Teorija informacije – PREGLED NAJVAŽNIJIH IZRAZA

KOLIČINA INFORMACIJE

$$I(x_i) = -\log_2 p(x_i) \left[\frac{\text{bit}}{\text{simbol}}\right]$$

$$I(x_1 x_2 \dots x_k) = -\log_2[p(x_1)\cdot p(x_2)\cdot \dots \cdot p(x_k)] \left[\frac{\text{bit}}{\text{poruka}}\right]$$

VJEROJATNOSTI U KOMUNIKACIJSKOM SUSTAVU

$$[p(y_j|x_i)] = \begin{bmatrix} p(y_1|x_1) & p(y_2|x_1) & \dots & p(y_m|x_1) \\ p(y_1|x_2) & p(y_2|x_2) & \dots & p(y_m|x_2) \\ \dots & \dots & \dots & \dots \\ p(y_1|x_n) & p(y_2|x_n) & \dots & p(y_m|x_n) \end{bmatrix} \begin{matrix} \}\Sigma = 1 \\ \}\Sigma = 1 \\ \dots \\ \}\Sigma = 1 \end{matrix}$$

$$[p(y_j)] = [p(x_i)][p(y_j|x_i)] \quad [p(x_j)]^T = [p(x_i|y_j)][p(y_j)]^T$$

$$[p(x_i, y_j)] = [p(x_i)p(y_j|x_i)] = [p(x_i|y_j)p(y_j)]$$

$$p(x_i|y_j) = \frac{p(x_i, y_j)}{p(y_j)} = \frac{p(x_i, y_j)}{\sum_{i=1}^{n} p(x_i, y_j)} = \frac{p(x_i)p(y_j|x_i)}{\sum_{i=1}^{n} p(x_i)p(y_j|x_i)}$$

$$[p(x_i, y_j)] = \begin{bmatrix} p(x_1, y_1) & p(x_1, y_2) & \dots & p(x_1, y_m) \\ p(x_2, y_1) & p(x_2, y_2) & \dots & p(x_2, y_m) \\ \dots & \dots & \dots & \dots \\ p(x_n, y_1) & p(x_n, y_2) & \dots & p(x_n, y_m) \end{bmatrix} \begin{matrix} \}\Sigma = p(x_1) \\ \}\Sigma = p(x_2) \\ \dots \\ \}\Sigma = p(x_n) \end{matrix}$$
$$\Sigma = p(y_1) \quad \Sigma = p(y_2) \quad \dots \quad \Sigma = p(y_m)$$

ENTROPIJA

$$H(X) = -\sum_{i=1}^{n} p(x_i)\log_2 p(x_i) \left[\frac{\text{bit}}{\text{simbol}}\right]$$

$$H(Y) = -\sum_{j=1}^{m} p(y_j)\log_2 p(y_j) \left[\frac{\text{bit}}{\text{simbol}}\right]$$

$$H(X,Y) = -\sum_{i=1}^{n}\sum_{j=1}^{m} p(x_i, y_j)\log_2 p(x_i, y_j) \left[\frac{\text{bit}}{\text{simbol}}\right]$$

ENTROPIJA ŠUMA (IRELEVANTNOST)

$$H(Y|X) = -\sum_{i=1}^{n}\sum_{j=1}^{m} p(x_i, y_j)\log_2 p(y_j|x_i) \left[\frac{\text{bit}}{\text{simbol}}\right]$$

EKVIVOKACIJA (MNOGOZNAČNOST)

$$H(X|Y) = -\sum_{i=1}^{n}\sum_{j=1}^{m} p(x_i, y_j)\log_2 p(x_i|y_j) \left[\frac{\text{bit}}{\text{simbol}}\right]$$

SREDNJI SADRŽAJ INFORMACIJE (TRANSINFORMACIJA)

