

Real NVP with Gaussian Mixture Prior

Andrei Atanov

Skolkovo Institute of Science and Technology

E-mail: andrei.atanov@skolkovotech.ru.

January 19, 2019

1 Model

I follow Normalizing Flows framework [2] for density estimation problem via maximum likelihood:

$$\mathcal{L}(\theta) = - \sum_{i=1}^N \log p_Z(f_\theta(x_i)) + \log \left| \frac{\partial f_\theta(x_i)}{\partial x_i} \right|$$

where $\{x_i\}_{i=1}^N$ – training data and f_θ – invertible function. As a flow f_θ I used Real NVP architecture [1].

For Gaussian Mixture prior I used the following p_Z :

$$p_Z(z) = \sum_{i=1}^K \pi_k \mathcal{N}(z|\mu_j, \Sigma_j)$$

Parameters $\{\pi, \mu, \Sigma, \theta\}$ of the prior distribution and normalizing flow are trained via EM algorithm [3].

2 Experimental Results

References

- [1] Dinh, Laurent and Sohl-Dickstein, Jascha and Bengio, Samy (2016) *Density estimation using Real NVP* arXiv preprint arXiv:1605.08803

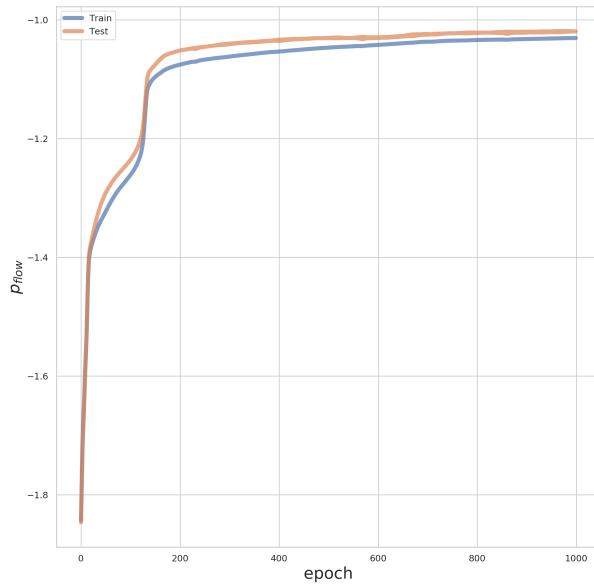


Figure 1: Real NVP flow likelihood for train and test sets

- [2] Rezende, Danilo Jimenez and Mohamed, Shakir (2015) *Variational inference with normalizing flows* arXiv preprint arXiv:1505.05770
- [3] Bishop, Christopher M. (2006) *Pattern Recognition and Machine Learning (Information Science and Statistics)* Springer-Verlag

