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Katedra statistiky a pravděpodobnosti

STATISTIKA

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Popisná statistika

$$p_i = \frac{n_i}{n} \qquad \sum_{i=1}^{k} n_i = n \qquad \sum_{i=1}^{k} p_i = 1 \qquad i = 1, 2, ..., k$$

$$n \cdot \frac{p}{100} < z_p < n \cdot \frac{p}{100} + 1$$

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \qquad \bar{x} = \frac{\sum_{i=1}^{k} x_i n_i}{n} \qquad \bar{x} = \sum_{i=1}^{k} x_i p_i \qquad \bar{x} = \frac{\sum_{i=1}^{n} x_i w_i}{\sum_{i=1}^{n} w_i}$$

$$\bar{x}_H = \frac{n}{\sum_{i=1}^{n} \frac{1}{x_i}} \qquad \bar{x}_H = \frac{\sum_{i=1}^{n} w_i}{\sum_{i=1}^{n} \frac{w_i}{x_i}} \qquad \bar{x}_H = \frac{1}{\sum_{i=1}^{n} \frac{p_i}{x_i}}$$

$$\bar{x}_G = \sqrt[n]{\prod_{i=1}^{n} x_i} = \sqrt[n]{x_1 \cdot x_2 \cdot \ldots \cdot x_n} \qquad \bar{x}_G = \sqrt[\sum w_i]{\prod_{i=1}^{n} x_i^{w_i}}$$

$$R = x_{\max} - x_{\min} \qquad R_Q = \tilde{x}_{75} - \tilde{x}_{25}$$

$$s_x^2 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n} \qquad s_x^2 = \overline{x^2} - \bar{x}^2 = \frac{\sum_{i=1}^{n} x_i^2}{n} - \left(\frac{\sum_{i=1}^{n} x_i}{n} \right)^2$$

$$s_x^2 = \frac{\sum_{i=1}^{k} (x_i - \bar{x})^2 n_i}{\sum_{i=1}^{k} n_i} \qquad s_x^2 = \frac{\sum_{i=1}^{k} x_i^2 n_i}{n} - \left(\frac{\sum_{i=1}^{k} x_i n_i}{n} \right)^2$$

$$s_x^2 = \sum_{i=1}^{k} (x_i - \bar{x})^2 p_i \qquad s_x^2 = \sum_{i=1}^{k} x_i^2 p_i - \left(\sum_{i=1}^{k} x_i p_i \right)^2$$

$$s_x^2 = \overline{s^2} + s_{\bar{x}}^2 = \frac{\sum_{i=1}^{k} s_i^2 n_i}{\sum_{i=1}^{k} n_i} + \frac{\sum_{i=1}^{k} (\bar{x}_i - \bar{x})^2 n_i}{\sum_{i=1}^{k} n_i} \qquad \bar{x} = \frac{\sum_{i=1}^{k} \bar{x}_i n_i}{n}$$

$$s_x^2 = \sum_{i=1}^{k} s_i^2 p_i + \sum_{i=1}^{k} (\bar{x}_i - \bar{x})^2 p_i \qquad \bar{x} = \sum_{i=1}^{k} \bar{x}_i p_i$$

$$s_x = \sqrt{s_x^2} \qquad V_x = \frac{s_x}{\bar{x}}$$

$v = 1 - p_{\text{Mo}} = 1 - n_{\text{Mo}}/n$

$nomvar = 1 - \sum_{i=1}^{k} p_i^2 = \sum_{i=1}^{k} \left(p_i(1-p_i)\right)$ $\quad nomvar = 1 - \sum_{i=1}^{k} \left(\frac{n_i}{n}\right)^2 = \frac{n^2 - \sum_{i=1}^{k} n_i^2}{n^2}$

norm. nomvar = $k \cdot nomvar/(k-1)$,

$H = -\sum_{i=1}^{k} p_i \ln p_i$

$H^* = H/\ln k$

$dorvar = 2\sum_{i=1}^{k-1} P_i(1-P_i)$

norm. dorvar = $2 \cdot dorvar/(k-1)$.

