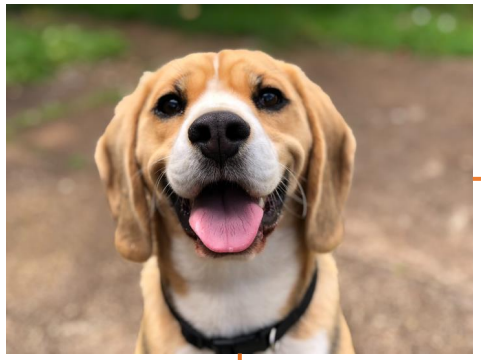
Variational Autoencoders

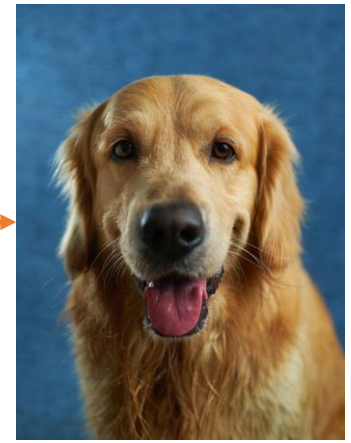
Generative Model



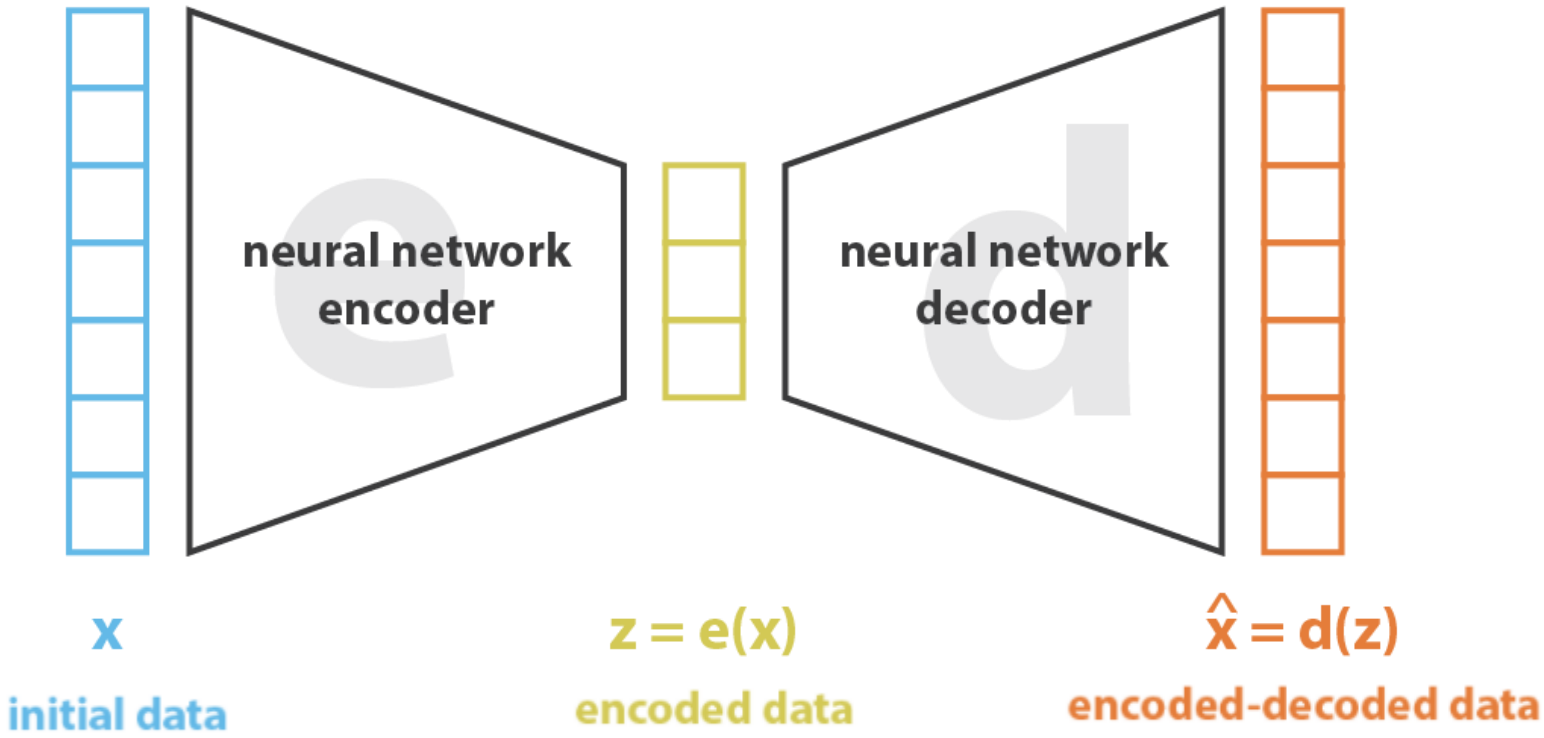
Neural Network

Alt text:
A dog opening the mouth

Generative Model

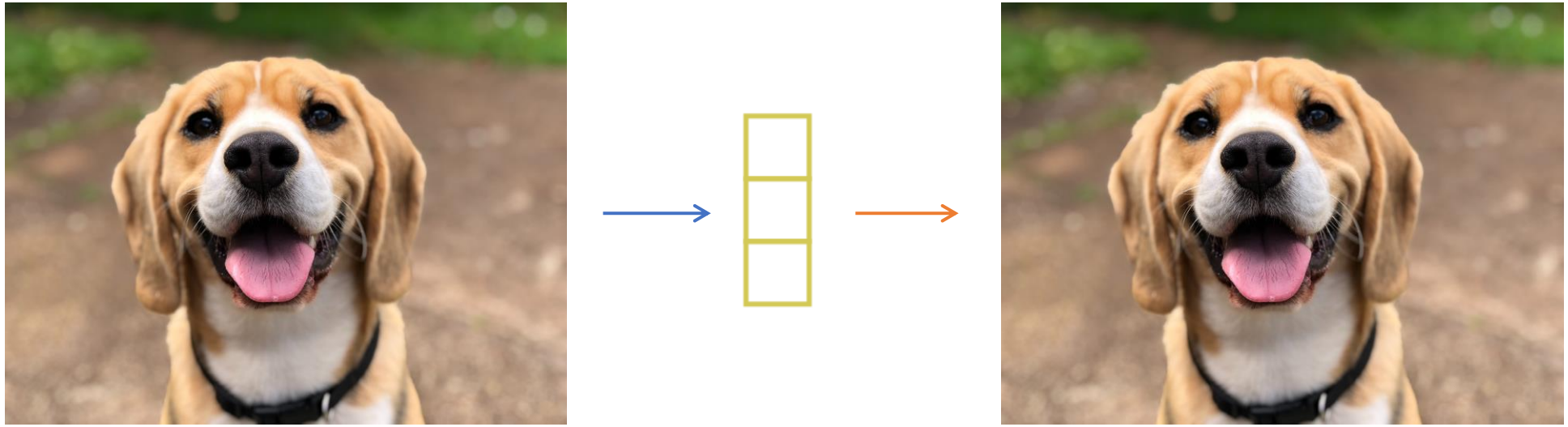


Autoencoder



Source: Understanding Variational Autoencoders (VAEs)