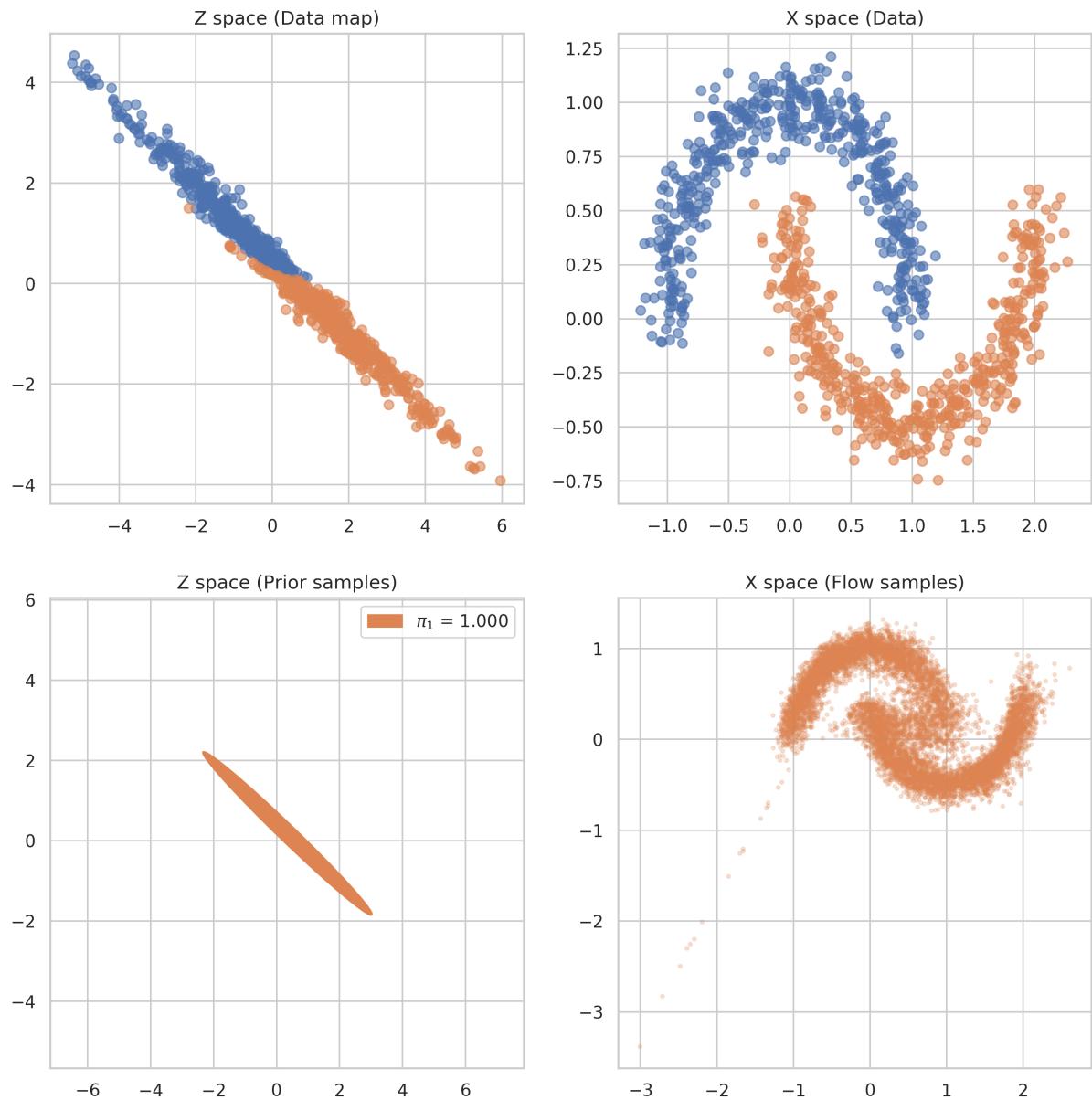


Figure 2: Visualization of trained flow with 1 components in prior, which corresponds to the vanilla real nvp