Analýza závislostí

Korelační analýza

$$r_{yx} = r_{xy} = \frac{s_{xy}}{s_x s_y} = \frac{\overline{xy} - \bar{x}\bar{y}}{\sqrt{\left(\overline{x^2} - \bar{x}^2\right) \cdot \left(\overline{y^2} - \bar{y}^2\right)}} \qquad r_s = 1 - \frac{6\sum_{i=1}^{n} d_i^2}{n \cdot (n^2 - 1)}$$

Analýza rozptylu

$$S_y = \sum_{i=1}^{k} \sum_{j=1}^{n_i} (y_{ij} - \bar{y})^2 = S_{y.m} + S_{y.v}$$

$$S_{y,m} = \sum_{i=1}^{k} (\bar{y}_i - \bar{y})^2 n_i \qquad S_{y,v} = \sum_{i=1}^{k} \sum_{j=1}^{n_i} (y_{ij} - \bar{y}_i)^2$$

$$P^2 = \frac{S_{y,m}}{S_y} \qquad P = \sqrt{P^2}$$

Kontingenční tabulka (*r* x *s*)

$$n_{i+} = \sum_{j=1}^{s} n_{ij} \qquad n_{+j} = \sum_{i=1}^{r} n_{ij} \qquad n'_{ij} = \frac{n_{i+} n_{+j}}{n}$$

$$G = \sum_{i=1}^{r} \sum_{j=1}^{s} \frac{(n_{ij} - n'_{ij})^2}{n'_{ij}} \qquad C = \sqrt{\frac{G}{n+G}} \qquad V = \sqrt{\frac{G}{n(m-1)}} \qquad m = \min\{r, s\}$$

Regresní analýza

$$b_{yx} = \frac{s_{xy}}{s_x^2} \quad b_{xy} = \frac{s_{xy}}{s_y^2} \quad b_0 = \bar{y} - b_{yx}\bar{x} \quad b_{yx} \cdot b_{xy} = r_{yx}^2 \quad R^2 = \frac{S_{y,T}}{S_y} = 1 - \frac{S_{y,R}}{S_y} \quad |r_{yx}| = \sqrt{R^2}$$

Časové řady

$$\bar{y} = \frac{\sum_{t=1}^{n} y_t}{n}$$

$$\bar{y} = \frac{\frac{y_1 + y_2}{2} + \frac{y_2 + y_3}{2} + \ldots + \frac{y_{n-1} + y_n}{2}}{n-1} = \frac{\frac{1}{2}y_1 + \sum_{t=2}^{n-1} y_t + \frac{1}{2}y_n}{n-1}$$

$$\bar{y} = \frac{\sum_{t=1}^{n} y_t d_t}{\sum_{t=1}^{n} d_t}$$

$$\bar{y} = \frac{\frac{y_1 + y_2}{2}d_2 + \frac{y_2 + y_3}{2}d_3 + \ldots + \frac{y_{n-1} + y_n}{2}d_n}{\sum_{t=2}^{n} d_t}$$

$$\Delta y_t = y_t - y_{t-1}$$

$$\bar{\Delta} = \frac{\sum_{t=2}^{n} \Delta y_t}{n-1} = \frac{y_n - y_1}{n-1}$$

$$\delta_t = \frac{\Delta y_t}{y_{t-1}} = \frac{y_t - y_{t-1}}{y_{t-1}} = \frac{y_t}{y_{t-1}} - 1$$

$$k_t = \frac{y_t}{y_{t-1}}$$

$$\bar{k} = \sqrt[n-1]{\prod_{t=2}^{n} k_t} = \sqrt[n-1]{\frac{y_n}{y_1}}$$

$$\widehat{T}_t = \frac{y_{t-p} + y_{t-p+1} + \ldots + y_t + \ldots + y_{t+p-1} + y_{t+p}}{m} = \frac{\sum_{i=-p}^{p} y_{t+i}}{m}$$

$$\widehat{T}_t = \frac{y_{t-p} + 2y_{t-p+1} + \ldots + 2y_t + \ldots + 2y_{t+p-1} + y_{t+p}}{2m}$$

