Informationstheorie – Übung

Lucerne University of Applied Sciences and Arts
HOCHSCHULE LUZERN
www.hslu.ch
HMT 1/2
Felix Rohrer

A

1) Entropie

$H(x) = -x \cdot (\log_2(x))$

$H(\text{"a"}) = -0{,}082 \cdot (\log_2(0{,}082)) = 0{,}296$

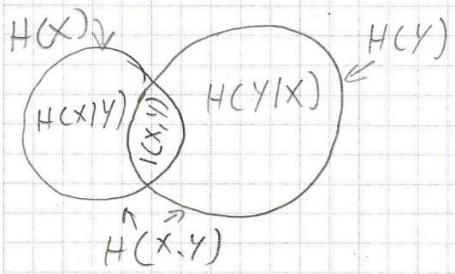
$H(\text{"b"}) = -0{,}014 \cdot (\log_2 0{,}014 = 0{,}096$

$H(a\text{-}z) = H(\text{"a"}) + H(\text{"b"}) + H(\text{"c"}) + \ldots + H(\text{"z"})$

$= 4{,}1319$

2) Entropie, Verbund-Entropie, etc.

y \ x	0	1	P(y)
0	1/3	1/3	2/3
1	0	1/3	1/3
P(x)	1/3	2/3	



(Randsumme) $H(X) = -(1/3 \cdot (\log_2(1/3)) + 2/3 \cdot (\log_2(2/3)) = 0{,}9183$ bit

$H(Y) = -(2/3 \cdot \log_2(2/3) + 1/3 \cdot (\log_2(1/3)) = 0{,}9183$ bit

(alle) $H(X,Y) = -(3 \cdot 1/3 (\log_2(1/3))) = 1{,}5850$ bit

$H(X|Y) = H(X,Y) - H(Y)$

$= 1{,}585 - 0{,}9183 = 0{,}6667$ bit

$H(Y|X) = H(X,Y) - H(X)$

$= 1{,}585 - 0{,}9183 = 0{,}6667$ bit

$I(X,Y) = H(X) + H(Y) - H(X,Y) = 0{,}2516$ bit

3) Länge der Kodierung

$P(X=1) = 1/3$ $\quad C(1) = 0$

$P(X=2) = 1/3$ $\quad C(2) = 10$

$P(X=3) = 1/3$ $\quad C(3) = 11$

$H(X) = -(3 \cdot 1/3 \cdot (\log_2(1/3))) = 1{,}5850$ bit

$L(C) = \sum_{x \in X} p(x) \cdot C(x)$

$= 1/3 \cdot 1 + 1/3 \cdot 2 + 1/3 \cdot 2 = 1{,}67$ Bit

0|1 1|0|1 1|1 1|0|0|1 1|0

1 3 1 3 3 1 1 3 1

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4) Kodierung

a) 26 + 26 + 1 = 53 Zeichen

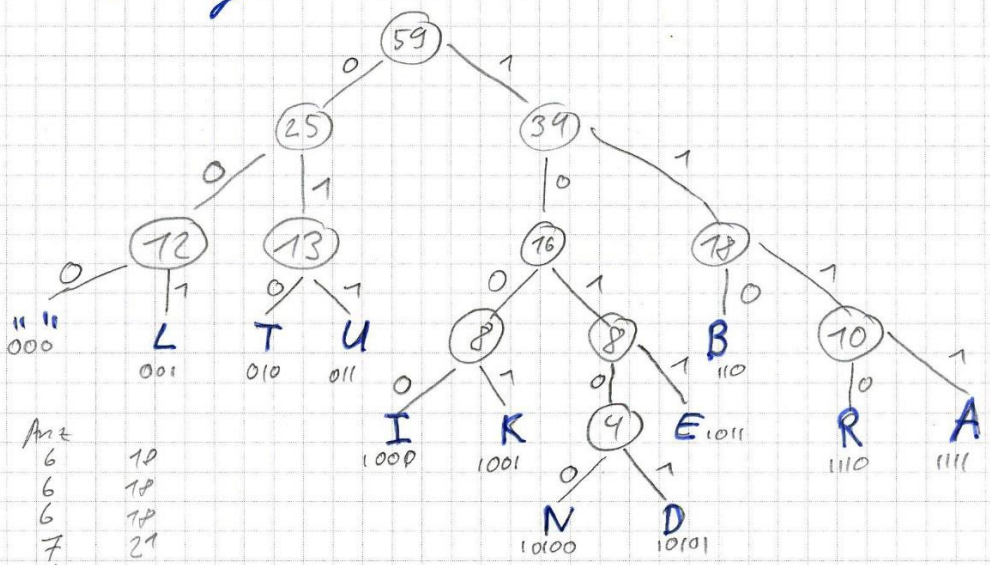
AnzBit = $\log_2(53) = 5{,}73 \Rightarrow$ 6 Bit

b) "Blacktrack...." ⇒ 13 Zeichen → $\log_2(13) \Rightarrow 3{,}70$ bit ⇒ 4 Bit

"blacktrack..." ⇒ 12 Zeichen → $\log_2 12 = 3{,}585$ bit ⇒ 4 Bit

5) Huffmann-Kodierung

b : 8
u : 7
a, ,t, " " : 6
e,i,k,r : 4
d : 3
n : 1



		Bits	Anz	
" "	000	3	6	18
L	001	3	6	18
T	010	3	6	18
U	011	3	7	21
I	1000	4	4	16
K	1001	4	4	16
B	110	3	8	24
E	1011	4	4	16
R	1110	4	4	16
A	1111	4	6	24
N	10100	5	1	5
D	10101	5	3	15
			59	207 Bits

Vergleiche Musterlös.