Obviously, $I_{\lambda>0} = I_\lambda \cup K_\lambda$ and $I_{\mu>0} = I_\mu \cup K_\mu$, so $p_f \leq p_m$ and $q_f \leq q_m$. *Intuitively a blue point that fails the margin is on the wrong side of the blue margin and a red point that fails the margin is on the wrong side of the red margin.* The points in $I_{\lambda>0}$ not in $K_\lambda$ are on the blue margin and the points in $I_{\mu>0}$ not in $K_\mu$ are on the red margin. There are $p - p_m$ points $u_i$ classified correctly on the blue side and outside the $\delta$-slab and there are $q - q_m$ points $v_j$ classified correctly on the red side and outside the $\delta$-slab.

It is easy to show that we have the following bounds on $K$:

$$\max\left\{\frac{1}{2p_m}, \frac{1}{2q_m}\right\} \leq K \leq \min\left\{\frac{1}{2p_f}, \frac{1}{2q_f}\right\}.$$

These inequalities restrict the choice of $K$ quite heavily.

It will also be useful to understand how points are classified in terms of $\epsilon_i$ (or $\xi_j$).

(1) If $\epsilon_i > 0$, then by complementary slackness $\lambda_i = K$, so the $i$th equation is active and by (2) above,

$$w^\top u_i - b - \delta = -\epsilon_i.$$

Since $\epsilon_i > 0$, the point $u_i$ is within the open half space bounded by the blue margin hyperplane $H_{w,b+\delta}$ and containing the separating hyperplane $H_{w,b}$; if $\epsilon_i \leq \delta$, then $u_i$ is classified correctly, and if $\epsilon_i > \delta$, then $u_i$ is misclassified.

Similarly, if $\xi_j > 0$, then $v_j$ is within the open half space bounded by the red margin hyperplane $H_{w,b-\delta}$ and containing the separating hyperplane $H_{w,b}$; if $\xi_j \leq \delta$, then $v_j$ is classified correctly, and if $\xi_j > \delta$, then $v_j$ is misclassified.

(2) If $\epsilon_i = 0$, then the point $u_i$ is correctly classified. If $\lambda_i = 0$, then by (3) above, $u_i$ is in the closed half space on the blue side bounded by the blue margin hyperplane $H_{w,b+\delta}$. If $\lambda_i > 0$, then by (1) and (2) above, the point $u_i$ is on the blue margin.

Similarly, if $\xi_j = 0$, then the point $v_j$ is correctly classified. If $\mu_j = 0$, then $v_j$ is in the closed half space on the red side bounded by the red margin hyperplane $H_{w,b-\delta}$, and if $\mu_j > 0$, then the point $v_j$ is on the red margin.

It shown in Section 54.2 how the dual program is solved using ADMM from Section 52.6. If the primal problem is solvable, this yields solutions for $\lambda$ and $\mu$.

If the optimal value is 0, then $\gamma = 0$ and $X\begin{pmatrix}\lambda\\ \mu\end{pmatrix} = 0$, so in this case it is not possible to determine $w$. However, if the optimal value is $> 0$, then once a solution for $\lambda$ and $\mu$ is obtained, by $(*_w)$, we have

$$\begin{aligned}
\gamma &= \frac{1}{2}\left(\begin{pmatrix}\lambda^\top & \mu^\top\end{pmatrix} X^\top X \begin{pmatrix}\lambda\\ \mu\end{pmatrix}\right)^{1/2} \\
w &= \frac{1}{2\gamma}\left(\sum_{i=1}^p \lambda_i u_i - \sum_{j=1}^q \mu_j v_j\right),
\end{aligned}$$