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Appendix A

A Brief note on the methods of estimation

To study of probability distributions provide the basis of considering one of the important ideas of statistical inference, i.e. problem of estimation. Estimation is that part of statistical theory which is concerned with the problem of how to use a finite number of observations to provide the "best possible" evaluation of the unknown parameters occurring in the mathematical definition of the population from which the observations are obtained.

There are several methods of estimation and these methods are based on separate theories of estimation. The justification of the theories rests on mathematics and we shall not consider it. However, our main interest is in the formal application of the methods of particular cases of estimation. In general, the methods lead to different estimates if used in the same situation because the methods come out from different theories of estimation. Three important methods of estimation are

(i) Method of maximum likelihood
(ii) Method of least square.
(iii) Method of moments

The method of maximum likelihood is the best and useful method of estimation. It was first used by C. F. Gauss in developing the theory of least squares. This method was reintroduced by Prof. R. A. Fisher in 1912.

The method of least squares is an important method based on the theory of linear estimation whose basic principle is due to Karl Friedrich Gauss and Andrei Andreerich Markov. This method is based on the principle that estimates of the parameters can be obtained by minimizing the sum of the squares of the deviations of the observations from their expectations.

Of all the methods of estimation, the method of moments is the oldest and the simplest and can be used with a desired number of accuracy. Karl Pearson first introduced the estimation by using method of moments. Sometimes, this method yields estimates most easily in comparison with the method of maximum likelihood estimation. In many of the simpler situations, the method gives estimates which are the same as those obtained by the least squares or maximum likelihood approach. In some situations where the method of maximum likelihood leads to intractable equations, then the method of moments is the best method to estimate the parameters of a distribution. Generally method of moments gives less efficient estimates than those obtained from the method of maximum likelihood.

Apart from the above three mentioned methods of estimation different authors suggested some simple modified methods to estimate the parameters of some generalized and mixture distributions. Sometimes it is very cumbersome for certain mixture or generalized distributions to obtaining maximum likelihood and least squares estimates, an ad-hoc methods may be used to estimate their parameters, as their parameters are often based on observations of relative frequencies. We obtain the equations for estimation by equating observed frequencies with the corresponding formulas for expected probabilities.

Since, for certain mixture distributions obtaining the solution of maximum likelihood equations for estimating the parameters is very cumbersome. Some authors like Fisher, Katti and Gurland preferred these ad-hoc methods to estimate the parameters. These methods have been found very useful in problem of fitting of the distributions.

In our investigation, because of some complexity for the fitting of the mixture distributions by the method of maximum likelihood, we use the following methods of estimation.

(a) Estimation from first two sample moments.
(b) Estimation from the first two ratios of the observed sample.
(c) Estimation from the first two probabilities and the mean of the observed sample.

and then this fitting can be compared with other simple distributions which can be fitted by method of maximum likelihood and method of moments. Also the p- values are calculated for each table and have shown along with the chi-square values and their respective degrees of freedom.

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