

Werk

Label: Abstract

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пенями свободы; наоборот, значение t будет (независимо от постоянных λ_i) значимым, если оно значимо относительно распределения Стьюдента с числом степеней свободы min m_i . Такое положение наступает, напр.

тогда, если x является линейной комбинацией k статистик, вычисленных из k независимых выборок, дисперсии которых отличаются друг от друга неизвестным образом. Самым известным случаем является разность двух независимых выборочных средних $\bar{x}-\bar{y}$.

Из теоремы следует между прочим и то, что доверите вный интервал $x \pm ts$, где s^2 имеет структуру (2) и t взято из распределения Стьюдента с числом степеней свободы min m_j , покроет среднее значение μ с вероят-

ностью, большей чем та, которой соответствует использованное значение t.

Summary

INEQUALITIES FOR THE GENERALISED STUDENT'S DISTRIBUTION AND THEIR APPLICATIONS

JAROSLAV HÁJEK, Praha.

(Received March 20, 1956.).

In this paper the following theorem is proved:

Theorem. Let x be a normally (μ, σ^2) distributed random variable, and let s^2 be an estimate of σ^2 with the structure

$$s^2 = \sigma^2 \sum_{j=1}^k \frac{\lambda_j}{m_j} \chi_j^2(m_j), \quad \lambda_i \ge 0, \quad \sum_{j=1}^k \lambda_j = 1,$$
 (2)

where the λ_i 's are unknown constants and the random variables $\chi_j^2(m_j)$ have chi-square distributions with m_j degrees of freedom and are independent of one another and of x; let us choose arbitrary bounds $t' \leq 0 \leq t''$.

Under these conditions the probability P of the event

$$t' \leq \frac{x - \mu}{s} < t'', \qquad t' \leq 0 \leq t'' \tag{14}$$

lies between the limits $P_{\nu} \leq P \leq P_m$, where P_m , P_{ν} denote the probability of the event (14) under the condition that $(x - \mu)/s$ has Student's distribution with m, ν degrees of freedom, respectively, $m = m_1 + m_2 + \ldots + m_k$ and ν may be any arbitrary integer $\nu \leq \min_{1 \leq j \leq k} \frac{m_j}{\lambda_j}$, for example, $\nu = \min_{1 \leq j \leq k} m_j$.

This result may be applied to the testing of the null hypothesis that a statistic x has a prescribed mean value μ_0 provided that the estimate s^2 of the

variance of x has the structure (2). Indeed, the observed value $t = \frac{x - \mu_0}{s}$ is (independently of the λ_j 's) not significant, if it is not significant with respect to the Student's distribution with $m = m_1 + m_2 + \ldots + m_k$ degrees of freedom; conversely, t is (independently of the λ_j 's) significant if it is significant with respect to the Student's distribution with min m_j degrees of freedom. Such a situation arises, for example, if x is a linear combination of k statistics evaluated from k independent samples, whose variances differ in an unknown manner. The most famous case is the difference of two independent

From the theorem it also follows, that the confidence interval $x \pm ts$, where s^2 has the structure (2) and t is taken from the Student's distribution with min m_j degrees of freedom, will contain the mean value μ with a probability $1 \le j \le k$ greater than that which corresponds to the used t.

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sample means $\bar{x} - \bar{y}$.