TINF

Jednoznačna dekodabilnost: So = { skup kodnih riječi C(x) } , S1 = { skup C(y), ako postoji C(x)C(y) u So }

S2= { C(x)c(z) iz S1 ili C(y)C(z) iz S0 } ...

Kod je nesingularan ako vrijedi: $\forall i, j \in \mathrm{N},\ x_i \neq x_j \Rightarrow C(x_i) \neq C(x_j)$ Prefiksan kod (Craft): $\sum_{i=1}^{n} 2\wedge(-li) \leq 1$

$L = \sum_{i=1}^{n} l_i p_i \qquad H(X) \leq L(X) \leq H(X)+1 \qquad \varepsilon_{(d)} = \frac{H_{(d)}(X)}{L_{(d)}(X)}$

$D' = D + (G-D) * D_s$

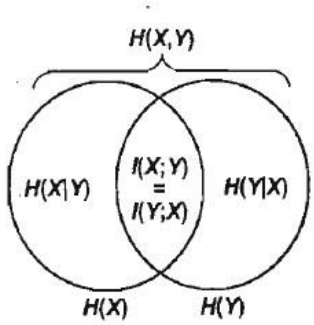
$D' = D + (G-D) * G_s$, uvjet jednoznačnosti $\overline{\log_2 \frac{1}{G'-D'}} + 1\, prvih\, znamenki$

Dekodiranje binarno: A = 0.xxxx iz S[X,Y), A = (A-X)/(Y-X)

T = 1/R ms , R(simbol/s)*L(bit/simbol)=R(bit/s) ,T = (X)/C s

1.	$I(X;Y) = H(X) - H(X\|Y)$
2.	$I(X;Y) = H(Y) - H(Y\|X)$
3.	$I(X;Y) = H(X) + H(Y) - H(X,Y)$
4.	$H(X,Y) = H(X) + H(Y\|X)$
5.	$H(X,Y) = H(Y) + H(X\|Y)$
6.	$I(X;Y) = I(Y;X)$
7.	$I(X;X) = H(X)$
8.	$I(X;Y) \geq 0$
9.	$H(X\|Y) \leq H(X)$

MATEMATIČKI OPIS
$\sum_{i=1}^{n} p(x_i) = \sum_{j=1}^{m} p(y_j) = 1$
$p(x_i) = \sum_{j=1}^{m} p(x_i, y_j), p(y_j) = \sum_{i=1}^{n} p(x_i, y_j)$
$p(x_i y_j) = p(x_i) p(y_j \mid x_i) = p(y_j) p(x_i \mid y_j)$
$p(x_i \mid y_j) = \frac{p(x_i, y_j)}{p(y_j)} = \frac{p(x_i, y_j)}{\sum_{i=1}^{n} p(x_i, y_j)} = \frac{p(x_i) p(y_j \mid x_i)}{\sum_{i=1}^{n} p(x_i) p(y_j \mid x_i)}$



$$C = \max_{\{p(x_i)\}} I(X;Y) = \max_{\{p(x_i)\}} [H(Y) - H(Y \mid X)].$$

pacitet binarnog simetričnog kanala

$$C = 1 + p_g \log_2 p_g + (1-p_g) \log_2 (1-p_g) \quad \left[\frac{\text{bit}}{\text{simbol}}\right]$$

$$H(X,Y) = -\sum_{i=1}^{n} \sum_{j=1}^{m} p(x_i, y_j) \log p(x_i, y_j).$$

$$H(X) = -\sum_{i=1}^{n} p(x_i) \log p(x_i),$$

$$H(Y) = -\sum_{j=1}^{m} p(y_j) \log p(y_j).$$

$$I(X;Y) = \sum_{i=1}^{n} \sum_{j=1}^{m} p(x_i, y_j) \log \frac{p(x_i, y_j)}{p(x_i) p(y_j)}.$$

$$H(X) = -\sum_{i=1}^{\infty} p(x_i) \log_2 p(x_i)$$

$$H(Y \mid X) = \sum_{i=1}^{n} p(x_i) H(Y \mid x = x_i) = -\sum_{i=1}^{n} p(x_i) \sum_{j=1}^{m} p(y_j \mid x_i) \log p(y_j \mid x_i)$$
$$= -\sum_{i=1}^{n} \sum_{j=1}^{m} p(x_i, y_j) \log p(y_j \mid x_i).$$