Autoencoder

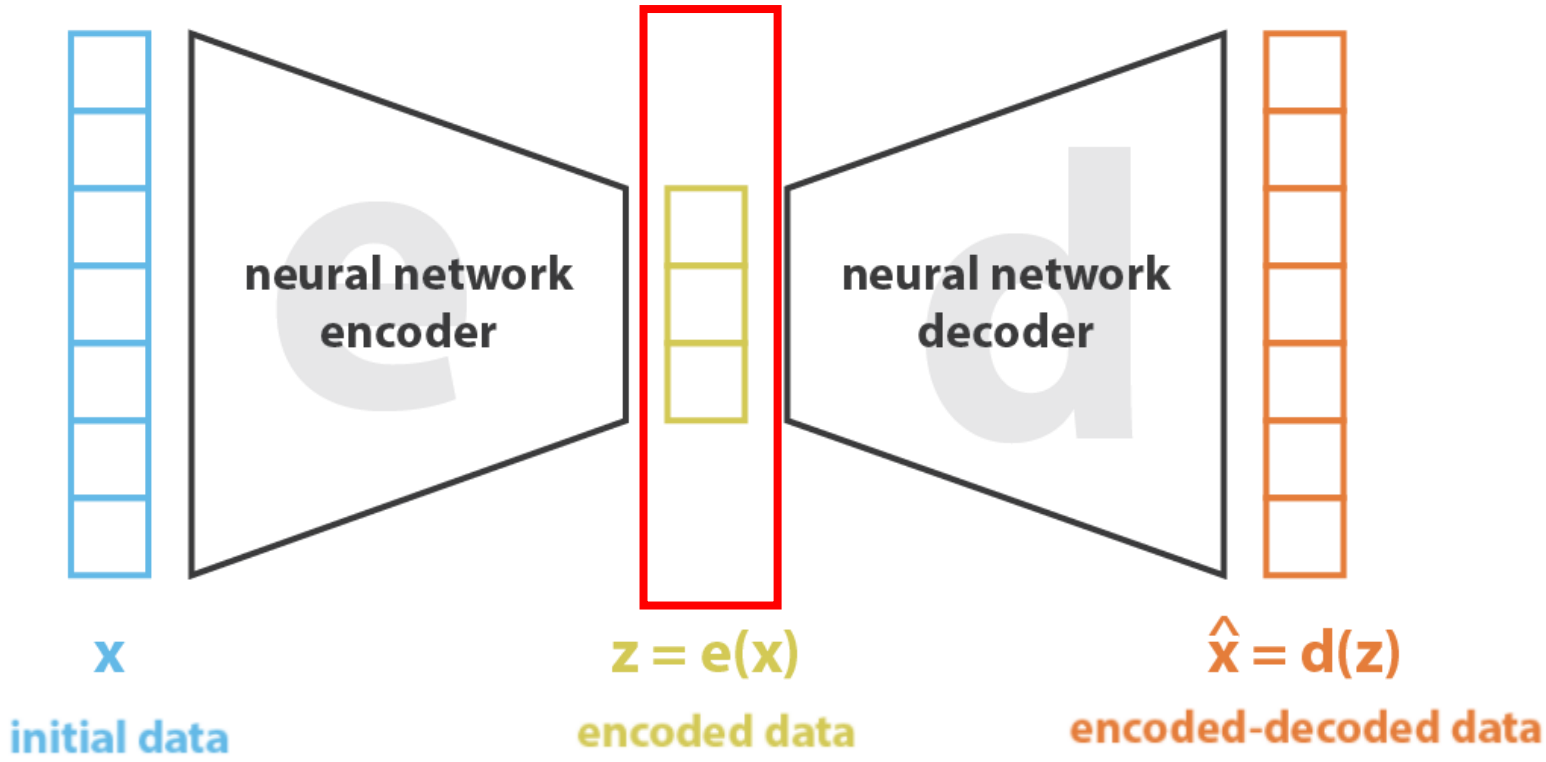


initial data

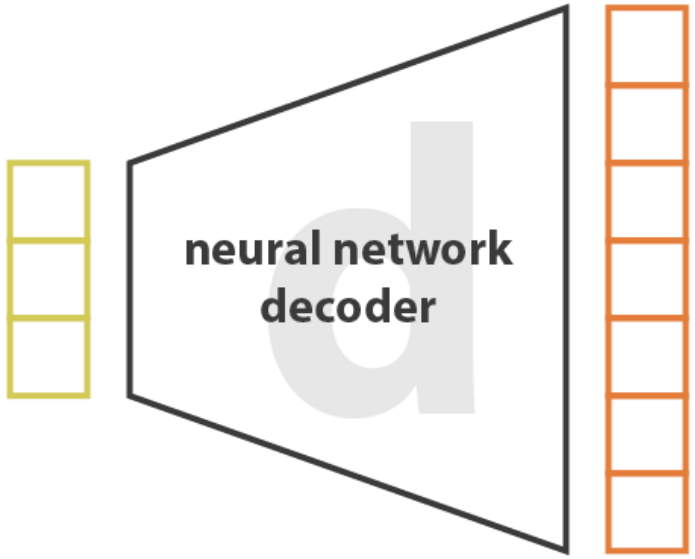
encoded data

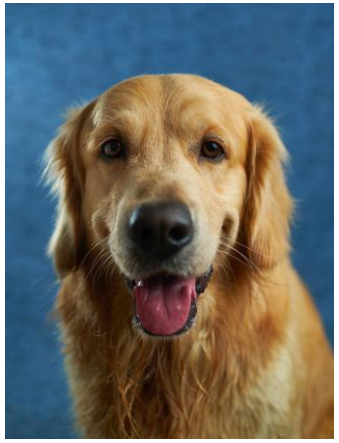
encoded-decoded data

Autoencoder



