

## NOVEL ICA ALGORITHM WITH NONPARAMETRIC ESTIMATION BASED ON GGD KERNEL

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**ABSTRACT.** *A basic element in most independent component analysis (ICA) algorithm is how to choose a model of the score functions of the unknown source signals. This is usually based on the parametric approximations, but the parametric approach will not be truly blind to the underlying distribution of the sources. In this paper, we describe an efficient scheme for achieving the probability density function (PDF) of sources by the generalized Gaussian density (GGD) kernel estimation based nonparametric method. The proposed ICA algorithm is able to separate the hybrid mixtures of source signals which include sub-Gaussian and super-Gaussian sources, symmetric and asymmetric sources using only a flexible score function model. Moreover, the GGD kernel can adaptively adjust its shaping and scaling parameters according to the high order statistics of the source signals. It paves the way to wider applications of ICA methods to real world signal processing. Simulations show that our proposed ICA algorithm can separate a wider range of sources than most of the state-of-the-art parametric method.*

**Keywords:** Independent component analysis (ICA), Nonparametric estimation, GGD kernel estimation, Natural gradient, Score function

**1. Introduction.** Independent Component Analysis (ICA) is to recover sources which are considered statistically independent given only the output of a number of sensor mixtures. Compared with those correlation based algorithm such as principal component analysis (PCA) and singular value decomposition (SVD), ICA attempts to make the separated signals as independent as possible. ICA is becoming an important theme due to some opened theoretical problems and many rapidly growing applications in various areas, such as in speech recognition and enhancements, telecommunication and biomedical signal analysis and processing [1-6]. So it has become a highly popular research topic in statistical signal processing (SP) and unsupervised neural network (NN).

Since Comon [1] gave a good insight to ICA problem from a statistical point of view, there emerged a set of efficient ICA algorithms, such as the Infomax algorithm [2], the Fast ICA algorithm [7], the Natural Gradient algorithm [3,8], the JADE algorithm [9], the