Mixture Kernel Versoria Criterion based Post-distortion for Mobile VLC Systems

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Abstract

Visible light communication (VLC) [1] has emerged as a promising supplement to the existing RF based communication systems because of the following desired features; high bandwidth, secure and interference free green communication, dual functionality of illumination and data transmission, high signal-to-noise ratio, and low power consumption. However, performance of VLC is limited by the following impairments: (1) nonlinear characteristics of LED, which makes the overall system nonlinear, (2) intersymbol interefernce due to limited modulation bandwidth of LED, and (3) mobility of users which makes the overall channel time-varying. Various polynomial like Volterra/Hammerstein based post-distorters have been proposed in the literature for joint mitigation of ISI and LED's nonlinearity. However, they are computationally complex, and are unable to handle non-stationarity due to the modeling error caused by abrupt truncation of Taylor's series till second/third order terms. Due to sparse, convex and computationally efficient, kernel least mean square (KLMS) based post-distorters [2] are preferred over Volterra series equalizers, that guarantees unique representation of wide class of nonlinearities in reproducing kernel Hilbert space (RKHS) (from Represener's theorem [2]). However, applicability of KLMS algorithm is limited under timevarying scenarios due to limited degrees of freedom in terms of choice of single kernel width. In this work, to mitigate LED's nonlinearity and ISI for mobility impaired/time-varying VLC channels, we propose a mixture kernel maximum Versoria criterion (Mx-KMVC) based post-distorter in RKHS, which uses an ensemble/mixture of kernels to model various time-varying channels by assigning different weights to each block of RKHS. Monte-Carlo simulations are performed over standard time-varying VLC channels with user's mobility. Simulations indicate that the proposed Mx-KMVC algorithm delivers better BER performance as compared to the conventional mixture KLMS (Mx-KLMS) [3] algorithm due to the incorporation of higher order statistics of error. Hence, the proposed algorithm is a viable solution for practical VLC deployments for beyond 5G and 6G communication systems.

Index Terms

Visible light communication, light emitting diode, mobility, reproducing kernel Hilbert space, mixture, kernel least mean square, Versoria criterion.

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