Principal Component Analysis (PCA) is a widely used technique for reducing dimensionality of multivariate data. The principal component subspace is defined as the affine subspace of a given dimension $d$ giving the best fit to the data. However, PCA suffers from a well-known lack of robustness. As a robust alternative, one can resort to an impartial trimming based approach. Here one searches for the best subsample containing a proportion $1-\alpha$ of the observations, with $0 < \alpha < 1$, and the best $d$-dimensional affine subspace fitting this subsample, yielding the trimmed principal component subspace.

A population version will be given and existence of a solution to both the sample and population problem will be proven. Moreover, under mild conditions, the solutions of the sample problem are consistent toward the solutions of the population problem. The robustness of the method is studied by proving quantitative robustness, computing the breakdown point, and deriving the influence functions. Furthermore, asymptotic efficiencies at the normal model are derived, and finite sample efficiencies of the estimators are studied by means of a simulation study.