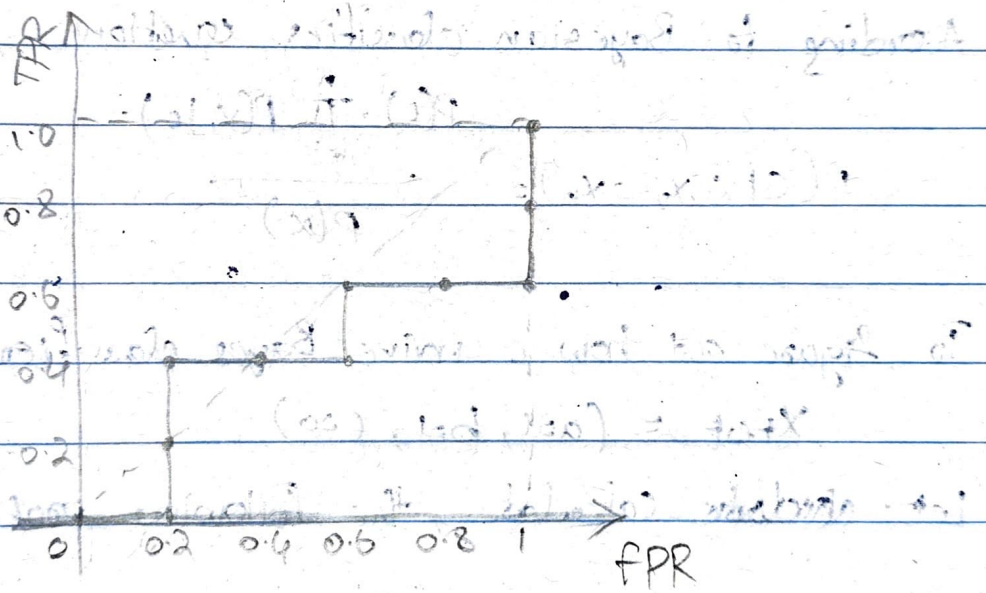
CAP 5771 Assignment-3 MN22L

1. Given posterior probabilities of a classification model with 10 instances. The sorted list is as follows:

Instance	True Class	P(+|A)
3	−	0.68
1	+	0.61
5	+	0.45
7	−	0.38
4	−	0.31
6	+	0.09
8	−	0.05
10	−	0.04
2	+	0.03
9	+	0.01

Class	+	+	-	-	+	-	-	+	+	-	-
Threshold >=	.01	.03	.04	.05	.09	.31	.38	.45	.61	.68	1
TP	5	4	3	3	3	2	2	2	1	0	0
FP	5	5	5	4	3	3	2	1	1	1	0
TN	0	0	0	1	2	2	3	4	4	4	5
FN	0	1	2	2	2	3	3	3	4	5	5
TPR	1	.8	.6	.6	.6	.4	.4	.4	.2	0	0
FPR	1	1	1	.8	.6	.6	.4	.2	.2	.2	0

ROC plot is the FPR vs TPR graph



2. Given training data

a	b	c	k
1	0	1	1
1	1	1	1
0	1	1	0
1	1	0	0
1	0	1	0
0	0	0	1
0	0	0	1
0	0	1	0

According to Bayesian classifier equation

$$P(c|x_1, x_2 \cdots x_n) = \frac{P(c) \cdot \prod_{i=1}^{n} P(x_i|c)}{P(x)}$$

To figure out how a naive Bayes classifier will classify

$$x_{test} = (a=1, b=1, c=0)$$

Let ~~calculate~~ calculate, the following probabilities

$$P(K=1 | a=1, b=1, c=0) = \frac{P(K=1)\left[P(a=1|K=1) \cdot P(b=1|K=1) \cdot P(c=0|K=1)\right]}{P(X_{test})}$$

$$= \frac{(1/2)\left[1/2 \times 1/4 \times 1/2\right]}{P(x)} = \frac{1/32}{P(x)}$$

$$P(k=0 \mid a=1, b=1, c=0) = \frac{P(k=0)\left[P(a=1 \mid k=0) \cdot P(b=1 \mid k=0) \cdot P(c=0 \mid k=0)\right]}{P(x)}$$

$$= \frac{(1/2)\left[1/2 \times 1/2 \times 1/4\right]}{P(x)} = \frac{1/32}{P(x)}$$

∴ Since both the probabilities are same, for the given training data, a naive bayes classifier will classify $X_{test} = (a=1, b=1, c=0)$ as $k=0$ (or) $k=1$ randomly.