

**Machine Learning for Computer Vision**  
**Winter term 2017**

January 30, 2018  
Topic: Variational Inference

**Exercise 1: Kullback-Leibler divergence**

- a) What does the KL divergence describe? Is it a metric? Why?
- b) Compute the KL-divergence of two univariate normal distributions.  
What if they have the same mean? What if they have the same variance?
- c) Consider a factorized variational distribution  $q(Z)$ . By using the technique of Lagrange multipliers, verify that minimization of  $KL(p||q)$  with respect to one of the factors  $q_i(Z_i)$  keeping all other factors fixed, leads to the solution:

$$q_j^*(Z_j) = \int p(Z) \prod_{i \neq j} dZ_i = p(Z_j)$$