}(0,1))$



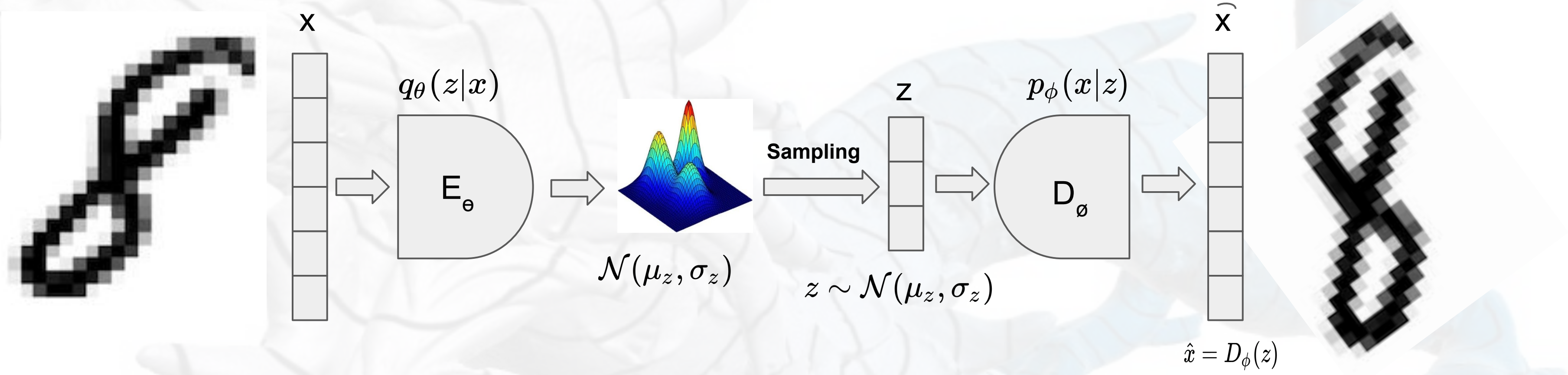
Sparse autoencoder $argmin_\theta \quad ||(x-\hat{x})||^2 + \frac{\lambda}{2}\sum|z_i|, \quad \hat{x}=D(z), z=E(x)$

Autoencoder



Fuente: https://towardsdatascience.com/understanding-variational-autoencoders-vaes-f70510919f73

