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ORIGINAL ARTICLE

Novel semi-blind estimation for turbo decoding in impulsive noise channel

Ali Chemsa · Djamel Saigaa · Hatem Ghodbane · Abdelmalik Taleb-Ahmed

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Abstract In order to calculate the branches metric in the maximum a posteriori algorithm of turbo decoder, it is mandatory to know the values of parameters of the noise contaminating the transmitted signal. In the case of a generalized Gaussian distribution impulsive noise, it is very difficult to estimate the shape parameter, because the noise is inseparable from transmitted signal at turbo decoder reception. Until now, few researches about shape parameter estimation for an impulsive noise on turbo codes have been presented, and existing estimation methods use only the high order statistics (HOS). In this paper, we propose a novel semi-blind method, that does not use the HOS, to estimate the shape parameter from only the received signal in the turbo decoder. This method is based on fractional lower order statistics and the probability that the received signal is the same sign as the transmitted signal modulated with BPSK. The results, in terms of root mean square error, show the advantage of our method over other methods using HOS in the case of impulsive noise.

Keywords MAP algorithm · Impulsive noise · GGD · FLOS approach · HOS approach · RMSE · BPSK modulation

A. Chemsa (✉)
Faculty of Science and Technology, University of El-Oued, El-Oued, Algeria
e-mail: chemsadoct@yahoo.fr

A. Chemsa · D. Saigaa · H. Ghodbane
LMSE, Mohamed Khider University, Biskra, Algeria
e-mail: d_saigaa@yahoo.fr

H. Ghodbane
e-mail: ghodbane_hatem@yahoo.fr

D. Saigaa
Electronics Department, Mohamed Boudiaf University, M'Sila, Algeria

A. Taleb-Ahmed
LAMIH UMR CNRS 8201, UVHC, The Mont Houy, 59313 Valenciennes Cedex 9, France
e-mail: abdelmalik.taleb-ahmed@univ-valenciennes.fr

1 Introduction

In the turbo decoding which use the MAP algorithm, it is necessary to estimate the parameters of the noise that contaminate the transmitted signal. These parameters are used in the decoder to calculate the branches metric in order to estimate the transmitted binary message (Majoul et al. 2008; Zhijiang et al. 2013). In the case of an additive white Gaussian noise, the estimation of its parameters is easy. Contrariwise, in the case of the generalized Gaussian distribution (GGD) noise the parameters estimation is highly problematic when it refers to the shape parameter (Majoul et al. 2008).

Li and Xie (2013) they used Mallat method given by Mallat (1989) to estimate the shape parameter of a GGD, which is a method of moments. In addition to the Mallat method used by Li and Xie (2013), there are other methods to estimate the shape parameter of a GGD, their main characteristics are summarized and compared with each other theoretically and practically in Yu et al. (2012), Roenko et al. (2014). Also a novel practical procedure is well presented in Graciela et al. (2003). All these works take into account that the proposed estimations are based on previously known GGD noise samples, which is not the case of the turbo decoding when the parameters estimations of the GGD noise must be made directly from the samples

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