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1988 ARVO ABSTRACT FORM

1134

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- ____ (PA) Paper only or Withdraw
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Scientific Section Preference

See Section descriptions starting on page 5. Check the Section best suited to your presentation:

- ____ (AN) Anatomy & Pathology
- ____ (BI) Biochemistry
- ____ (CL) Clinical Research
- ____ (CO) Cornea
- ____ (EL) Electrophysiology
- ____ (EY) Eye Movements, Strabismus & Amblyopia
- ____ (GL) Glaucoma
- ____ (IM) Immunology & Microbiology
- ____ (LE) Lens
- ____ (PH) Physiology & Pharmacology
- ____ (RE) Retina
- ____ (RC) Retinal Cell Biology
- ✓ (VI) Visual Psychophysics

Key Words

See instructions on page 4. Circle the *number* of no more than 3 key words. Do *not* write the word.

765 / 437 / 761

Suggested Key Words

See instructions on page 4. Key words that were not on this year's list, should be included in 1989.

A/V Requirements

See information on page 13.

- ____ (OH) Overhead
- ____ (MP) 16 mm movie projector
- ____ (VE) Video equipment (contact AVA Tech directly)
- ____ (OT) Other (specify)

Travel Grant

Check here if you are applying for a Travel Grant. ☐

COMPLETE FORM ON REVERSE SIDE

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IS REDUNDANCY INCREASED OR DECREASED IN VISUAL CODING.

D. Field[1], D. Kersten[2], and H.B. Barlow[1] Physiological Laboratory, University of Cambridge, Cambridge England[1] and Dept. of Psychology and Dept. of Cognitive and Linguistic Sciences, Brown University.[2]

Several recent studies have pointed out similarities between "efficient" image coding techniques and the spatial properties of neurones in the mammalian visual cortex. The efficiency of an image code is usually defined in terms of a change in the entropy of the coefficients (e.g., bits per pixel). A code which is capable of representing an image with relatively few bits is considered to be an efficient code. By definition, redundancy and entropy are inversely related. Hence, such theories seem to imply that the cortical representation of spatial information is more redundant than the original image. This notion appears to contrast with theories that suggest that the goal of visual processing is to represent the environment with reduced redundancy. We will suggest that there is no conflict between these two notions. In theory, a complete recoding (e.g., a Fourier transform) will have no effect on the total redundancy of the representation. Rather, such coding shifts the redundancy from one level to another.

The total redundancy of a set of images must be defined in relation to all the nth-order conditional probabilities of the coefficients. The visual cortex can be shown to be efficient at converting high-order redundancy (e.g., correlations between pixels) into first-order redundancy (i.e., the response distribution of the coefficients). First-order redundancy is increased by decreasing the high-order redundancy. Although this has no effect on overall redundancy, the conversion has a number of advantageous effects on the cortical representation of an image (e.g., an increase in signal to noise). These effects are demonstrated quantitatively with a variety of natural images using models that code the image into coefficients localized in space, spatial frequency and orientation (Gabor-like transforms).

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