Variational autoencoders

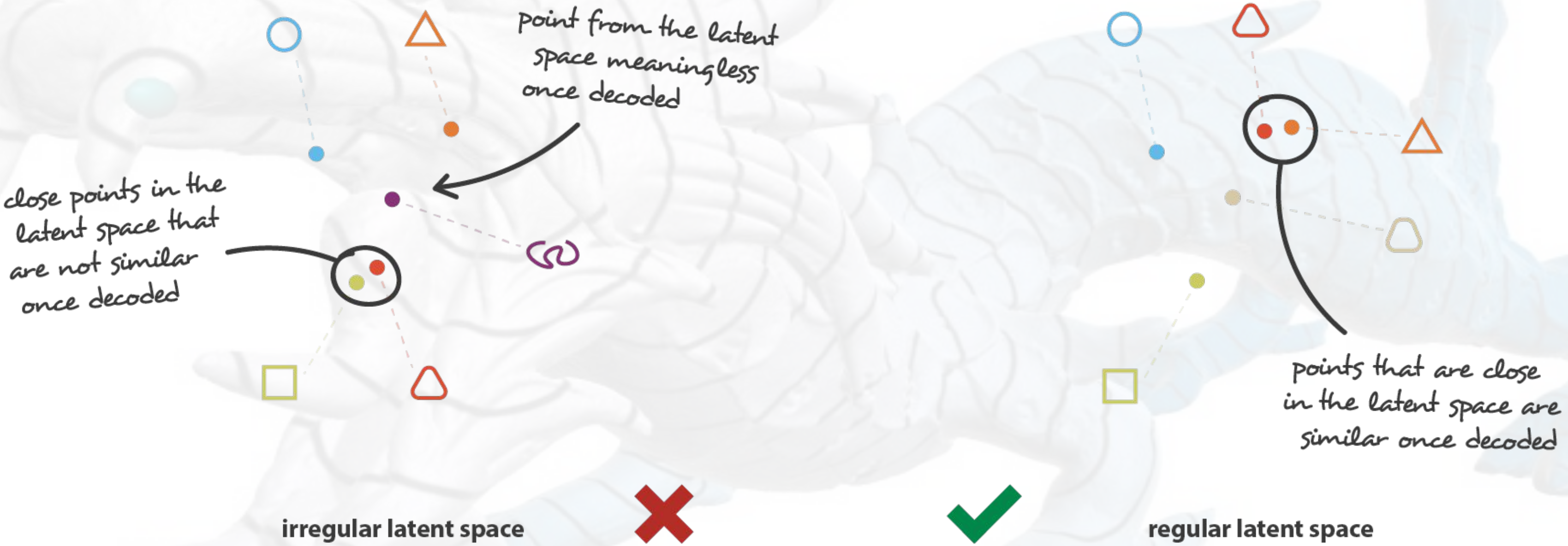


$$\mathcal{L}(\theta, \phi) = ||x - \hat{x}|| + KL(\mathcal{N}(\mu_x, \sigma_x), \mathcal{N}(0, 1))$$

Calidad de reconstrucción

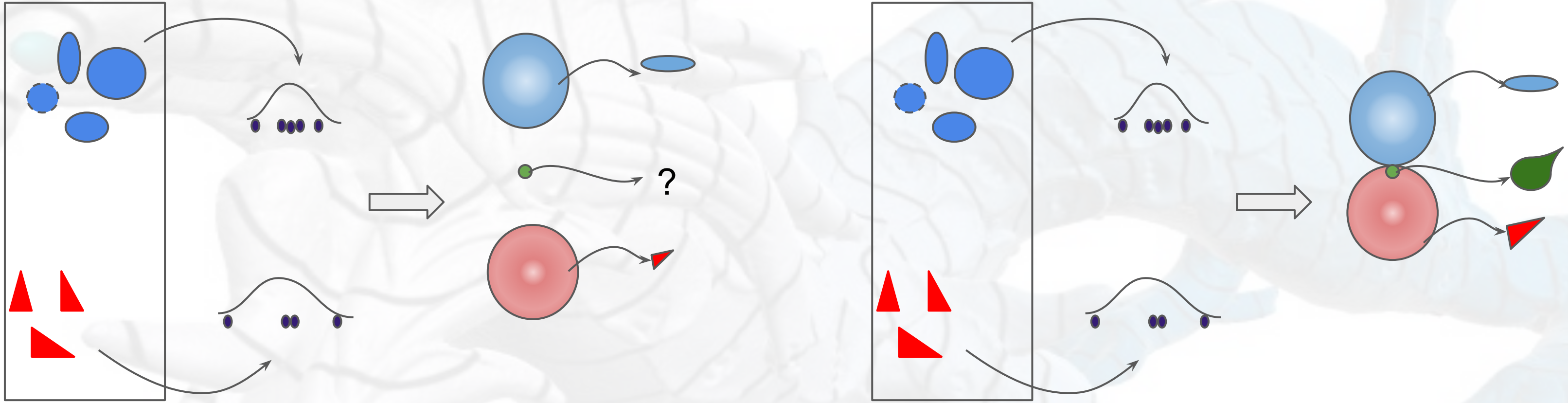
Asegura continuidad, completitud

Variational autoencoders

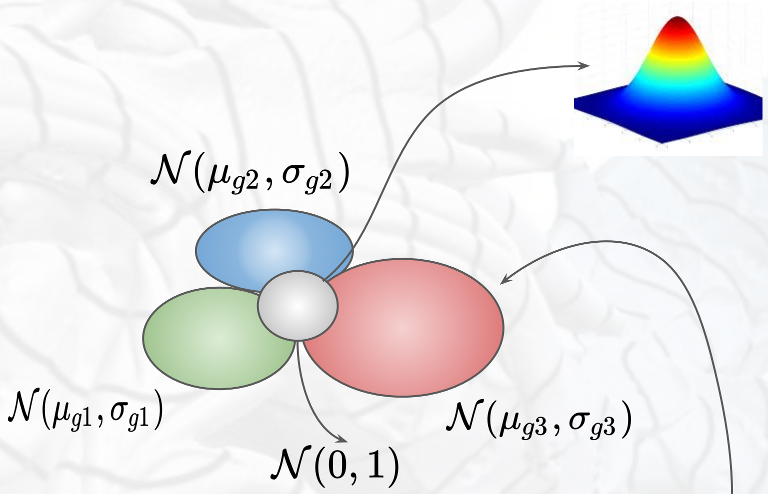


Fuente: https://towardsdatascience.com/understanding-variational-autoencoders-vaes-f70510919f73