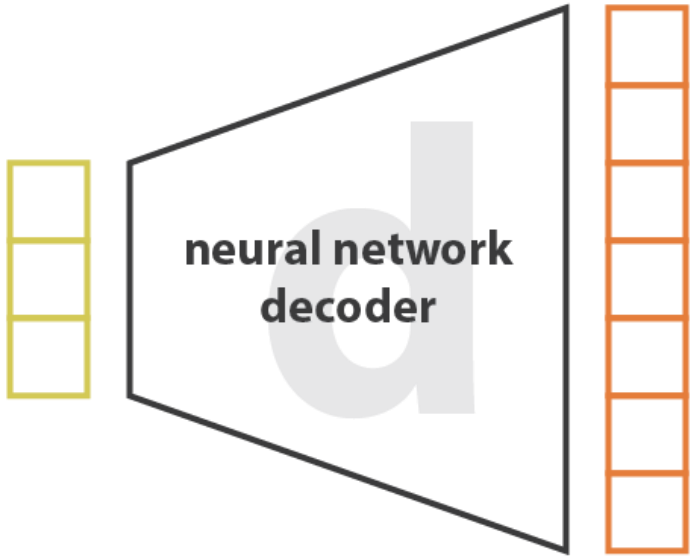
Autoencoder





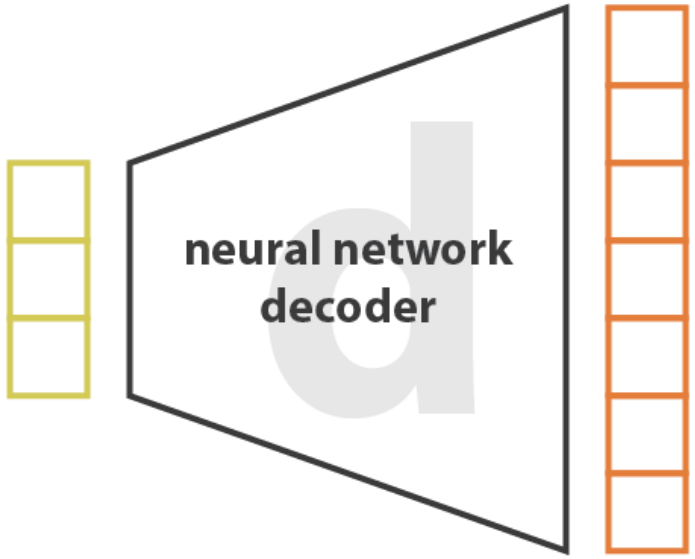
Autoencoder

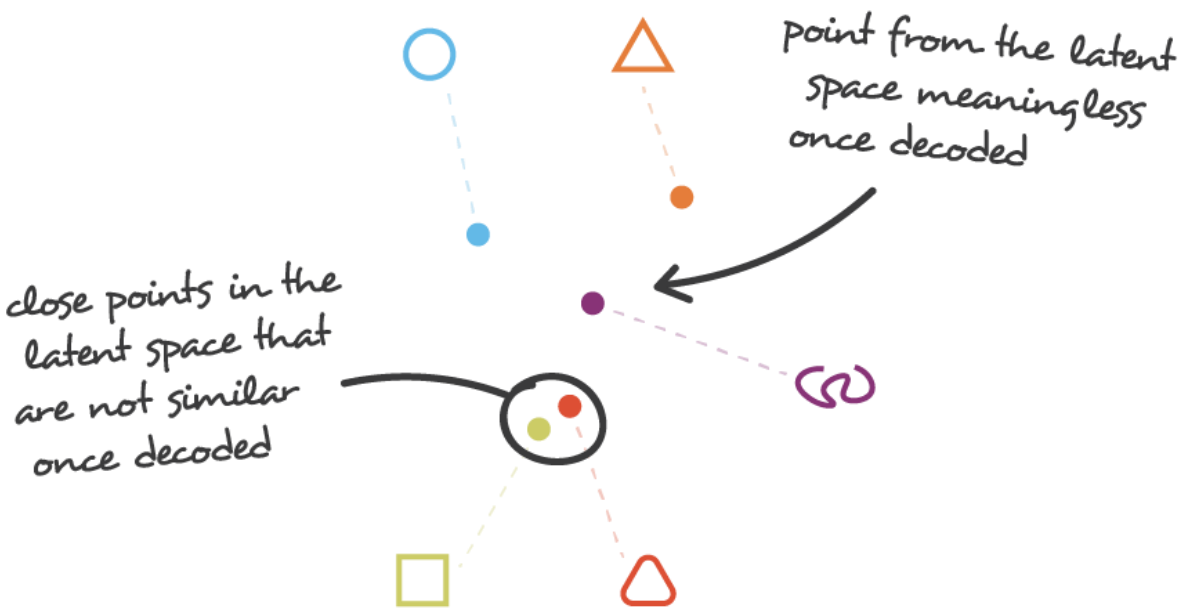
3.74
-28.43
-394
0.83
-5.52
9.45
192



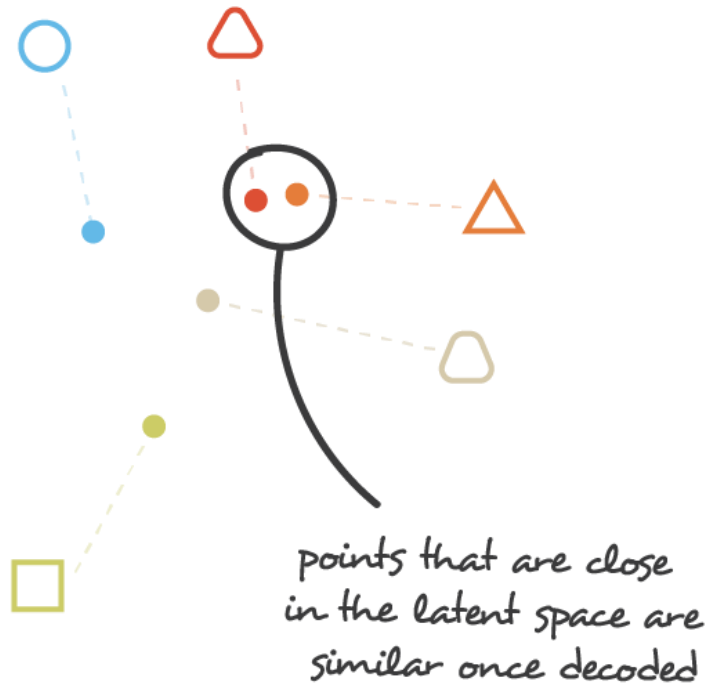
Autoencoder