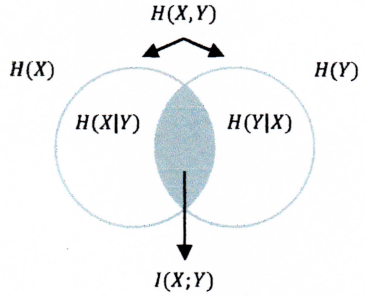
$$I(X;Y) = \sum_{i=1}^{n}\sum_{j=1}^{m} p(x_i, y_j)\log_2 \frac{p(x_i, y_j)}{p(x_i)p(y_j)} \left[\frac{\text{bit}}{\text{simbol}}\right]$$

$$I(X;Y) = H(X) - H(X|Y) \quad I(X;Y) = H(Y) - H(Y|X) \quad I(X;X) = H(X)$$

$$I(X;Y) = H(X) + H(Y) - H(X,Y)$$

$$H(X,Y) = H(X) + H(Y|X) \quad H(X,Y) = H(Y) + H(X|Y)$$

X i Y nezavisni $\rightarrow H(X,Y) = H(X) + H(Y)$



RELATIVNA ENTROPIJA

$$D(p\|q) = \sum_{i=1}^{n} p(x_i)\log\frac{p(x_i)}{q(x_i)}$$

KAPACITET DISKRETNOG KOMUNIKACIJSKOG KANALA

$$C = \max_{\{p(x_i)\}} I(X;Y) = \max_{\{p(x_i)\}} \left(H(Y) - H(Y|X)\right) \left[\frac{\text{bit}}{\text{simbol}}\right]$$

INFORMACIJSKA BRZINA IZVORIŠTA

$$R = \frac{H(X)}{T_s} \left[\frac{\text{bit}}{\text{s}}\right] \quad (T_s - \text{prosječno trajanje simbola})$$

ENTROPIJSKO KODIRANJE

SREDNJA DULJINA KODNE RIJEČI

$$L(X) = \sum_{i=1}^{n} p(x_i) l_i \left[\frac{\text{bit}}{\text{simbol}}\right]$$

EFIKASNOST KODA

$$\varepsilon = \frac{H(X)}{L(X)}$$

KRAFTOVA NEJEDNAKOST *(nužan i dovoljan uvjet za prefiksni kod)*

$$\sum d^{-L_i} \leq 1$$

OPTIMALNOST KODA *(nužan i dovoljan optimalnosti koda)*

$$H(X) \leq L(X) < H(X) + 1$$

$$\min\left[L(X) = \sum_{i=1}^{n} p(x_i) l_i\right] \text{ uz uvjet } \sum_{i=1}^{n} d^{-L_i} \leq 1$$

SARDINAS-PATTERSONOV TEST

$C(y)$ se dodaje u skup S_{i+1} ako i samo ako:

$\exists\, C(x) \in S_0$ tako da $C(x)C(y) \in S_i$

ili

$\exists\, C(z) \in S_i$ tako da $C(z)C(y) \in S_0$

■ Kod je JDK ako niti jedan S_i $(i \geq 1)$ ne sadrži kodne riječi iz S_0 ■

HUFFMANNOVO KODIRANJE

N – broj simbola; B – baza kodiranja; $k = \left\lceil \frac{N-1}{B-1} \right\rceil$

$N' = (B-1)k + 1$; $N' \neq N \Rightarrow$ dodaj $N' - N$ simbola s $\boldsymbol{p} = 0$

ARITMETIČKO KODIRANJE

$$D' = D + (G - D)\cdot D_s$$

$$G' = D + (G - D)\cdot G_s$$

$\left\lceil \log_2\left(\frac{1}{G' - D'}\right)\right\rceil + 1$ znamenki $\rightarrow$ kod koji se može JDK

$$L_{a(d=10)} = \sum_{i=1}^{N} L_{a(d=2)}(i)\cdot 2^{-i}$$

SREDNJA DULJINA KODNE RIJEČI

$$L(X) = \frac{\sum_{i=1}^{n} p(x_i)\cdot l(x_i)}{\sum_{i=1}^{n} p(x_i)\cdot n(x_i)} \left[\frac{\text{bit}}{\text{simbol}}\right]$$

