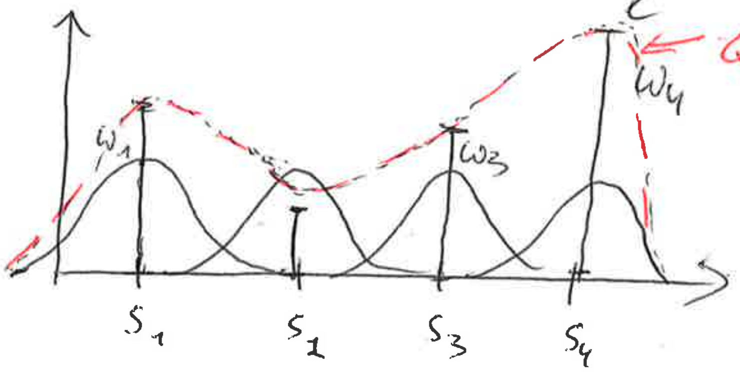
Blackboard 3, RL2

$\cancel{Q(a_2, s)} =$

$Q(s, a_2) = \sum_k w^2_k \, \phi(s - s_k)$

later



$s = (x, y)$

for example

amplitudes

$\omega_1 \quad \omega_2 \quad \omega_3 \,, \quad \omega_4$

$\Rightarrow$ smooth function with few parameters

$Q(a_2, s) \; : \; \omega_{21}, \; \omega_{22}, \; \omega_{23}, \; \omega_{24}$

Blackboard 4 – RL 2 : Loss function

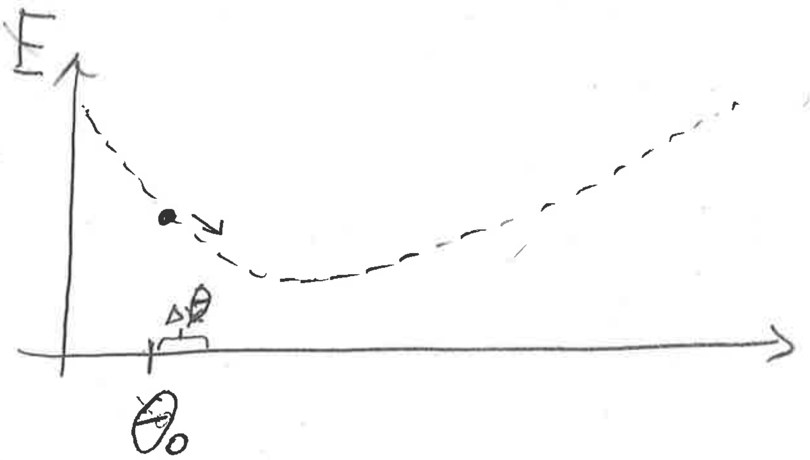
error (loss function)

$$E(\vec{w}^{a_1}, \dots) = \frac{1}{2}\Big[\underbrace{r + \gamma Q(s', a' | \vec{w}^{a'})}_{\text{target}} - \underbrace{Q(s, a | \vec{w}^{a})}_{\text{depends on parameters } \theta}\Big]^2$$

(the weights $\underset{\theta}{\overset{\|}{w_1, w_2, \dots}}$)

$$= \frac{1}{2}[\delta]^2$$

minimize error by gradient descent



$$\Delta\theta = -\eta \cdot \frac{\partial E}{\partial \theta} = +\eta \cdot \Big[r + \gamma Q(s', a') - Q(s, a)\Big] \frac{\partial Q(s,a)}{\partial \theta}$$

for basis function network with fixed weights $\vec{w}^{a_1}, \vec{w}^{a_2}$

$$\Delta w_n^{a_1} = -\eta \cdot \frac{\partial E}{\partial w_n^{a_1}} = +\eta \Big[r + \gamma Q(s', a' | \vec{w}^{a'}) - Q(s, a | \vec{w}^{a})\Big] \cdot \frac{\partial Q(s, a | \vec{w}^{a})}{\partial w_n^{a_1}}$$

$\boxed{\text{exercise in class}}$

$$= \underbrace{\delta_{a, a_1}}_{\text{Kronecker}} \cdot \phi(s - s_n)$$