Article

ANOVA-nSTAT: ANOVA methodology and computational tools in the paradigm of new statistics

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Received 25 July 2023; *Accepted 28 August 2023*; *Published online 17 September 2023*; *Published 1 March 2024*

Abstract
Based on the statistical significance testing, the Analysis of Variance (ANOVA) is one of the most popular statistics widely used in experimental sciences. However, in recent years, the statistical significance testing has been widely criticized for its various shortcomings. To address this problem, in present article we developed the new ANOVA methodology in the paradigm of new statistics. In this methodology, effect size testing is added to six most used ANOVA methods and the finer *p*-value standardard is used in the statistical significance testing of eight ANOVA methods. Both online and offline computational tools are developed for free use.

Keywords analysis of variance (ANOVA); effect sizes; effect size testing; significance testing; standalone software; online computation.

Computational Ecology and Software
ISSN 2220-721X
URL: http://www.iaees.org/publications/journals/ces/online-version.asp
RSS: http://www.iaees.org/publications/journals/ces/rss.xml
E-mail: ces@iaees.org
Editor-in-Chief: WenJun Zhang
Publisher: International Academy of Ecology and Environmental Sciences

1 Introduction

The Analysis of Variance (ANOVA) is one of the most popular statistics widely used in experimental sciences including biology, ecology, medicine, and agronomy, etc. The ANOVA theory originated from the British mathematician Fisher, and many ANOVA methods have been developed so far. ANOVA can be used to distinguish various variances according to the causes of variation; use appropriate variances as experimental errors to conduct significance tests, and find best treatment measures, etc. Traditionally, one can use ANOVA to compare whether there are significant differences among treatments and factors, and discover the interactions and causes between treatments or factors (Zhang and Qi, 2005).

ANOVA is based on the statistical significance testing (Fisher, 1935; Zhang, 2022c). Statistical significance tests are one of the most important statistical inference methods in statistics (Fisher, 1935; Yates, 1951; Amrhein et al., 2019; Sellke et al., 2001; Zhang, 2022c). Whether a research result is statistically significant is mainly determined by using the *p*-value obtained from hypothesis testing (Bergstrom and West,

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