Finite Mixture Modelling with rank-based samples

We develop statistical methods for estimation and classification of finite mixture models (FMMs) based on rank-based sampling (RBS) designs. RBS techniques are powerful and cost-effective sampling designs which are used to obtain more representative samples from the underlying population when variable of interest is costly or difficult to quantify; however ranking the sampling units can be done easily. The traditional expectation–maximization algorithm is not directly applicable for these settings. Through a different missing mechanism, we propose a suitable expectation–maximization algorithm to estimate the parameters of the FMMs based on RBS samples. We also study the problem of classification of the RBS sample into the components of the FMM. We show that the maximum likelihood estimators based on RBS samples perform better than their simple random sample counterparts. The results are finally applied to a fish population using the length-frequency data.