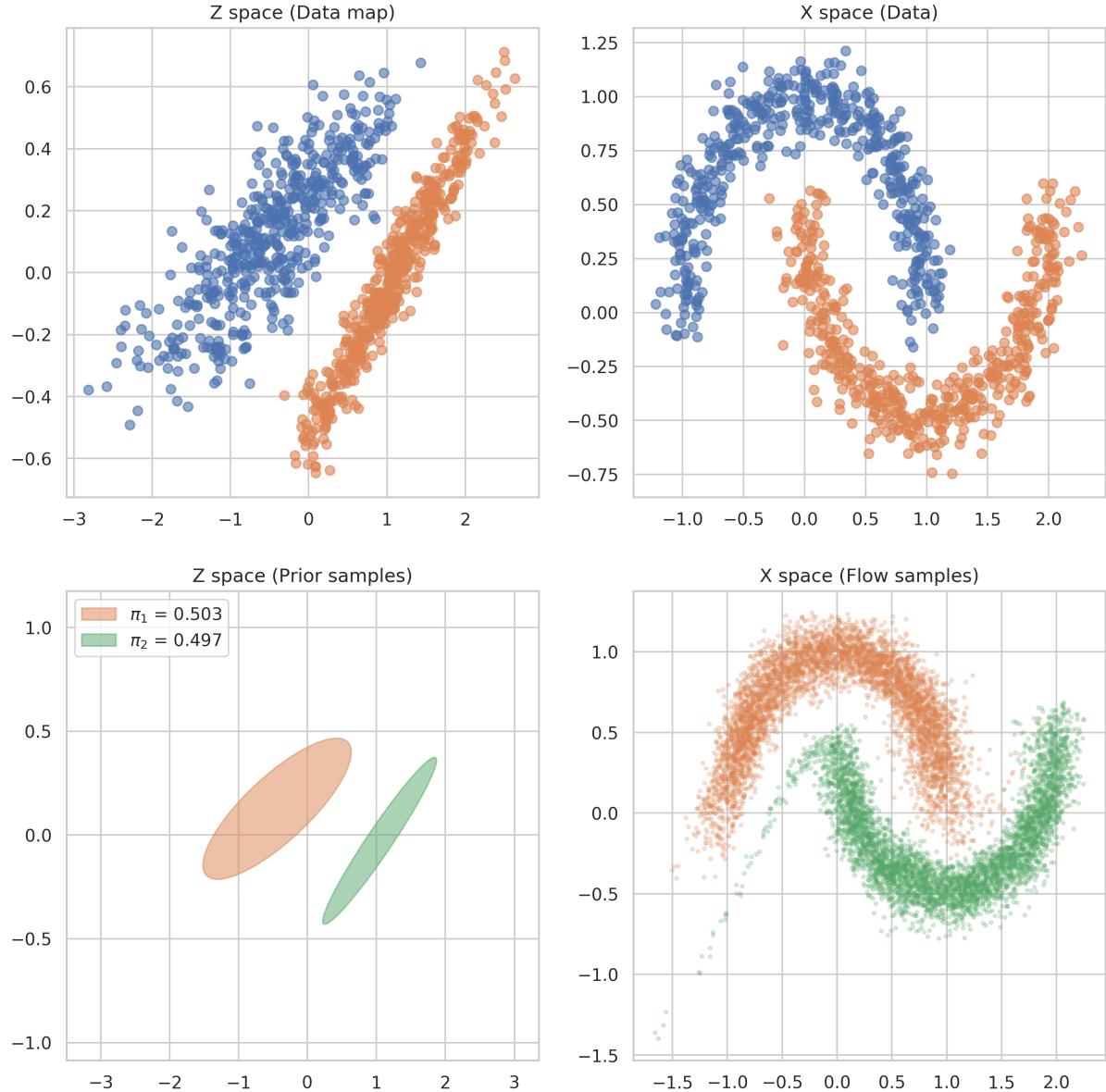


Figure 3: Visualization of trained flow with 2 components in prior

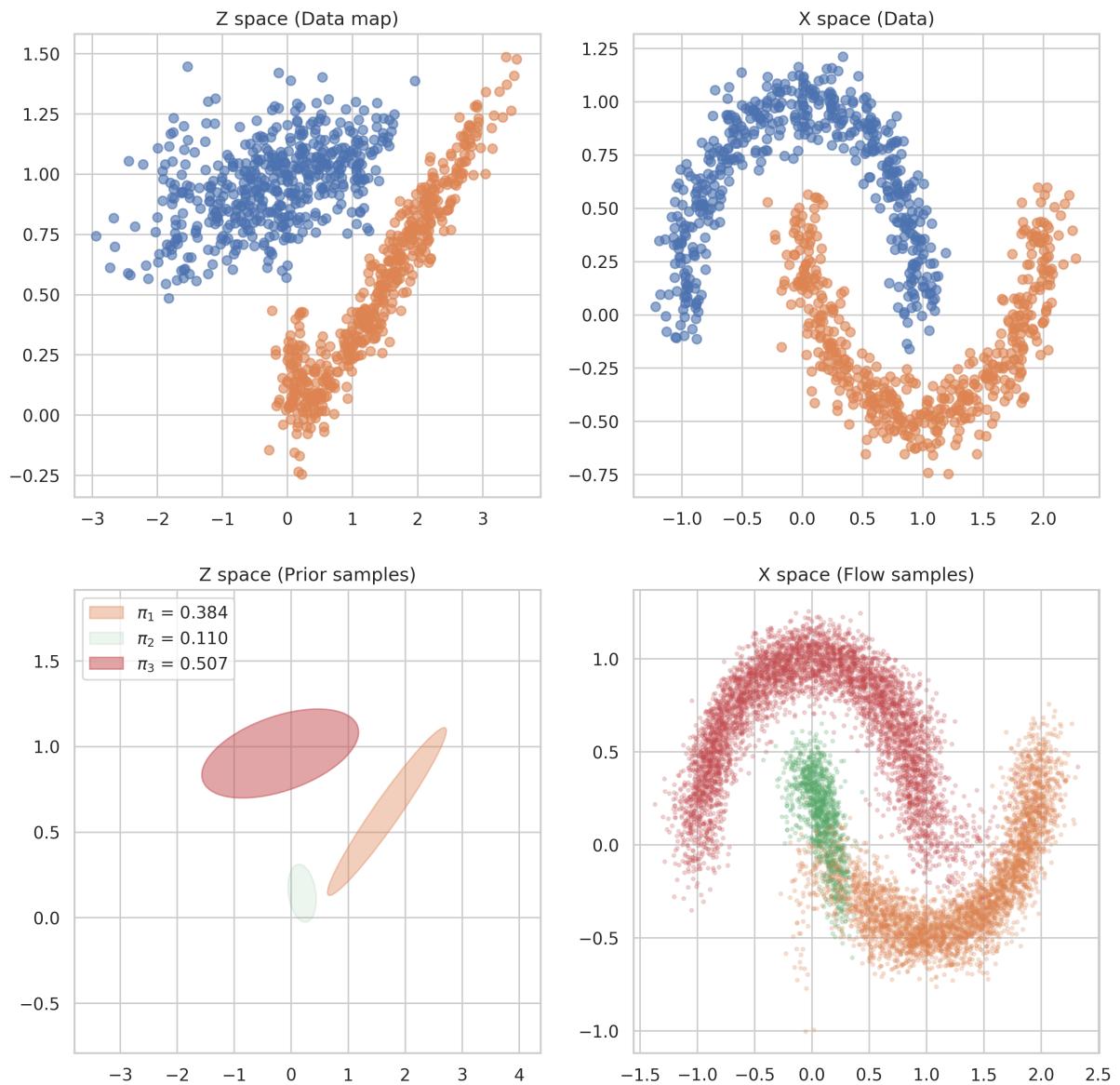