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

$$I(X;Y) = \sum_{i=1}^{n} \sum_{j=1}^{m} p(x_i, y_j) \log \frac{p(x_i, y_j)}{p(x_i) p(y_j)} = \sum_{i=1}^{n} \sum_{j=1}^{m} p(x_i) p(y_j \mid x_i) \log \frac{p(y_j \mid x_i)}{p(y_j)}$$
$$= \sum_{i=1}^{n} \sum_{j=1}^{m} p(x_i) p(y_j \mid x_i) \log \frac{p(y_j \mid x_i)}{\sum_{i=1}^{n} p(x_i, y_j)} = \sum_{i=1}^{n} \sum_{j=1}^{m} p(x_i) p(y_j \mid x_i) \log \frac{p(y_j \mid x_i)}{\sum_{i=1}^{n} p(x_i) p(y_j \mid x_i)}. \quad (2.3$$

$$\left[p(x_i \mid y_j)\right] = \left[\frac{p(x_i, y_j)}{p(y_j)}\right] =$$

Matrica združenih vjerojatnosti

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

Također, ako su $[p(X)]$ i $[p(Y)]$ dijagonalne matrice tj.:

$$[p(X)]_d = \begin{bmatrix} p(x_1) & 0 & \cdots & 0 \\ 0 & p(x_2) & \cdots & 0 \\ \cdots & \cdots & \ddots & \cdots \\ 0 & 0 & \cdots & p(x_n) \end{bmatrix}$$

$$[p(Y)]_d = \begin{bmatrix} p(y_1) & 0 & \cdots & 0 \\ 0 & p(y_2) & \cdots & 0 \\ \cdots & \cdots & \ddots & \cdots \\ 0 & 0 & \cdots & p(y_m) \end{bmatrix}$$

tada je

$$[p(X,Y)] = [p(X)]_d[p(Y|X)] = [p(X|Y)][p(Y)]_d$$

Vjerojatnost pojave simbola

$$p(x_i) = \sum_{j=1}^{m} p(x_i,y_j), \quad i = 1,\ldots,n$$

$$p(y_j) = \sum_{i=1}^{n} p(x_i,y_j), \quad j = 1,\ldots,m$$

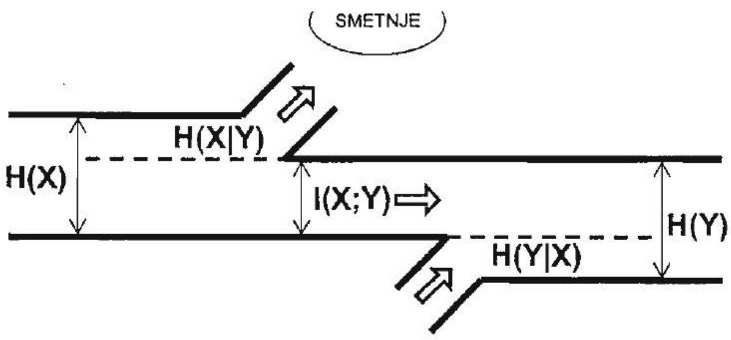
Prijelaz iz apriorne u aposteriornu vjerojatnost pojave x_i

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

Izračun vjerojatnosti na ulazu i izlazu iz matričnog zapisa

$$[p(x_i,y_i)] = \begin{bmatrix} p(x_1,y_1) & p(x_1,y_2) & \cdots & p(x_1,y_m) \\ p(x_2,y_1) & p(x_2,y_2) & \cdots & p(x_2,y_m) \\ \cdots & \cdots & \cdots & \cdots \\ \underbrace{p(x_n,y_1)}_{\sum = p(y_1)} & \underbrace{p(x_n,y_2)}_{\sum = p(y_2)} & \cdots & \underbrace{p(x_n,y_m)}_{\sum = p(y_m)} \end{bmatrix} \begin{matrix} \} \sum = p(x_1) \\ \} \sum = p(x_2) \\ \\ \} \sum = p(x_n) \end{matrix}$$

$$[p(yj \mid xi)] = [p(zk \mid xi)][p(yj \mid zk)]$$



Entropija na ulazu sustava

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

Entropija na izlazu sustava

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

Združena entropija (entropija para slučajnih varijabli)

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

Entropija šuma (irelevantnost)

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

Ekvivokacija (mnogoznačnost)

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

Relativna entropija

$$D(p||q) = \sum_{i=1}^{n} p(x_i)\log_2\frac{p(x_i)}{q(x_i)} \quad \left[\frac{\text{bit}}{\text{simbol}}\right]$$

$p(x_i)$ i $q(x_i)$ – dvije razdiobe vjerojatnosti slučajne varijable X

Vrijedi $D(p||q) \neq D(q||p)$

Srednji uzajamni sadržaj informacije (transinformacija)

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