Sampling from
a distribution



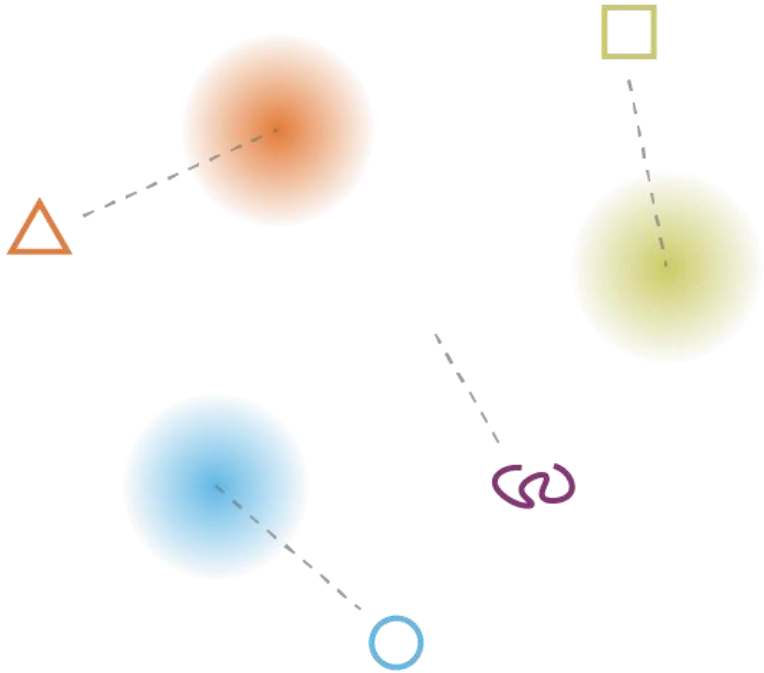


irregular latent space

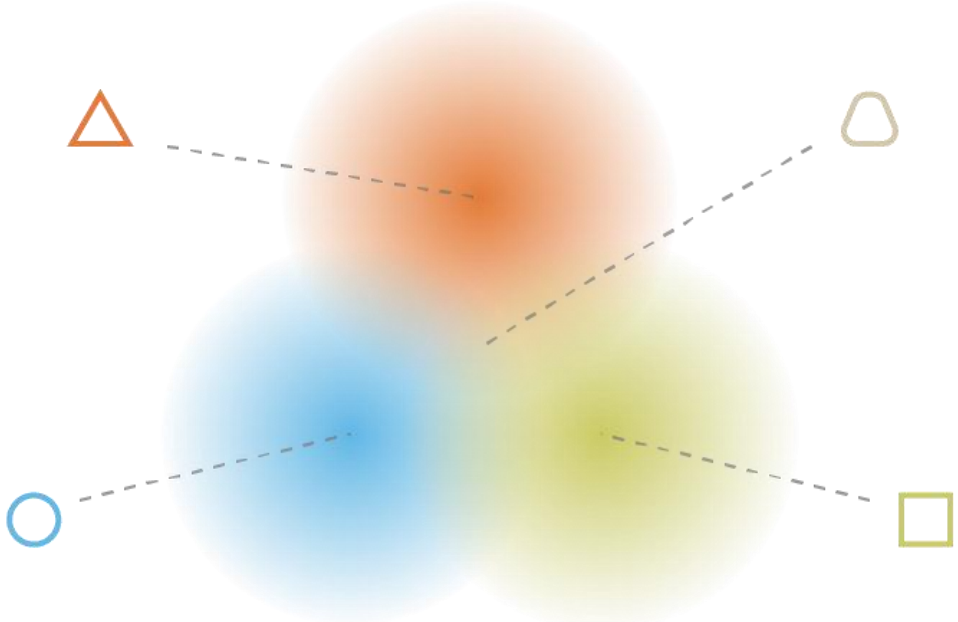


regular latent space

Source: Understanding Variational Autoencoders (VAEs)

