$$f(x) = g_x(u;a) = \sum_{k=0}^{D} a_j (u-x)^k = \mathbf{r}_u^\top(x)\mathbf{a}$$

$$\begin{aligned}
\hat{a} &= \underset{a\in\mathbb{R}^{D+1}}{\arg\min} \sum_{i=1}^{n} w_i \left(y_i - g_x(x_i;a)\right)^2 \\
&= \underset{a\in\mathbb{R}^{D+1}}{\arg\min} \sum_{i=1}^{n} w_i \left(y_i - \mathbf{r}_{x_i}^\top(x)\mathbf{a}\right)^2 \\
&= \underset{a\in\mathbb{R}^{D+1}}{\arg\min} \left(\mathbf{y} - \mathbf{R}_\mathbf{x}\mathbf{a}\right)^\top \mathbf{W}\left(\mathbf{y} - \mathbf{R}_\mathbf{x}\mathbf{a}\right)
\end{aligned}$$

$$\hat{a} = \left(\mathbf{R}_\mathbf{x}^\top \mathbf{W}\mathbf{R}_\mathbf{x}\right)^{-1} \mathbf{R}_\mathbf{x}^\top \mathbf{W}\mathbf{y}$$

$$\hat{f}(x) = g_x(x;\hat{a}) = \hat{a}_0$$

$$\begin{aligned}
\hat{f}(x) &= \mathbf{R}_\mathbf{x}\hat{a} = \mathbf{R}_\mathbf{x}\left(\mathbf{R}_\mathbf{x}^\top \mathbf{W}\mathbf{R}_\mathbf{x}\right)^{-1} \mathbf{R}_\mathbf{x}^\top \mathbf{W}\mathbf{y} \\
&= \mathbf{H}\mathbf{y}
\end{aligned}$$