

HW4 0816192 張嘉誠

1. NCTUNCTUNYCU

(a)

$$\eta = \sum_{i=1}^n p_i \log_2 \frac{1}{p_i}$$

$$P_N = \frac{1}{4} \quad P_C = \frac{1}{4} \quad P_T = \frac{3}{20} \quad P_U = \frac{1}{4} \quad P_Y = \frac{1}{10}$$

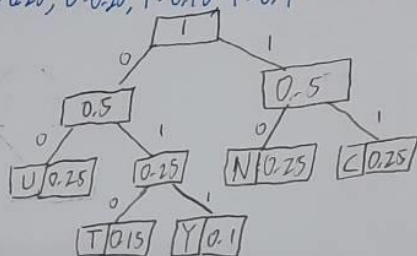
$$\begin{aligned} \eta &= \left(\frac{1}{4} \log_2 4\right) \times 3 + \left(\frac{3}{20} \log_2 \frac{20}{3}\right) + \frac{1}{10} \log_2 10 \\ &= \frac{3}{2} + \frac{3}{20} (2 + \log_2 5 - \log_2 3) + \frac{1}{10} (1 + \log_2 5) \\ &= \frac{3}{2} + \frac{3}{10} + \frac{3}{20} \log_2 5 - \frac{3}{20} \log_2 3 + \frac{1}{10} + \frac{1}{10} \log_2 5 \\ &= \frac{19}{10} + \frac{1}{4} \log_2 5 - \frac{3}{20} \log_2 3 = 2.2427 \end{aligned}$$

Symbols	N	C	T	U	Y
Count	5	5	3	5	2
Probability	0.25	0.25	0.15	0.25	0.1

Symbols	Probability
N	0.25
C	0.25
U	0.25
T	0.15
Y	0.1

Binary Tree:

$$N=0.25, C=0.25, U=0.25, T=0.15, Y=0.1$$



Encoding:

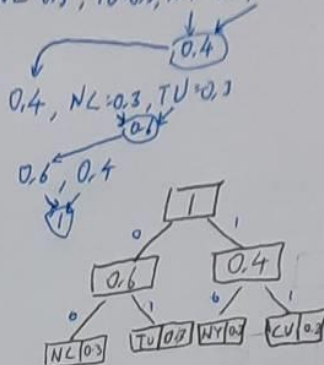
Symbols	N	C	T	U	Y
Code	10	11	010	00	011

Encode: 1011010201011010001001110010110100010011100

Pattern	NC	TU	NY	CU
Count	3	3	2	2
Probability	0.3	0.3	0.2	0.2

Binary Tree:

$$N=0.3, T=0.3, Y=0.2, C=0.2$$



Encoding:

Pattern	NC	TU	NY	CU
Code	00	01	10	11

Encode: 00010001101100011011

(d)

Symbol	Probability	Range
C	0.25	[0, 0.25)
N	0.25	[0.25, 0.5)
T	0.15	[0.5, 0.65)
U	0.25	[0.65, 0.9)
Y	0.1	[0.9, 1)

2
.25
.25
1.25
80
625

Symbol	low	high	range
	0	1.0	1.0
N	0.25	0.5	0.25
C	0.25	0.3125	0.0625

Output: 0.3

2. First level:

120	20	20	15
40	30	08	12
30	20	84	126
20	20	120	110

row
operation

70	17.5	50	2.5
35	10	5	-2
25	105	5	-21
20	115	0	5

column
operation

52.5	13.75	27.5	0.25
22.5	110	2.5	-8
17.5	3.75	22.5	2.25
2.5	-5	2.5	-13

Second level:

52.5	13.75
22.5	110

row
operation

33.125	19.375
66.25	-43.75

column
operation

49.6875	-12.1875
-16.5625	-31.5625

Output:

49.6875	-12.1875	27.5	0.25
-16.5625	-31.5625	2.5	-8
17.5	3.75	22.5	2.25
2.5	-5	2.5	-13

3. $T_0 = 32$

dominant pass: pttt.

subordinate passes: 1

Subband	Coefficient Value	Symbol	Reconstruction Value
LL2	49.6875	p	48
HL2	-12.1875	t	0
LH2	-16.5625	t	0
HH2	-31.5625	t	0

Coefficient Magnitude	Symbol	Reconstruction Magnitude
49.6875	1	56