Then, focusing on G,

$$\begin{aligned}G_m =&\text{argmin}_G \sum_{i=1}^{N} w_i^{(m)} \exp\{y_i \frac{\alpha}{2} G(x_i)]\}\\
=&\text{argmin}_G \left(\sum_{G(x_i)=y_i} w_i^{(m)} \exp\{-\frac{\alpha}{2}\} + \sum_{G(x_i)\neq y_i} w_i^{(m)} \exp\{\frac{\alpha}{2}\} \right)\\
=&\text{argmin}_G \left(\exp\{-\frac{\alpha}{2}\} \sum_{i=1}^{N} w_i^{(m)} + \right.\\
&\left. + \left(\exp\{\frac{\alpha}{2}\} - \exp\{-\frac{\alpha}{2}\}\right) \sum_{G(x_i)\neq y_i} w_i^{(m)} \right)\\
=&\text{argmin}_G \left(\exp\{-\frac{\alpha}{2}\} \sum_{i=1}^{N} w_i^{(m)} + \right.\\
&\left. + \left(\exp\{\frac{\alpha}{2}\} - \exp\{-\frac{\alpha}{2}\}\right) \sum_{i=1}^{N} w_i^{(m)} I(G(x_i) \neq y_i) \right)\end{aligned}$$

so $G_m = \text{argmin}_G \sum_{i=1}^{N} w_i^{(m)} I(y_i \neq G(x_i))$. For the explanation of the steps, see lecture 11 notes (page 4).

Focusing on α, instead,

$$\alpha_m = \text{argmin}_\alpha \sum_{i=1}^{N} w_i^{(m)} \exp\{y_i \frac{\alpha}{2} G(x_i)]\}$$

Deriving with respect to α

$$-\sum_{G(x_i)=y_i} w_i^{(m)} \exp\{-\frac{\alpha}{2}\} + \sum_{G(x_i)\neq y_i} w_i^{(m)} \exp\{\frac{\alpha}{2}\} = 0$$

$$-\sum_{G(x_i)=y_i} w_i^{(m)} + \sum_{G(x_i)\neq y_i} w_i^{(m)} \exp\{\alpha\} = 0$$

$$\exp\{\alpha\} \frac{\sum_{G(x_i)\neq y_i} w_i^{(m)}}{\sum_{i=1}^{N} w_i^{(m)}} = \frac{\sum_{G(x_i)=y_i} w_i^{(m)}}{\sum_{i=1}^{N} w_i^{(m)}}$$

and

$$\alpha_m = \log\left(\frac{1 - \text{err}_m}{\text{err}_m}\right)$$

where

$$\text{err}_m = \frac{\sum_{i=1}^{N} w_i^{(m)} I(y_i \neq G_m(x_i))}{\sum_{i=1}^{N} w_i^{(m)}}$$