

Statistical Analysis of Natural Images

Take a digital photo of a natural outdoor scene. For simplicity, convert the photo from color to black and white. The photo can be reduced, or scaled, to make a new (smaller) picture, say half the size in both dimensions. In comparison to the original picture, the new picture is of a scene in which each of the original objects, and in fact every imaged point, has been relocated twice as far from the camera. This “stretching” is artificial in that it does not correspond to any movement of the camera in the real world. Yet the picture looks perfectly normal, and the local spatial statistical structure (e.g. the distribution of values of horizontal or vertical derivatives) is largely indistinguishable from the local spatial statistical structure of the original. “Images of natural scenes are scale invariant.” The source of scale invariance in natural images is an enduring mystery.