$$I_{t/1} = \frac{y_t}{y_1} = I_{2/1} \cdot I_{3/2} \cdot \ldots \cdot I_{t/t-1}$$

$$I_{t/t-1} = \frac{y_t}{y_{t-1}} = \frac{I_{t/1}}{I_{t-1/1}}$$

Indexní analýza

$$Q = p \cdot q$$

$$i_p = \frac{p_1}{p_0} \quad \Delta p = p_1 - p_0 \qquad i_q = \frac{q_1}{q_0} \quad \Delta q = q_1 - q_0 \qquad i_Q = \frac{Q_1}{Q_0} \quad \Delta Q = Q_1 - Q_0$$

$$I_q = \frac{\sum q_1}{\sum q_0} = \frac{\sum i_q\, q_0}{\sum q_0} = \frac{\sum q_1}{\sum \frac{q_1}{i_q}} \qquad \Delta_q = \sum q_1 - \sum q_0$$

$$I_Q = \frac{\sum Q_1}{\sum Q_0} = \frac{\sum p_1 q_1}{\sum p_0 q_0} \qquad \Delta Q = \sum Q_1 - \sum Q_0$$

$$I_p = \frac{\overline{p}_1}{\overline{p}_0} = \frac{\frac{\sum Q_1}{\sum q_1}}{\frac{\sum Q_0}{\sum q_0}} = \frac{\frac{\sum p_1 q_1}{\sum q_1}}{\frac{\sum p_0 q_0}{\sum q_0}} = \frac{\frac{\sum Q_1}{\sum \frac{Q_1}{p_1}}}{\frac{\sum Q_0}{\sum \frac{Q_0}{p_0}}} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \; \frac{\frac{\sum p_0 q_1}{\sum q_1}}{\frac{\sum p_0 q_0}{\sum q_0}} = \frac{\sum p_1 q_0}{\sum p_0 q_0} \; \frac{\frac{\sum p_1 q_1}{\sum q_1}}{\frac{\sum p_1 q_0}{\sum q_0}}$$

$$\Delta p = \overline{p}_1 - \overline{p}_0 = \frac{\sum p_1 q_1}{\sum q_1} - \frac{\sum p_0 q_0}{\sum q_0}$$

$$I_Q = I_p \cdot I_q$$

$$I_p^{(L)} = \frac{\sum p_1\, q_0}{\sum p_0\, q_0} = \frac{\sum i_p\, p_0 q_0}{\sum p_0 q_0} = \frac{\sum i_p\, Q_0}{\sum Q_0} \qquad I_p^{(P)} = \frac{\sum p_1 q_1}{\sum p_0 q_1} = \frac{\sum p_1 q_1}{\sum \frac{p_1 q_1}{i_p}} = \frac{\sum Q_1}{\sum \frac{Q_1}{i_p}}$$

$$I_p^{(F)} = \sqrt{I_p^{(L)} \cdot I_p^{(P)}}$$

$$I_q^{(L)} = \frac{\sum p_0 q_1}{\sum p_0 q_0} = \frac{\sum i_q p_0 q_0}{\sum p_0 q_0} = \frac{\sum i_q Q_0}{\sum Q_0} \qquad I_q^{(P)} = \frac{\sum p_1 q_1}{\sum p_1 q_0} = \frac{\sum p_1 q_1}{\sum \frac{p_1 q_1}{i_q}} = \frac{\sum Q_1}{\sum \frac{Q_1}{i_q}}$$

$$I_q^{(F)} = \sqrt{I_q^{(L)} \cdot I_q^{(P)}}$$

$$I_Q = \frac{\sum Q_1}{\sum Q_0} = \frac{\sum p_1 q_1}{\sum p_0 q_0} = \qquad \Delta Q = \sum p_1 q_1 - \sum p_0 q_0$$

$$I_Q = I_p^{(L)} \cdot I_q^{(P)}$$

$$I_Q = I_p^{(P)} \cdot I_q^{(L)}$$