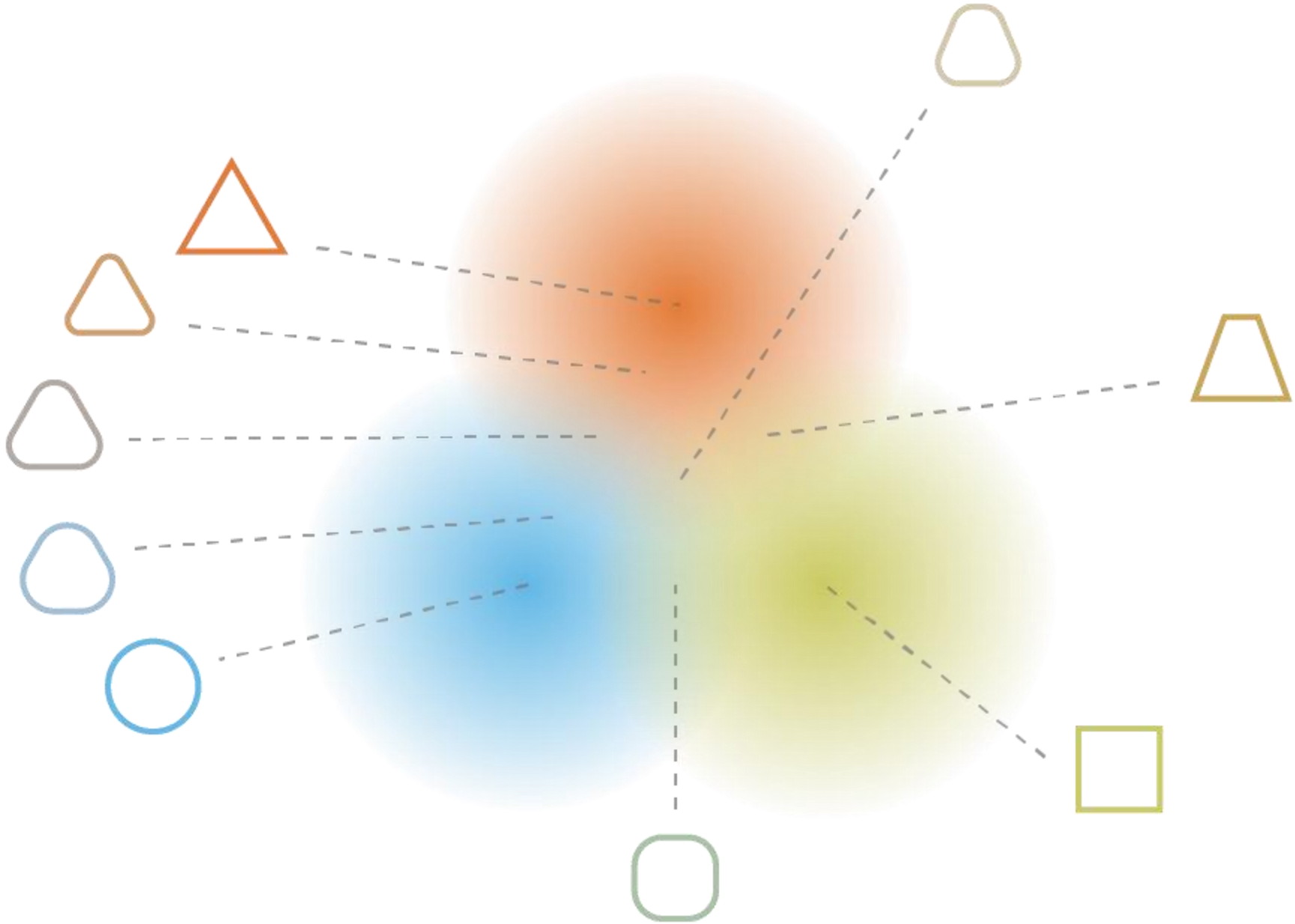


what can happen without regularisation



what we want to obtain with regularisation

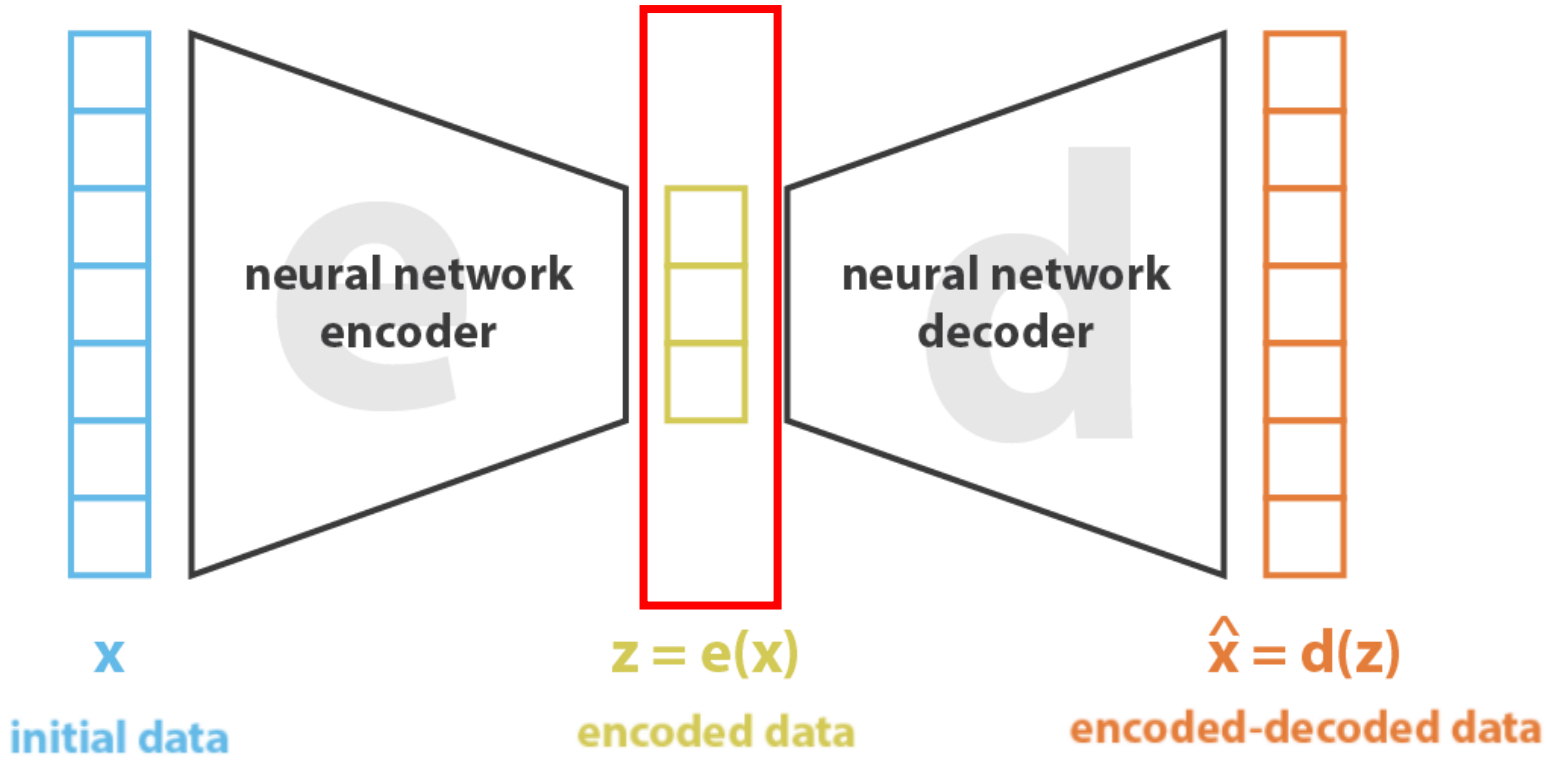
Source: Understanding Variational Autoencoders (VAEs)



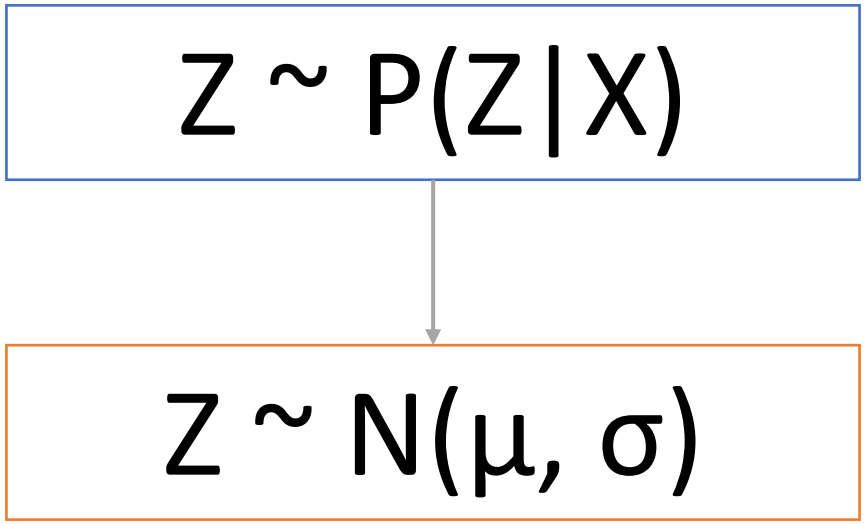
Source: Understanding Variational Autoencoders (VAEs)

