Exercises for "Vertiefung Neuronale Netze"
SS 2018 Sheet 7

Due on: 11.5.2018

Task 7.1, product rule: Derive the generalized product rule:

$$f(x) = \prod_i g_i(x) \tag{1}$$

$$\frac{\partial f(x)}{\partial x} = \sum_i \frac{\partial g_i(x)}{\partial x} \cdot \prod_{j \neq i} g_j(x) \tag{2}$$

$$= f(x) \cdot \sum_i \frac{\partial g_i(x)}{\partial x} \cdot g_i^{-1}(x) \quad \text{if } g_i(x) \neq 0 \tag{3}$$

$$\tag{4}$$

Task 7.2, PSOM matching: To continuosly match a stimulus $\vec{x}$ to the PSOM manifold, the error function

$$E(\vec{s}) = \frac{1}{2}\|\vec{x} - \vec{w}(\vec{s})\|^2 = \frac{1}{2}\sum_{k=1}^{L}(x_k - w_k(\vec{s}))^2 \tag{5}$$

is minimized via gradient descent:

$$\Delta\vec{s} = -\eta\nabla_{\vec{s}}E = \nabla_{\vec{s}}\vec{w}_{\vec{s}} \cdot (\vec{x} - \vec{w}_{\vec{s}}) \tag{6}$$

$$\Delta s_\mu = -\eta\sum_{k=1}^{L}\frac{\partial w_k(\vec{s})}{\partial s_\mu}(x_k - w_k(\vec{s})) \tag{7}$$

Derive the required derivative of $w_k(\vec{s})$ with respect to s_μ.