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Application of tetrachoric and polychoric correlation coefficients to forecast verification

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A novel interpretation of contingency table that is used in forecast verification is proposed. The measure of association in 2×2 ($K \times K$) contingency tables known as tetrachoric (polychoric) correlation coefficient is recalled. These measures rely on two assumptions which are reexamined: 1) there exist continuous latent variables underlying the contingency table and 2) joint distribution of corresponding standard normal deviates is bivariate normal. It is shown that, in practice, the tetrachoric (polychoric) correlation coefficient is an estimate of Pearson correlation coefficient between the latent variables. Consequently, these measures do not depend on bias nor on marginal frequencies of the table. The information carried by the contingency table is naturally and conveniently divided between association, bias and probability of the event, which may be used to asses quality of various forecasting systems and also compare forecasts produced by a single system over different climatological regions. In case of $K \times K$ tables, the eventual reduction in dimensionality from K^2 to $2K$ is obtained. The theoretical findings are illustrated through analysis of real–life, 6×6 contingency tables on verification of quantitative precipitation forecasts.