$l(x_i) \rightarrow$ duljina kodne riječi

$n(x_i) \rightarrow$ broj simbola

VJEROJATNOST POJAVE POJEDINOG SIMBOLA

$$p(\text{pojave\_simbola}) = \frac{p(x_i)\cdot n(x_i)}{L(X)}$$

$n(x_i) \rightarrow$ duljina simbola

VJEROJATNOST ISPRAVNOG PRIJENOSA BINARNOG SIMETRIČNOG KANALA

$$P_{BSK} = \frac{1}{2}(1 + (1 - 2\cdot p)^k) \quad p \rightarrow \text{vjerojatnost pogreške}$$

VJEROJATNOST POGREŠNOG PRIJENOSA BINARNOG SIMETRIČNOG KANALA

$$P_{BSK} = \frac{1}{2}(1 - (1 - 2\cdot p)^k) \quad p \rightarrow \text{vjerojatnost pogreške}$$

Teorija informacije – PREGLED NAJVAŽNIJIH IZRAZA

OSTALO

VJEROJATNOST PRIJELAZA

$$[p(y_j)] = [p(z_k)][p(y_j|z_k)]$$
$$[p(y_j)] = [p(x_i)][p(y_j|x_i)] \rightarrow [p(y_j|x_i)] = [p(z_k|x_i)][p(y_j|z_k)]$$
$$[p(z_k)] = [p(x_i)][p(z_k|x_i)]$$

MATRIČNO

HUFFMANOVO KODIRANJE (m simbola)

$$p(x_i) = \frac{1}{m}$$

$$2^n \leq m < 2^{n+1} \rightarrow k = m - 2^n \quad , \quad m = 2^n + k$$

kodnih riječi duljine n *ima* $\rightarrow 2^n - k$

kodnih riječi duljine $n+1$ *ima* $\rightarrow 2k$

NAJMANJI BROJ ELEMENATA SKUPA

$$\min(\text{card}(X)) \rightarrow \max(H(X))$$

$|X| = \text{card}(X)$

$H(X) \leq \log_2|X|$

$|X| \geq 2^{H(X)}$

~~$\text{card}(X) \geq \log_2(H(X))$~~

NAJMANJA DULJINA KODNE RIJEČI (Aritmetički algoritam)

$$l(x) = \left\lceil \log_2\left(\frac{1}{P(X)}\right) \right\rceil + 1 \text{ [bit]}$$

$$P_i(x) = \prod_{i=1}^{n} p(x_i)$$

ako tražimo minimalnu duljinu $\rightarrow$ *tražimo* $\max(P_i(x))$

KAPACITET SIMETRIČNOG ILI SLABOSIMETRIČNOG ~~KANALA~~

$$H(y) = \log(\text{card}(y)) \quad \text{kx ck} \frac{1}{n}$$

$$C = \log(\text{card}(y)) - H(y|x)$$

$$H(y|x) = \sum_{y \in Y} p(y|x_i) \log\left(\frac{1}{p(y|x_i)}\right)$$

postiže se za

$$p(x_i) = \frac{1}{\text{card}(X)}$$

RETCI PERMUTIRANI

Σ STUP = const.

Vjerojatnosti $p_i = \frac{k_i}{W}$

$$H(x) = \log_2 W - \frac{\sum k_i \log_2 k_i}{W}$$

$$H(X) = -E(\log[p(X)])$$

LZW I = INPUT O = output DICT = NOVO (RR * O)

KORAK	R.R.	I	O	DICT

R.R. = radna riječ I = NOVA_RR

KORAK	DICT	O

DICT = PREP. NIJE NAĐEN

O = PREP_BIO

KORAK

LZ77

(pomak, duljina, sljed_simb)

$$t_{prijenos} = \frac{\text{ukupan broj bita}}{\text{brzina\_veze}}$$

$$\log_2 x = \frac{\ln x}{\ln 2}$$