6. domaća zadaća iz Neizrazitog, evolucijskog i neuroračunarstva

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1. Izvod postupka učenja

Prolaz unaprijed kroz mrežu:

$$\alpha_i^{(x)} = \frac{1}{1+e^{b_i^{(x)} \cdot (x - a_i^{(x)})}} \qquad \alpha_i^{(y)} = \frac{1}{1+e^{b_i^{(y)} \cdot (y - a_i^{(y)})}} \qquad \alpha_i = \alpha_i^{(x)} \cdot \alpha_i^{(y)}$$

$$o_k = \frac{\sum_{i=1}^{m} \alpha_i \cdot (p_i \cdot x_k + q_i \cdot y_k + r_i)}{\sum_{i=1}^{m} \alpha_i} \qquad E_k = \frac{1}{2} \cdot (z_k - o_k)^2$$

Gradijent za p_i:

$$\frac{\partial E_k}{\partial p_i} = \frac{\partial E_k}{\partial o_k} \cdot \frac{\partial o_k}{\partial p_i} \qquad \frac{\partial E_k}{\partial o_k} = -(z_k - o_k) \qquad \frac{\partial o_k}{\partial p_i} = \frac{\alpha_i \cdot x_k}{\sum_{j=1}^{m} \alpha_j}$$

$$\frac{\partial E_k}{\partial p_i} = -(z_k - o_k) \cdot \frac{\alpha_i \cdot x_k}{\sum_{j=1}^{m} \alpha_j}$$

Gradijent za q_i:

$$\frac{\partial E_k}{\partial q_i} = \frac{\partial E_k}{\partial o_k} \cdot \frac{\partial o_k}{\partial q_i} \qquad \frac{\partial o_k}{\partial q_i} = \frac{\alpha_i \cdot y_k}{\sum_{j=1}^{m} \alpha_j} \qquad \frac{\partial E_k}{\partial q_i} = -(z_k - o_k) \cdot \frac{\alpha_i \cdot y_k}{\sum_{j=1}^{m} \alpha_j}$$

Gradijent za r_i:

$$\frac{\partial E_k}{\partial r_i}=\frac{\partial E_k}{\partial o_k}\cdot\frac{\partial o_k}{\partial r_i} \qquad \frac{\partial o_k}{\partial r_i}=\frac{\alpha_i}{\sum_{j=1}^{m}\alpha_j} \qquad \frac{\partial E_k}{\partial r_i}=-(z_k-o_k)\cdot\frac{\alpha_i}{\sum_{j=1}^{m}\alpha_j}$$

Ažuriranje parametara:

	Koristeći pravi gradijent	Koristeći stohastičku varijantu
p	$p_i(t+1)=p_i(t)+\eta\sum_{k=1}^{N}(z_k-o_k)\cdot\frac{\alpha_i\cdot x_k}{\sum_{j=1}^{m}\alpha_j}$	$p_i(t+1)=p_i(t)+\eta(z_k-o_k)\cdot\frac{\alpha_i\cdot x_k}{\sum_{j=1}^{m}\alpha_j}$
q	$q_i(t+1)=q_i(t)+\eta\sum_{k=1}^{N}(z_k-o_k)\cdot\frac{\alpha_i\cdot y_k}{\sum_{j=1}^{m}\alpha_j}$	$q_i(t+1)=q_i(t)+\eta(z_k-o_k)\cdot\frac{\alpha_i\cdot y_k}{\sum_{j=1}^{m}\alpha_j}$
r	$r_i(t+1)=r_i(t)+\eta\sum_{k=1}^{N}(z_k-o_k)\cdot\frac{\alpha_i}{\sum_{j=1}^{m}\alpha_j}$	$r_i(t+1)=r_i(t)+\eta(z_k-o_k)\cdot\frac{\alpha_i}{\sum_{j=1}^{m}\alpha_j}$