Variational Autoencoder

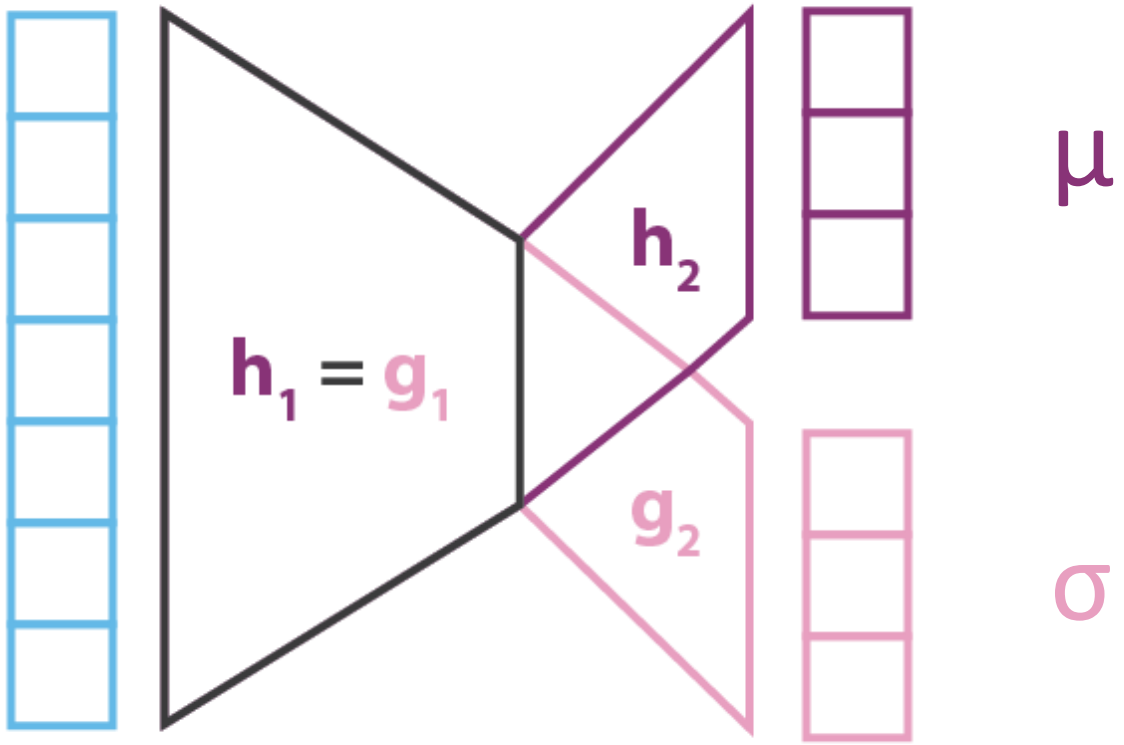
Autoencoder

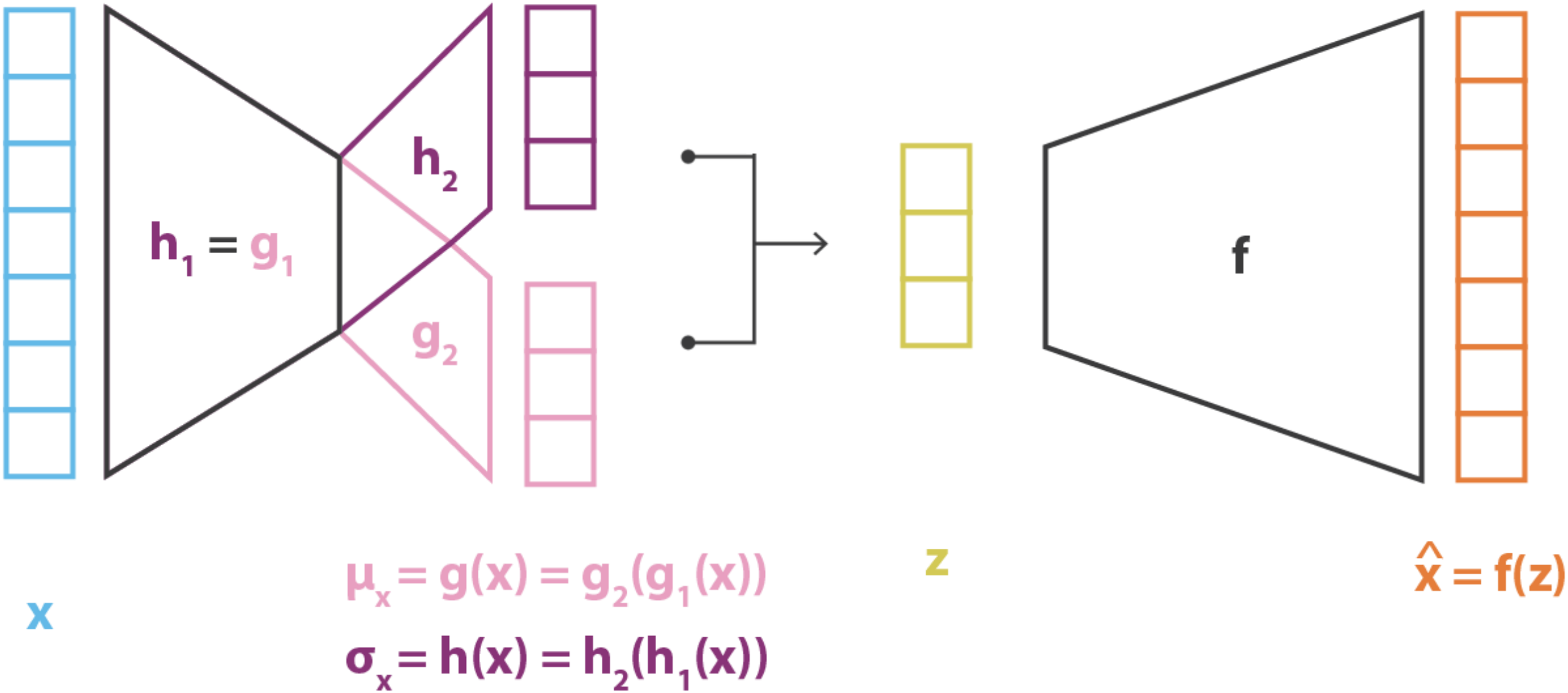


Variational Autoencoder



