Regression

$$a_{ik}^{(0)} = a_{ik}^{(0)} - \alpha \frac{\partial \left(SE(y, O_0^{(2)}) \right)}{\partial (a_{ik}^{(0)})}$$

* In updating first layer weights, we can not use the least squares rule directly as we do not have a desired output specified for the hidden units.
So, $\rightarrow$ chain rule

$$= \sum \frac{\partial E}{\partial O_{(0)}^2} \frac{\partial O_{(0)}^2}{\partial O_k^{(1)}} \frac{\partial O_k^{(1)}}{\partial a_{ik}^{(0)}}$$

$$\left.\begin{aligned} \frac{\partial E}{\partial O_{(0)}^{(2)}} &= -(y - O_{(0)}^2) \\ \frac{\partial O_{(0)}^2}{\partial O_k^{(1)}} &= a_{k0}^{(1)} \\ \frac{\partial O_k^{(1)}}{\partial a_{ik}^{(0)}} &= O_k^{(1)}(1 - O_k^{(1)}) O_i^{(0)} \end{aligned}\right\} + \alpha \left[(y - O_{(0)}^2) a_{k0}^{(1)} O_k^{(1)} (1 - O_k^{(1)}) O_i^{(0)} \right]$$

$$O_k^{(1)} = \frac{1}{1 + e^{-(a_{0k}^{(0)} + x_1 a_{1k}^{(0)} + x_2 a_{2k}^{(0)})}}$$

$$\Rightarrow \quad a_{0k}^{(0)} = a_{0k}^{(0)} + \alpha (y - O_{(0)}^2) a_{k0}^{(1)} O_k^{(1)} (1 - O_k^{(1)}) 1$$

$$a_{1k}^{(0)} = a_{1k}^{(0)} + \alpha (y - O_{(0)}^2) a_{k0}^{(1)} O_k^{(1)} (1 - O_k^{(1)}) x_1$$

$$a_{2k}^{(0)} = a_{2k}^{(0)} + \alpha (y - O_{(0)}^2) a_{k0}^{(1)} O_k^{(1)} (1 - O_k^{(1)}) x_2$$

$$a_{k0}^{(1)} = a_{k0}^{(1)} - \alpha \frac{\partial SE(y, O_{(0)}^2)}{\partial a_{k0}^{(1)}} \Rightarrow -\alpha (y - O_{(0)}^2) O_k^{(1)}$$

$$\Rightarrow \quad a_{k0}^{(1)} = a_{k0}^{(1)} - \alpha (y - O_{(0)}^2) \frac{1}{1 + e^{-(a_{0k}^{(0)} + x_1 a_{1k}^{(0)} + x_2 a_{2k}^{(0)})}}$$

AY / MONTH
01 02 03 04 05 06 07 08 09 10 11 12

GÜN / DAY
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Classification

$$CE = -\left(l_0 \log(O_0^{(2)}) + l_1 \log(O_1^{(2)}) + l_2 \log(O_2^{(2)}) \right)$$

$$\frac{\partial CE}{\partial a_{kn}^{(1)}} = \sum_{n=0} \text{softmax}(x_n^{(2)}, x^{(2)}) - l_n$$

$$\Delta = \left[\sum_{n=0} \text{softmax}\left(\sum_{k=0} O_k^{(1)} \cdot a_{kn}^{(1)}, x^{(2)} \right) - l_n \right) \cdot O_k^{(1)}$$

$$O_k^{(1)} = \frac{1}{1 + e^{-(a_{0k}^{(0)} + x_1 a_{1k}^{(0)} + x_2 a_{2k}^{(0)})}}$$

$$a_{kn}^{(1)} = a_{kn}^{(1)} - \alpha \Delta$$