Variational autoencoders

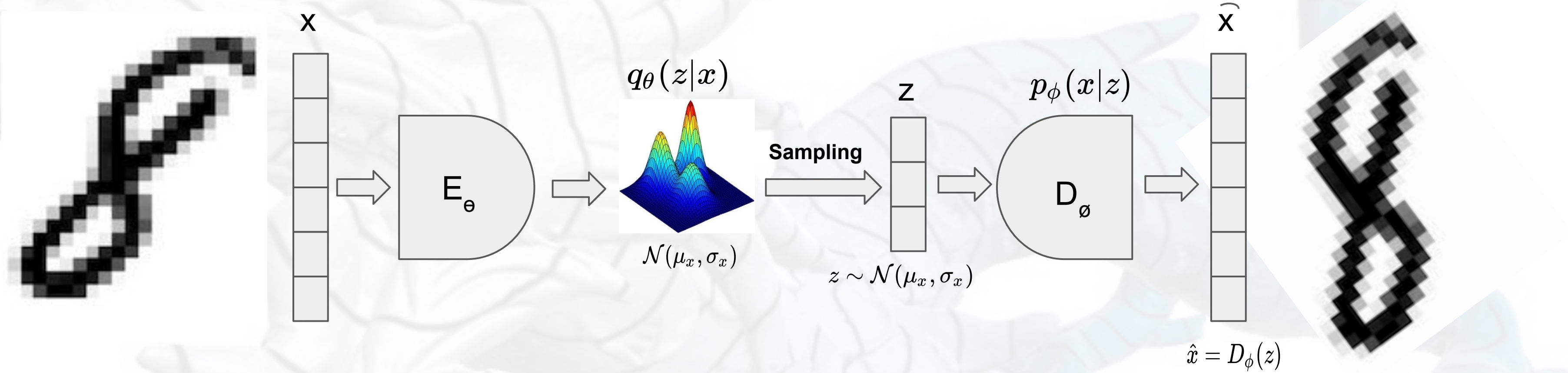


Variational autoencoders



$$\mathcal{L}(\theta, \phi) = ||x - \hat{x}|| + KL(\mathcal{N}(\mu_x, \sigma_x), \mathcal{N}(0, 1))$$

