Optical information processing with white speckle carrier applied to the detection of the difference between two photographs

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The detection of the difference between two photographs of the object taken at different instants is one of the practical applications of optical information processing. For this purpose, M. Francon et al. have proposed an available method, in which it is necessary to use an additional diffuser to produce the laser speckle pattern as a random carrier. In this paper we propose a method without the additional diffuser, and the white light speckle pattern in the image itself is taken as a random carrier directly, so that the unnecessary effect of the additional diffuser is removed, and this method is simpler than the former.

In our experiments we detect the difference between two photographs taken by satellite. First, a photographic plate placed immediately behind the first photograph is exposed with white light, and this step is regarded as those informations of the photograph is carried in the white light speckle pattern as a random carrier from the photograph itself. Then we replace this photograph by another, and the plate is translated in its plane through a small distance. The second exposure is made with white light again, thus the informations of the second photograph is carried in the white light speckle pattern too. After processing the plate is illuminated by a parallel beam of coherent light. Now the plate is placed in the front focal plane of a lens, so that its spatial spectrum will occur in the back focal plane of the lens. There are three parts of the spectrum, i,e. the direct image of the light source, the sum of the spatial spectra of the informations of two photographs which is modulated by a set of Young's fringes, and the difference of the spatial spectra of the informations of two photographs which is modulated by another set of Young's fringes. These two sets of fringes are complementary (each other). We place a spatial filter adequately so that only the difference of the spectra can pass through it. Then the difference of the spectra is inversely transformed by another lens, thus the difference between two photographs is given in the back focal plane of the lens.

白光斑纹载波的光信息处理用于检验两张图片间的差别

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检测一个物体在不同时刻拍摄的两张图片之间的差别，是光信息处理的一种实际应用。为此，M. Francon 等曾提出一种可行的方法，其中必须利用一个附加的漫射器产生激光斑纹图样作为随机载波。本文提出一种不用附加漫射器的方法，直接用图象本身的白光斑纹图样作为随机载波，因此可消除附加漫射器不必要的影响，这个方法比前者更为简便。

本实验检测由卫星拍摄的两张图片之间的差别。首先把照相底片紧挨在第一张图片后面用白光曝光，这一步可看作把该图片的信息载入来自图片本身作为随机载波的白光斑纹图样中。然后以另一图片取代前者，并使底片在其本身平面内有一微小位移，再用白光作第二次曝光，于是该图片的信息也载入白光斑纹图样中，底片经处理后被一束平行的相干光照明。此时底片放在透镜的前焦面上，故在透镜的后焦面上将出现它的空间频谱。它分成三部分，即光源的直接象，被一组杨氏条纹调制的两张图片信息的空间频谱之和，以及被另一组杨氏条纹调制的两张图片信息的空间频谱之差。这两组条纹是互补的。适当放置空间滤频器，使得它只透过频谱之差。再用另一个透镜作逆变换，结果在该透镜的后焦面上得出两张图片之间的差别。