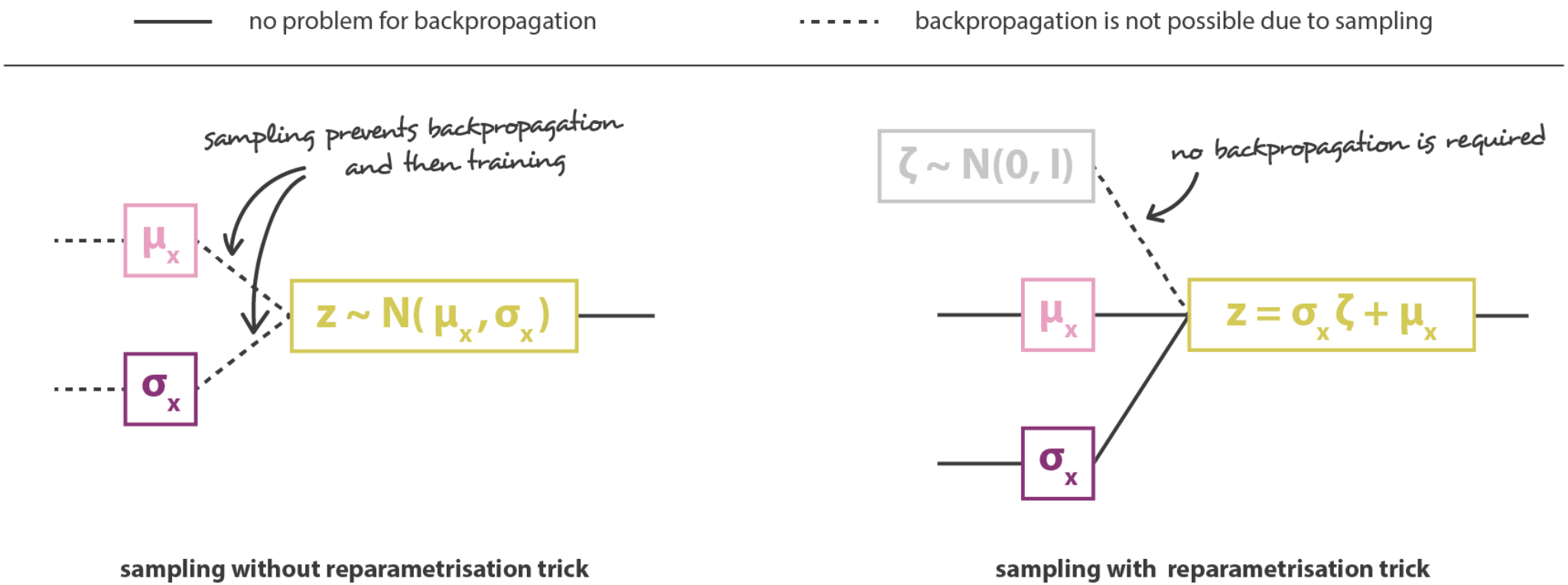
Variational Autoencoder



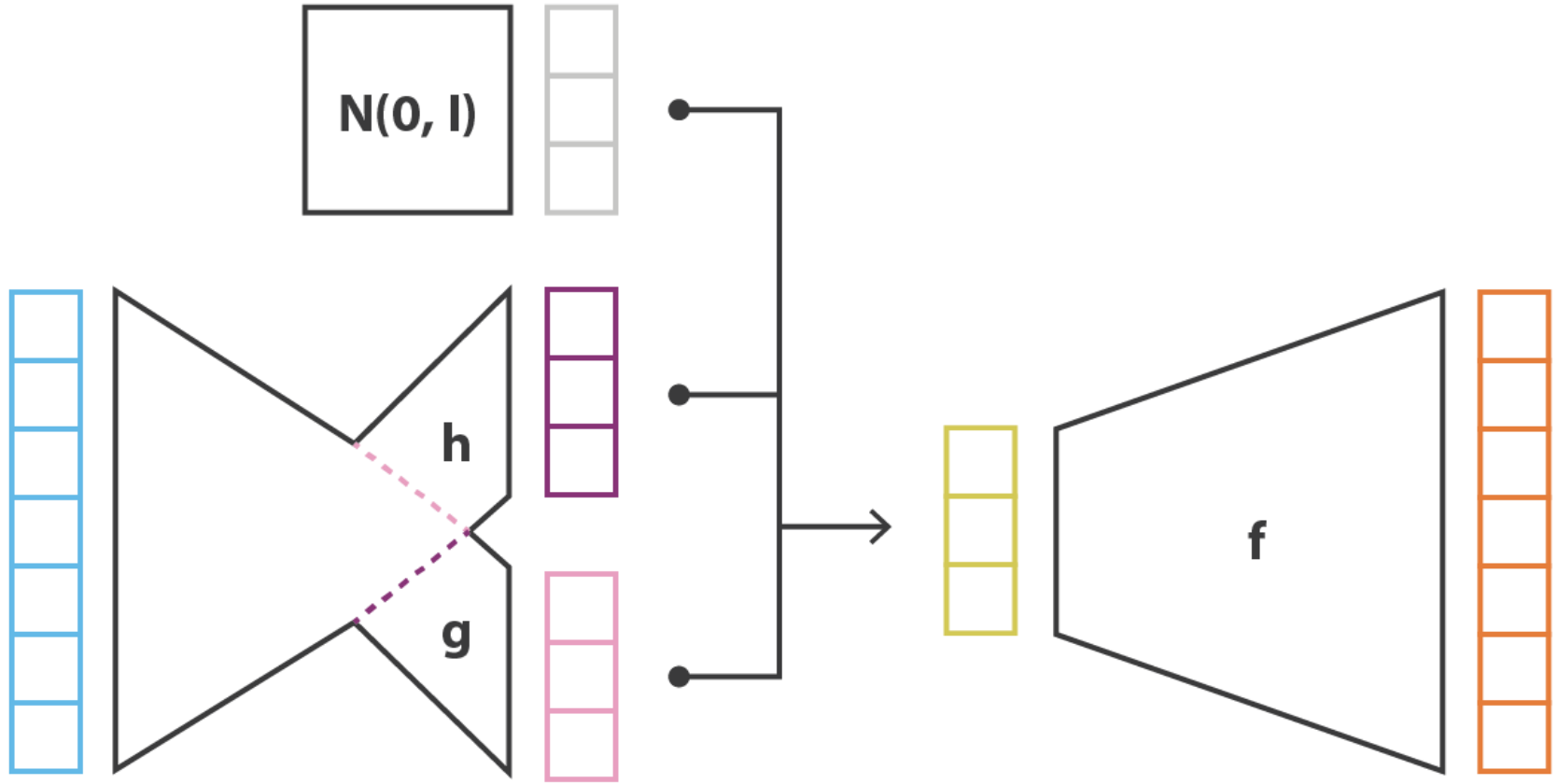


Source: Understanding Variational Autoencoders (VAEs)