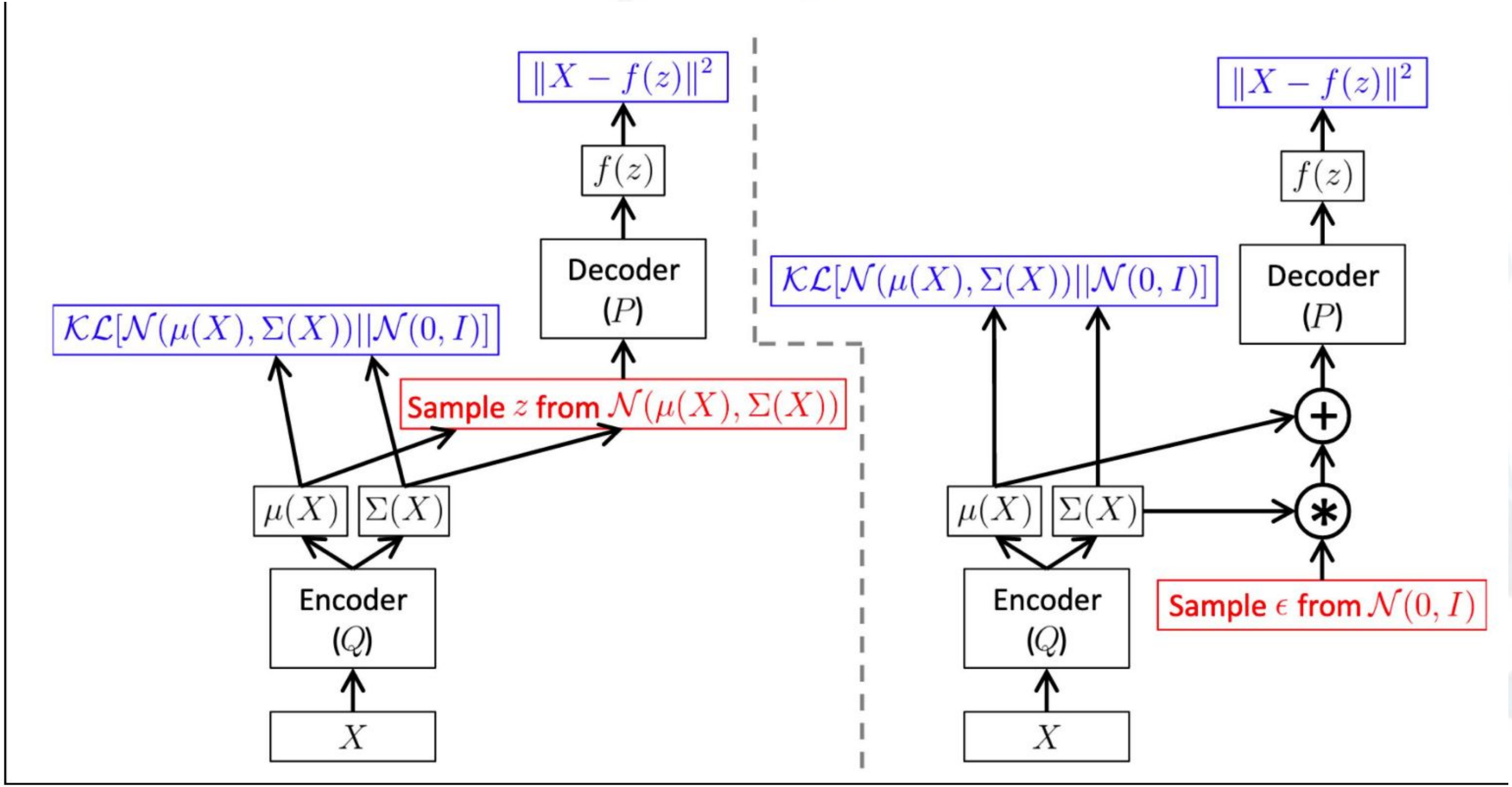
Autoencoder



$z = \mu + \sigma$ No es continuo, no es posible aplicar la gradiente descendiente

$z = \mu_x + \sigma_x * \mathcal{N}(0,1)$ Continuo, es posible aplicar la gradiente descendiente

$$\mathcal{L}(\theta, \phi) = ||x - \hat{x}|| + KL(\mathcal{N}(\mu_x, \sigma_x), \mathcal{N}(0,1))$$

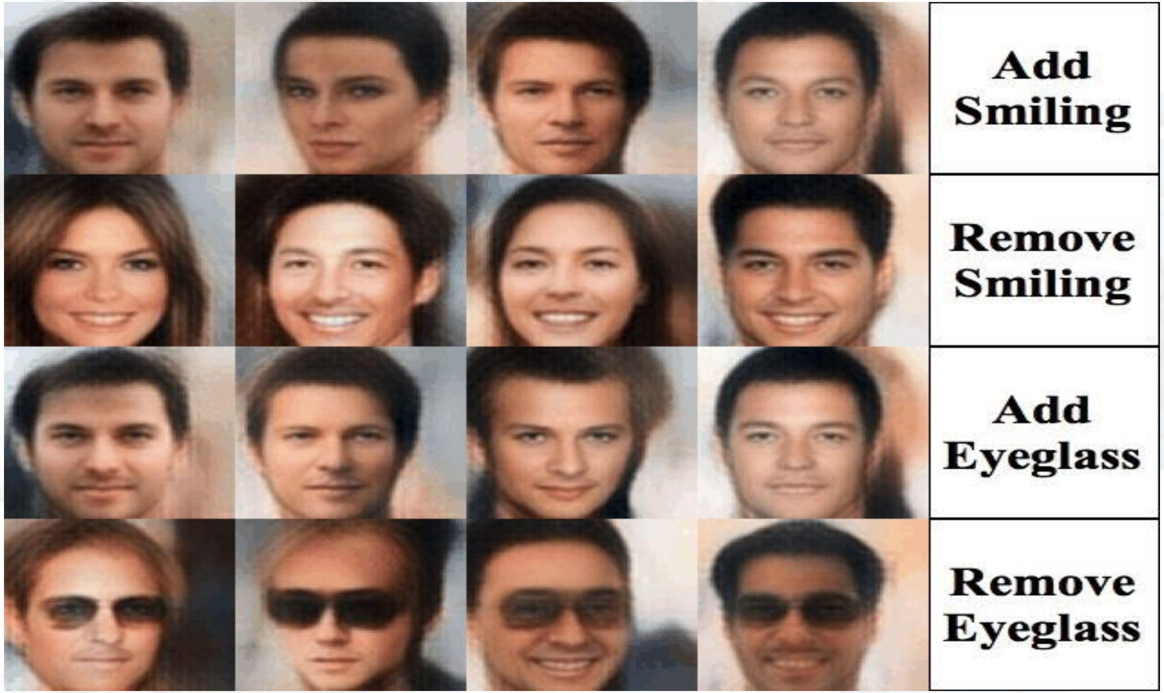


Trained by minimizing negative ELBO:

$$l_i(\theta, \phi) = -E_{z \sim q_\phi(z|x_i)}\left[\log p_\theta(x_i \mid z)\right] + KL\left(q_\phi(z \mid x_i) \,||\, p(z)\right)$$

