$$\sum_{x_a \in X} \omega(x_a)\left(\bar{\gamma}_a(x_a) - \hat{\gamma}_a(x_a)\right)^2$$

$$= \frac{1}{2}\sum_{x_a \in X} 2\omega(x_a)\left[\left(\bar{\gamma}_a(x_a)\right)^2 + \left(\hat{\gamma}_a(x_a)\right)^2 - 2\hat{\gamma}_a(x_a)\bar{\gamma}_a(x_a)\right]$$

$$= \frac{1}{2}\sum_{x_a \in X} 2\omega(x_a)\left(\bar{\gamma}_a(x_a)\right)^2 + 2\omega(x_a)\left(\hat{\gamma}_a(x_a)\right)^2 - 2\bar{\gamma}_a(x_a)\hat{\gamma}_a(x_a)\,\omega(x_a)$$

$$= \underbrace{\sum_{x_a \in X} \omega(x_a)\left(\bar{\gamma}_a(x_a)\right)^2}_{\text{constant}} + \frac{1}{2}\sum_{x_a \in X} 2\,\omega(x_a)\left(\hat{\gamma}_a(x_a)\right)^2 - 2\bar{\gamma}_a(x_a)\hat{\gamma}_a(x_a)\,\omega(x_a)$$

The given problem now reduced to solving the non constant part.

$$\frac{1}{2}\sum_{x_a \in X} 2\,\omega(x_a)\left(\hat{\gamma}_a(x_a)\right)^2 - 2\bar{\gamma}_a(x_a)\hat{\gamma}_a(x_a)\,\omega(x_a)$$

Let say $X = \{x_{a_1}, x_{a_2}, x_{a_3}\}$.

The first half of the equation becomes

$$\frac{1}{2}\left(2\omega(x_{a_1})\hat{\gamma}(x_{a_1})^2 + 2\omega(x_{a_2})\hat{\gamma}(x_{a_2})^2 + 2\omega(x_{a_3})\hat{\gamma}(x_{a_3})^2\right)$$

Let $\hat{\gamma}(x_{a_1}) = x_1$, $\hat{\gamma}(x_{a_2}) = x_2$, $\hat{\gamma}(x_{a_3}) = x_3$

(since $\hat{\gamma}(x_a)$ is the x we are trying to solve)

$$= \frac{1}{2}\left(2w(x_{a_1})\,x_1^2 + 2w(x_{a_2})\,x_2^2 + 2w(x_{a_3})\,x_3^2\right)$$

$$= \frac{1}{2}\left[x_1^T\left(2w(x_{a_1})\right)x_1 + x_2^T\left(2w(x_{a_2})\right)x_2 + x_3^T\left(2w(x_{a_3})\right)x_3\right]$$

$$= \frac{1}{2}\begin{bmatrix} x_1 & x_2 & x_3 \end{bmatrix}\begin{bmatrix} 2w(x_{a_1}) & 0 & 0 \\ 0 & 2w(x_{a_2}) & 0 \\ 0 & 0 & 2w(x_{a_3}) \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

This is of the form $\frac{1}{2}x^T H x$

$$\therefore H = \begin{bmatrix} 2w(x_{a_1}) & 0 & 0 \\ 0 & 2w(x_{a_2}) & 0 \\ 0 & 0 & 2w(x_{a_3}) \end{bmatrix}$$

The second half of the equation

$$\frac{1}{2} \sum_{x_a \in X} -2\,\omega(x_a)\,\bar{\gamma}(x_a)\,\hat{\gamma}(x_a)$$

$$= -\sum_{x_a \in X} \omega(x_a)\,\bar{\gamma}(x_a)\,\hat{\gamma}(x_a)$$

Let $X = \{x_{a_1}, x_{a_2}, x_{a_3}\}$ and $\hat{\gamma}(x_{a_1}) = x_1$
$\hat{\gamma}(x_{a_2}) = x_2$, $\hat{\gamma}(x_{a_3}) = x_3$

$$= -\Big[\omega(x_{a_1})\bar{\gamma}(x_{a_1})\,x_1 + \omega(x_{a_2})\bar{\gamma}(x_{a_2})\,x_2 + \omega(x_{a_3})\bar{\gamma}(x_{a_3})\,x_3\Big]$$

$$= \begin{bmatrix} -\omega(x_{a_1})\bar{\gamma}(x_{a_1}) & -\omega(x_{a_2})\bar{\gamma}(x_{a_2}) & -\omega(x_{a_3})(\bar{\gamma}(x_{a_3})) \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

which is of the form $f^T x$

$$\therefore\ f^T = \begin{bmatrix} -\omega(x_{a_1})\bar{\gamma}(x_{a_1}) & -\omega(x_{a_2})\bar{\gamma}(x_{a_2}) & -\omega(x_{a_3})\bar{\gamma}(x_{a_3}) \end{bmatrix}$$

Constraints :

$$\hat{\gamma}(x_a) \leq \hat{\gamma}(y_a) \quad \forall (x_a, y_a) : x_a \leq y_a .$$

let $X = \{x_{a_1}, x_{a_2}, x_{a_3}\}$

and $x_{a_1} \leq x_{a_2}$

$x_{a_2} \leq x_{a_3}$

Now the constraints become

$$\hat{\gamma}(x_{a_1}) \leq \hat{\gamma}(x_{a_2}) \Rightarrow \hat{\gamma}(x_{a_1}) - \hat{\gamma}(x_{a_2}) \leq 0$$

$$\hat{\gamma}(x_{a_2}) \leq \hat{\gamma}(x_{a_3}) \Rightarrow \hat{\gamma}(x_{a_2}) - \hat{\gamma}(x_{a_3}) \leq 0$$

which is of the form

$$Ax \leq b$$

$$\underbrace{\begin{bmatrix} 1 & -1 & 0 \\ 0 & 1 & -1 \end{bmatrix}}_{(A)} \underbrace{\begin{bmatrix} \hat{\gamma}(x_{a_1}) \\ \hat{\gamma}(x_{a_2}) \\ \hat{\gamma}(x_{a_3}) \end{bmatrix}}_{(x)} \leq \underbrace{\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}}_{(b)}$$