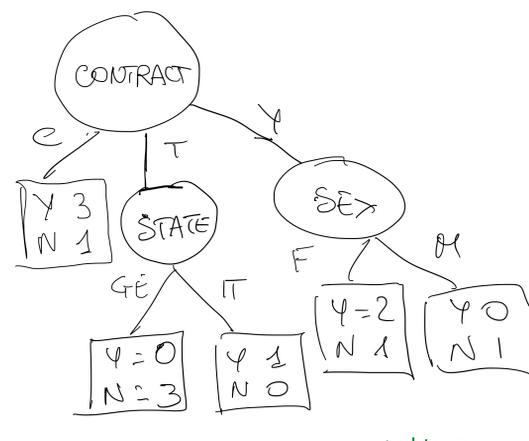


SIMULATE THE DT LEARNING

	STATE	CONTRACT	SEX	CALLS	CHURN	PREDICTION
1	IT	C	F	>10	Y	Y
2	GE	T	M	≤10	Y	N
3	IT	T	M	>10	Y	Y
4	GE	T	F	≤10	Y	N
5	GE	T	F	>10	Y	Y
6	GE	C	M	≤10	Y	Y
7	GE	C	M	≤10	Y	Y
8	GE	Y	F	≤10	Y	Y
9	GE	Y	F	>10	Y	Y
10	GE	Y	F	≤10	Y	Y
11	GE	Y	F	>10	Y	Y
12	IT	C	F	>10	N	N



ROOT
Y = 6
N = 6
ME = 6/12

$ME = 1 - \max(P)$

CONFUSION MATRIX ON TRAINING

STATE

Y	IT	GE
N	1	5

$ME(IT) = 1/3$
 $ME(GE) = 4/3$
 $E = \frac{1}{3} \cdot \frac{3}{12} + \frac{4}{3} \cdot \frac{9}{12} = \frac{5}{12}$

ACTUAL \ PREDICTED

	Y	N
Y	TP 6	FN 0
N	FP 2	TN 4

CONTRACT

Y	C	T	Y
N	1	3	2

$ME(C) = 1/4$
 $ME(T) = 1/4$
 $ME(Y) = 2/4$
 $E = \frac{1}{4} \cdot \frac{4}{12} + \frac{1}{4} \cdot \frac{4}{12} + \frac{2}{4} \cdot \frac{6}{12} = \frac{4}{12}$

CT

Y	CT	Y
N	4	2

$ME(CT) = 6/8$
 $ME(Y) = 2/4$
 $E = \frac{6}{8} \cdot \frac{8}{12} + \frac{2}{4} \cdot \frac{6}{12} = \frac{6}{12}$

C

Y	C	TY
N	1	5

$ME(C) = 1/4$
 $ME(TY) = 3/8$
 $E = \frac{1}{4} \cdot \frac{4}{12} + \frac{3}{8} \cdot \frac{8}{12} = \frac{4}{12}$

CY

Y	CY	T
N	5	3

$ME(CY) = 3/8$
 $ME(T) = 1/4$
 $E = \frac{3}{8} \cdot \frac{8}{12} + \frac{1}{4} \cdot \frac{6}{12} = \frac{4}{12}$

SEX

Y	F	M
N	4	2

$ME(F) = 3/7$
 $ME(M) = 2/5$
 $E = \frac{3}{7} \cdot \frac{7}{12} + \frac{2}{5} \cdot \frac{5}{12} = \frac{5}{12}$

CALLS

Y	≤10	>10
N	2	3

$ME(≤10) = 2/5$
 $ME(>10) = 3/7$
 $E = \frac{2}{5} \cdot \frac{5}{12} + \frac{3}{7} \cdot \frac{7}{12} = \frac{5}{12}$

SELECT CONTRACT = C

Y = 3
N = 1
ME = 1/4

STATE

Y	IT	GE
N	1	0

$ME(IT) = 1/2$
 $ME(GE) = 0$
 $E = \frac{1}{2} \cdot \frac{2}{4} = \frac{1}{4}$

SEX

Y	F	M
N	1	0

$ME(F) = 1/2$
 $ME(M) = 0$
 $E = \frac{1}{2} \cdot \frac{2}{4} = \frac{1}{4}$

CALLS

Y	≤10	>10
N	0	1

$ME(≤10) = 0$
 $ME(>10) = 1/3$
 $E = \frac{1}{3} \cdot \frac{3}{4} = \frac{1}{4}$

NO IMPROVEMENT

SELECT CONTRACT = T : Y = 1, N = 3, E = 1/4

STATE

Y	IT	GE
N	0	3

$ME(IT) = 0$
 $ME(GE) = 0$
 $E = 0$

We can stop with STATE because we reach the lowest value for the error

SELECT CONTRACT = Y :

Y = 2
N = 2
E = 2/4

STATE

Y	IT	GE
N	0	2

$ME(IT) = 0$
 $ME(GE) = 2/4$
 $E = \frac{2}{4} \cdot \frac{4}{4} = \frac{2}{4}$

SEX

Y	F	M
N	2	0

$ME(F) = 1/3$
 $ME(M) = 0$
 $E = \frac{1}{3} \cdot \frac{3}{4} = \frac{1}{4}$

CALLS

Y	≤10	>10
N	1	1

$ME(≤) = 1/2$
 $ME(>) = 1/2$
 $E = \frac{1}{2} \cdot \frac{2}{4} + \frac{1}{2} \cdot \frac{2}{4} = \frac{2}{4}$

SELECT SEX = F

Y = 2
N = 1
E = 1/3

STATE

Y	IT	GE
N	0	1

$ME(IT) = 0$
 $ME(GE) = 1/3$
 $E = \frac{1}{3} \cdot \frac{3}{3} = \frac{1}{3}$

CALLS

Y	≤10	>10
N	1	0

$ME(≤10) = 1/2$
 $ME(>10) = 0$
 $E = \frac{1}{2} \cdot \frac{2}{3} = \frac{1}{3}$

NO IMPROVEMENT