Fuente: Sargur N. Srihari

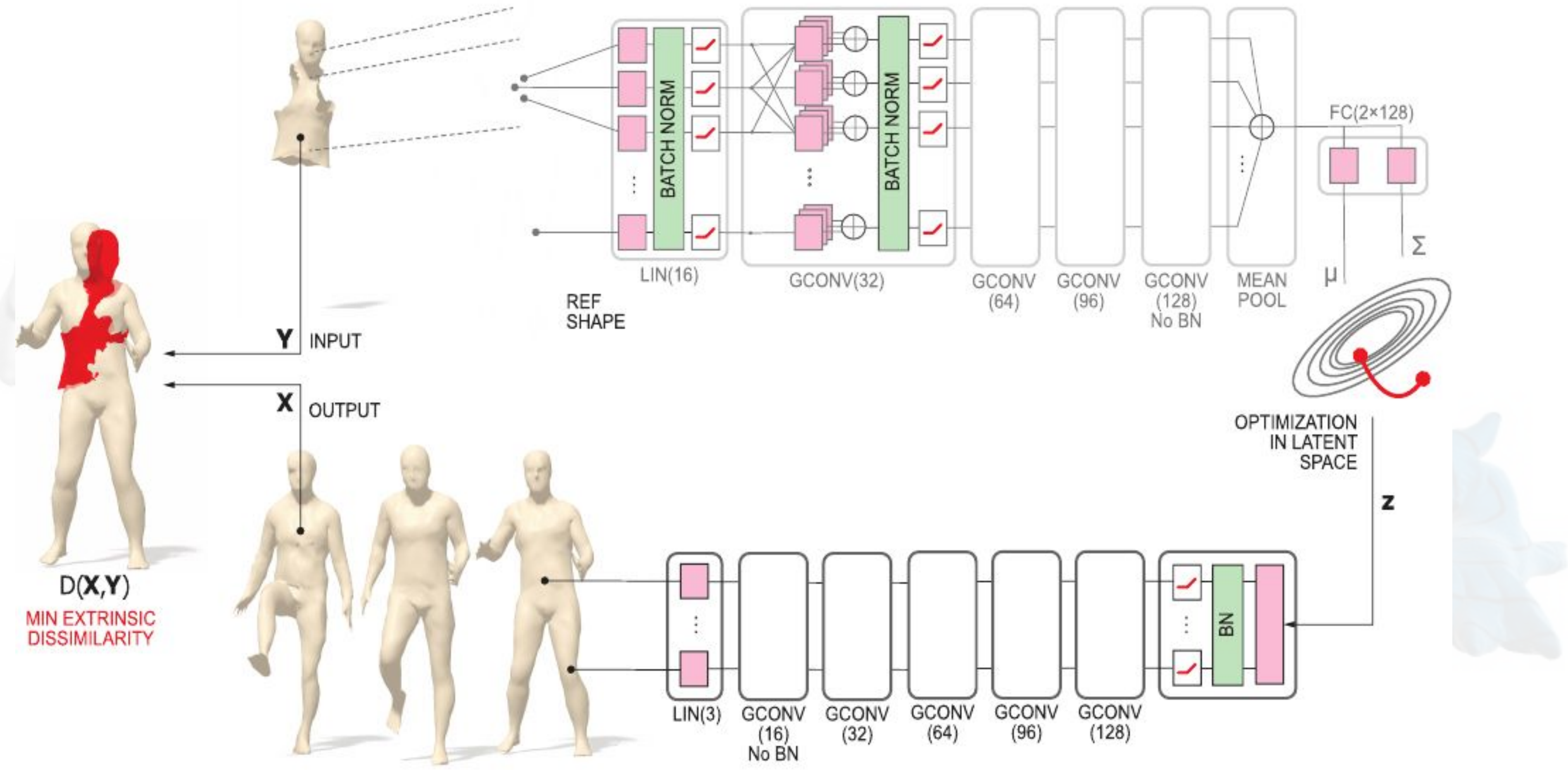
Aplicaciones



Fuente: https://medium.com/analytics-vidhya/an-introduction-to-generative-deep-learning-792e93d1c6d4

Aplicaciones

Fuente: https://medium.com/analytics-vidhya/an-introduction-to-generative-deep-learning-792e93d1c6d4



Fuente: [Litany el all, 2018] https://arxiv.org/abs/1712.00268

¿Preguntas?

Modelos Generativos
Autoencoders

RESEARCHGROUP
IPRODAM3D

Dr. Cristian López Del Alamo

Enero 8, 2020