

CONTENTS

1.	INTRODUCTION	1
2.	BACKGROUND AND RELATED WORK	3
2.1	Variational Autoencoders	3
2.1.1	Artificial Neural Networks	3
2.1.2	Autoencoders	9
2.1.3	Variational Bayesian Methods	11
2.1.4	Auto Encoding Variational Bayes	12
2.2	t-Distributed Stochastic Neighbor Embedding	16
2.2.1	SNE	16
2.2.2	t-SNE	17
2.2.3	Parametric t-SNE	20
3.	METHOD	21
3.1	Learning a Parametric Embedding Using VAE Sampling	21
3.2	Robustness to Sparse and Noisy Data	24
3.3	Sampling from Hidden Layers	25
3.4	Inference with the Generative Model	26
3.5	Implementation	27
4.	EXPERIMENTS	28
4.1	Data Sets	28
4.1.1	MNIST	28
4.1.2	Fashion-MNIST	28
4.1.3	Mass Cytometry	28
4.2	Evaluation Metrics	30
4.2.1	Nearest Neighbor Classifier	30
4.2.2	Trustworthiness	30
4.3	Network Structure and Parameters	31
4.4	Learning	32
4.5	Comparisons	32
4.5.1	Embedding Quality	33
4.5.2	Scalability	34
4.6	Robustness to Sparse Data	36
4.7	Robustness to Noisy Data	36
4.8	Sampling from Hidden Layers	37
4.9	Inference with the Generative Model	38
5.	CONCLUSIONS	41
	REFERENCES	43