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Vision as Bayesian inference: analysis by synthesis?

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We argue that the study of human vision should be aimed at determining how humans perform natural tasks with natural images. Attempts to understand the phenomenology of vision from artificial stimuli, although worthwhile as a starting point, can lead to faulty generalizations about visual systems, because of the enormous complexity of natural images. Dealing with this complexity is daunting, but Bayesian inference on structured probability distributions offers the ability to design theories of vision that can deal with the complexity of natural images, and that use â€˜analysis by synthesisâ€™ strategies with intriguing similarities to the brain. We examine these strategies using recent examples from computer vision, and outline some important imlications for cognitive science.

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