Step1

$$y_{n(t)}W_t^T x_{n(t)} \le 0 \ then \ \left\lfloor \frac{-y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|^2} \right\rfloor \ge 0 \ and \ \left\lceil \frac{-y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|^2} \right\rceil \ge 1$$

Step2

$$W_f^T W_{t+1} = W_f^T \left(W_t + y_{n(t)}x_{n(t)} * \left\lfloor \frac{-y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|^2} + 1 \right\rfloor \right)$$

$$\ge W_f^T W_t + y_{n(t)}W_f^T x_{n(t)} * \left\lfloor \frac{-y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|^2} \right\rfloor + y_{n(t)}W_f^T x_{n(t)} \qquad \because \lfloor X+1 \rfloor = \lfloor X \rfloor + 1$$

$$\ge W_f^T W_t + y_{n(t)}W_f^T x_{n(t)} \qquad \because y_{n(t)}W_f^T x_{n(t)} > 0 \ and \ \left\lfloor \frac{-y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|^2} \right\rfloor \ge 0$$

$$\ge W_f^T W_t + \min_n y_n W_f^T x_n$$

Step3

$$\|W_{t+1}\|^2 \le \left\| W_t + y_{n(t)}x_{n(t)} * \left\lfloor \frac{-y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|^2} + 1 \right\rfloor \right\|^2$$

$$= \|W_t\|^2 + 2 * y_{n(t)}W_t x_{n(t)} * \left\lfloor \frac{-y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|^2} + 1 \right\rfloor + \left\| y_{n(t)}x_{n(t)} * \left\lfloor \frac{-y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|^2} + 1 \right\rfloor \right\|^2$$

$$\le \|W_t\|^2 + 2 * y_{n(t)}W_t x_{n(t)} * \left(\frac{-y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|^2} + 1 \right) + \|y_{n(t)}\|^2 \|x_{n(t)}\|^2 \left\| \frac{-y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|^2} + 1 \right\|^2$$

$$\because \lfloor X \rfloor \le X \ and \ \lfloor X \rfloor^2 \le X^2 \ when \ X \ge 0$$

$$= \|W_t\|^2 + 2 * y_{n(t)}W_t x_{n(t)} * \left(\frac{-y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|^2} + 1 \right) + \left\| \frac{-y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|} + \|x_{n(t)}\| \right\|^2$$

$$= \|W_t\|^2 - 2 * \left(\frac{y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|} \right)^2 + 2 * y_{n(t)}W_t x_{n(t)} + \left\| \frac{-y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|} \right\|^2$$

$$+2 * \left(\frac{-y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|} \right) * \|x_{n(t)}\| + \|x_{n(t)}\|^2$$

$$= \|W_t\|^2 - 2 * \left\| \frac{y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|} \right\|^2 + 2 * y_{n(t)}W_t x_{n(t)}$$

$$+ \left\| \frac{y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|} \right\|^2 + 2 * \left(-y_{n(t)}W_t^T x_{n(t)} \right) + \|x_{n(t)}\|^2$$

$$= \|W_t\|^2 - \left\| \frac{y_{n(t)}W_t^T x_{n(t)}}{\|x_{n(t)}\|} \right\|^2 + \|x_{n(t)}\|^2$$

$$\le \|W_t\|^2 + \|x_{n(t)}\|^2 \le \|W_t\|^2 + \max_n \|x_{n(t)}\|^2$$

Start from $W_0 = 0, after\ T\ mistake\ corrections,$

$$W_f^T W_T \ge T * \min_n y_n W_f^T x_n \cdots (1)$$

$$\|W_T\|^2 \le T * \max_n \|x_{n(t)}\|^2 \to \|W_T\| \le \sqrt{T} * \max_n \|x_{n(t)}\| \cdots (2)$$

Combining inequality (1) and (2), we can derive to inequality $1 \geq \frac{W_f^T W_T}{\|W_T\| \|W_f\|} \geq \sqrt{T} * \frac{\min_n y_n W_f^T x_n}{\|W_f\| * \max_n \|x_{n(t)}\|}$

When T grows to $\frac{1}{constant^2}$, $\frac{W_f^T W_T}{\|W_T\| \|W_f\|}$ will be 1 and make W_T equal to W_f.