Figure 4: Visualization of trained flow with 3 components in prior

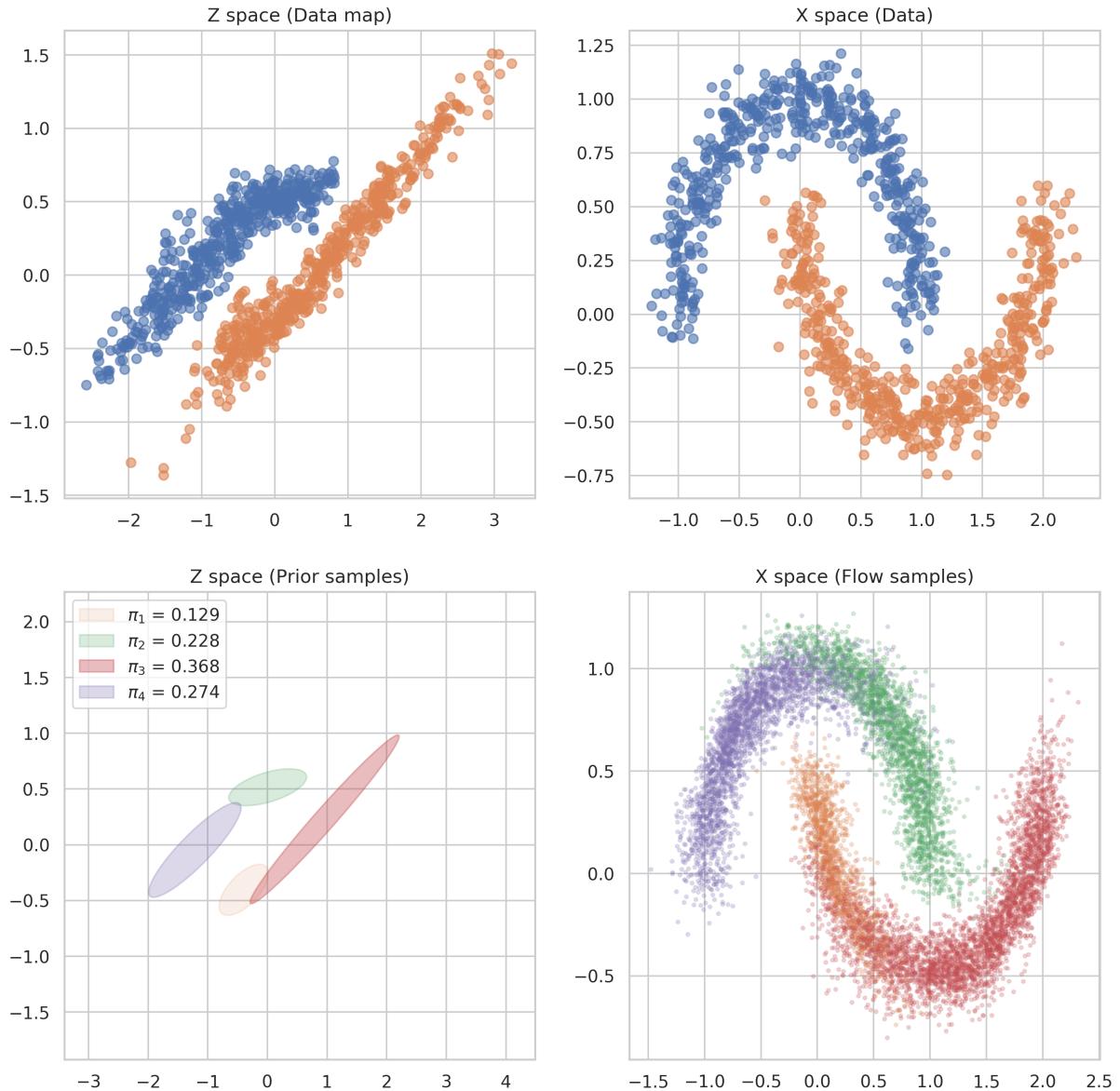


Figure 5: Visualization of trained flow with 4 components in prior