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An Optical Encryption Scheme that uses Polarization of Coherent Light

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Abstract: We demonstrate an optical system that encodes two dimensional data as different polarization states. The encrypted image is recorded using a digital holographic setup and the decryption is done numerically.

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1. Introduction

Polarization of coherent light has been used recently to encrypt 2-D information [1-3]. We propose, and experimentally demonstrate, an optical encryption scheme that encodes a 2-D image as different states on a Poincare sphere. The polarization state of each pixel of the encrypted image (represented as a Jones vector) is detected using a digital holographic system. The encrypted signal is recorded digitally and the decryption is done numerically. Our scheme has advantages over earlier approaches in that the encrypted signal is recorded as an electrical signal and hence makes it possible to send the data over a digital channel. In our method, the encryption key could take more than two levels which increases the key space.

2. Principle

Fig.1 Schematic of the encryption system

Fig. 1 shows the schematic of the optical system for encryption. The plaintext image to be encrypted is displayed on the SLM1 and the key to encrypt data is displayed on SLM2. A lens images each pixel of SLM1 to a corresponding pixel of SLM2. The polarization state of the j^{th} pixel of the encrypted image is given by

$$E_j = M_2(V_j) M_1(V_j) P_i \quad (1)$$

where P_i is the Jones vector corresponding to input polarization, and $M_1(V_j)$ and $M_2(V_j)$ are the Jones Matrices corresponding to SLM1 and SLM2 respectively, which are functions of grey levels (voltage driving the pixels, V_j) of the j^{th} pixel. E_j is the Jones vector corresponding to the polarization state of the j^{th} pixel of encrypted image. E_j is measured using a digital holographic setup. The encrypted image is recorded digitally and the decryption is done numerically

3. References

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