Variational Autoencoder



Source: Understanding Variational Autoencoders (VAEs)



x

$\mu_x = g(x)$

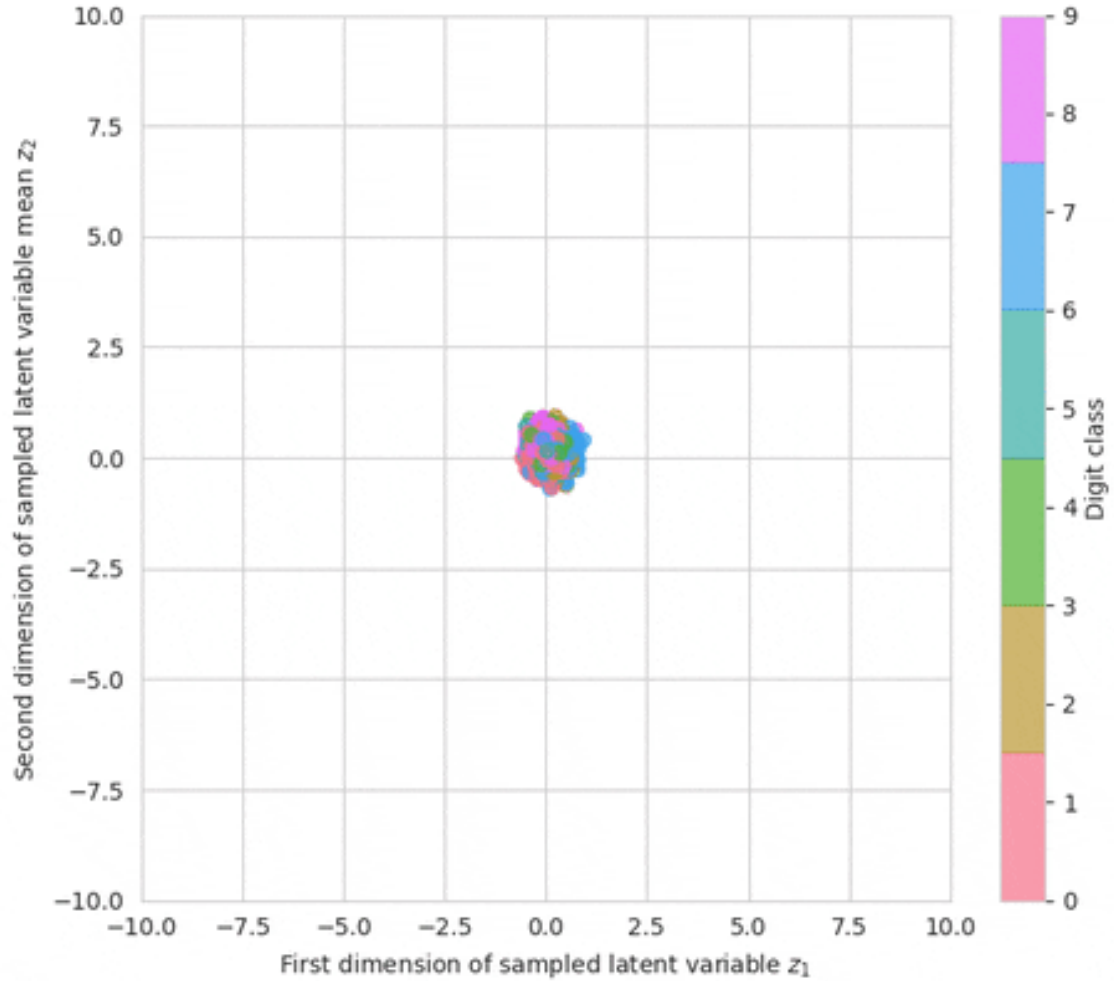
$\sigma_x = h(x)$

$\zeta \sim N(0, I)$

$z = \sigma_x \zeta + \mu_x$

$\hat{x} = f(z)$

$$\text{loss} = C \,||\, x - \hat{x} \,||^2 + KL[\, N(\mu_x, \sigma_x), N(0, I) \,] = C \,||\, x - f(z) \,||^2 + KL[\, N(g(x), h(x)), N(0, I) \,]$$



Source: https://giphy.com/gifs/

Implementation

- Clustering
- Generating
- Recommendation

Example

'云日隐层阙，风烟出绮疏',
'岩廊罢机务，崇文聊驻辇',
'玉匣启龙图，金绳披凤篆',
'韦编断仍续，缥帙舒还卷',
'对此乃淹留，欹案观坟典',
'移步出词林，停舆欣武宴',
'雕弓写明月，骏马疑流电',
'惊雁落虚弦，啼猿悲急箭',
'阅赏诚多美，于兹乃忘倦',
'鸣笳临乐馆，眺听欢芳节',
'急管韵朱弦，清歌凝白雪',
'彩凤肃来仪，玄鹤纷成列',
'去兹郑卫声，雅音方可悦',
'芳辰追逸趣，禁苑信多奇',
'桥形通汉上，峰势接云危',

Some of the inputs

```
Epoch 42/100
2319/2319 [==============================] - 62s 27ms/step - loss: 6
1.6676
          幽性清香处，春山独望空
Epoch 43/100
2319/2319 [==============================] - 62s 27ms/step - loss: 6
1.6427
          君生一无事，不以良与主
Epoch 44/100
2319/2319 [==============================] - 62s 27ms/step - loss: 6
1.6127
          何将身不难，不敢问鞭者
Epoch 45/100
 427/2319 [====>.........................] - ETA: 50s - loss: 61.3366
```

Some of the outputs

Reference

- Understanding Variational Autoencoders (VAEs)
- Tutorial - What is a variational autoencoder?
- Variational Autoencoders
- Autoencoder-wiki
- giphy.com
- Kingma, D. P., & Welling, M. (2013). Auto-encoding variational bayes. arXiv preprint arXiv:1312.6114.
- Pu, Y., Gan, Z., Henao, R., Yuan, X., Li, C., Stevens, A., & Carin, L. (2016). Variational autoencoder for deep learning of images, labels and captions. arXiv preprint arXiv:1609.08976.