Assume: $\theta^1 = \alpha_1 \cdot \phi(x^1)$ PS2) 2)

$\theta^2 = \alpha_2 \cdot \phi(x^2) + \alpha_1 \cdot \phi(x^1)$

$\theta^3 = \alpha_3 \cdot \phi(x^3) + \alpha^2 \phi(x^2) + \alpha_1 \phi(x^1)$

Training: $\Rightarrow \theta = \sum_i \alpha_i \phi(x^i)$ where $\alpha_i \in \cancel{\{-1, 0, 1\}}$

$\in \{-\alpha, 0, \alpha\}$

Prediction: $\theta^T \cdot \phi(x)$

$\Rightarrow \boxed{h_\theta(z) = g\left(\sum_i \alpha_i \phi(x^i)^T \cdot \phi(z)\right) = g\left(\sum_i \alpha_i \cdot K(x^i, z)\right)}$

$\boxed{\text{Insight}}$ $\Rightarrow$ only need to learn all α_i!

$\Rightarrow$ how to train and find α_i?

Example: α_2:

$\alpha_2 = y^{(2)} - g\left(\alpha_1 \phi(x^1)^T \phi(x^2)\right) = y^{(2)} - g\left(\alpha_1 K(x^1, x^2)\right)$

$\Rightarrow \alpha_{i+1} = \alpha\left(y^{(i+1)} - g\left(\sum_{p=1}^{i} \alpha_p \phi(x^p)^T \phi(x^{i+1})\right)\right)$

$= \alpha\left(y^{(i+1)} - g\left(\sum_{p=1}^{i} \alpha_p K(x^p, x^{i+1})\right)\right)$

$\Rightarrow$ Update Rule: $\boxed{\alpha_{i+1} = \alpha\left(y^{(i+1)} - g\left(\sum_{p=1}^{i} \alpha_p K(x^{(p)}, x^{(i+1)})\right)\right)}$ for $i \geq 1$

Zero State: $\alpha_1 = \alpha\left(y^{(1)} - g(\vec{0}^T \phi(x^1))\right) = \cancel{y^1 - g(K(\vec{0}, x^1))}$

$= \alpha\left(y^{(1)} - g(0)\right) = \boxed{\alpha(y^{(1)} - 1/2)}$

$= \alpha(y^{(1)} - 1)$

$\Rightarrow$ a) θ_{a}^{i+1} is represented by the $\alpha_{1 \ldots i}$s and the prev data points leading up to $i+1$