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$p = t/m$; % 超过临界秩和的频率

通过运行该程序, 得到 $p = P(R \geq R_{obs}) = 0.21811$, p 值均大于 0.05, 故接受 H_0 , 认为两位化验员所测得的数据无显著差异。若使用 EPT 方法进行全排列, 所有组合将达到 $C_{21}^{10} = 352716$ 种, 且随着样本量的增加 EPT 方法运算次数还将呈几何数增长, 故 EPT 方法在实践中是难以实现的。对上述程序进行适当修改后我们可以得出该问题的确切概率 $p' = P(R \geq R_{obs}) = 0.2181239$, RPT 方法与之相比相对误差只有 0.0063626%。若使用传统方法, 求得的概率 $p'' = 0.21891$, 此时相对误差达到了 0.36%, 是 RPT 方法的近 60 倍。当 P 值较小时, 传统方法的相对误差还将进一步增大。由此我们可知 RPT 方法较传统方法减少了误差, 较 EPT 方法减少了运算次数, 且该方法可根据实际情况适当调整抽样次数, 以达到增加精度或减少计算量的目的。

结 论

在样本量较大、总体分布未知, 没有其他合适方法进行两样本均值比较时, 可以使用秩和检验来进行统计推断^[4-6]。在应用 RPT 方法进行秩和检验时需注意如下几个问题:

1. 秩和检验作为一种非参数检验, 由于不依赖资料的分布类型, 故适用范围广泛, 尤其在等级资料的分析中有较高的功效。

2. 编秩时相同值要取平均秩次, 否则将使秩和的临界值发生错误, 影响最终结果。

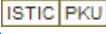
3. 模拟误差来源于 Monte Carlo 模拟抽样。理论上, 无限次的模拟将会完全消除模拟误差, 但显然这是不可能也没有必要的。因此确定模拟误差足够小并且计算可行的 RPT 抽样次数是有效控制模拟误差的必要步骤^[3]。

4. 由于程序运行中要用到随机数, 最终的结果有一定的误差, 因此建议反复运行程序, 待结果相对稳定时再下结论。

RPT 作为 EPT 的一种近似方法, 具有使用方便、误差小、执行效率高的优点, 对出现较多相同秩次时处理能力较强, 是一种有效提高秩和检验效率的好方法。

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作者: 张斌, 吕朵, 段重阳, 陈平雁
作者单位: 南方医科大学公共卫生与热带医学学院生物统计学系
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