Dasten Turlin HW1 ROBT 407 201637993

0.2

(a) Show that $y(t)\, w^T(t)\, x(t) < 0$

As $x(t)$ is missclassified by $g_w(t)$ this means that.

$\text{sign}\,(y(t)) \neq \text{sign}(w^T(t)\, x(t))$.

Therefore, product of $y(t)$ and $w^T(t)\, x(t)$ will be < 0.

(b) Two possible cases here:

$y(t) = 1$ and $y(t) = -1$

1. $y(t) = 1$

We know that $y(t) \cdot w^T(t)\, x(t) < 0$.

Therefore, we can prove that $y(t) \cdot w^T(t+1)\, x(t) > 0$ and it will be enough.

As $x(t)$ is classified correctly by $g_w(t+1)$, we can infer that:

$\text{sign}\,(y(t)) = \text{sign}\,(w^T(t+1)\, x(t)) \Rightarrow y(t)\, w^T(t+1)\, x(t) > 0 \Rightarrow$

$\Rightarrow y(t)\, w^T(t+1)\, x(t) > y(t)\, w^T(t)\, x(t)$

2. Same for $y(t) = -1$.

Dasten Turlin

0.4 Discrete r.v.:

$$E[XY] = \sum_{1}^{n} P(X=x, Y=y)\, xy = \sum P(X=x)\, P(Y=y)\, xy$$

$$= \sum P(X=x)\, x \;\; P(Y=y)\, y$$

$$= \sum P(X=x)\, x \;\; P(Y=y)\, y$$

$$= E[X]\, E[Y]$$

Continuous r.v.

$$E[XY] = \int_{-\infty}^{\infty} f(X=x, Y=y)\, xy \, dx\, dy = \int_{-\infty}^{\infty} f(X=x)\, f(Y=y)\, xy \, dx\, dy$$

$$= \int_{-\infty}^{\infty} f(X=x)\, x \, dx \int_{-\infty}^{\infty} f(Y=y)\, y\, dy$$

$$= E[X]\, E[Y]$$

0.6 Naive Bayes

$$P(S|W) = \frac{P(W|S)\, P(S)}{P(W)} = \frac{P(W|S)\, P(S)}{\underbrace{P(W|S)\, P(S) + P(W|S^{C})\, P(S^{C})}_{\text{by the law of total probability}}}$$

$$= \frac{P(W|S)\, P(S)}{P(W|S)\, P(S) + P(W|H)\, P(H)}$$