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  A Novel Solution to an Old Problem: Invariant Recognition by a Neural Network with Fractal-like Connectivity

  The human visual system has a remarkable ability to recognize thousands of objects despite changes in their viewing conditions. During ego motion, for example, static surrounding objects are perceived as unchanging, although their retinal images undergo various transformations including scaling and translation. A traditional approach to size and position invariant recognition is based on pooling from a large number of replicated filters, each one selective to a certain feature at a specific position and size. This approach suffers from a number of drawbacks and is limited in its ability to account for physiological findings. This talk will present a novel approach to invariant recognition. The suggested model is a neural network with connection weight patterns which resemble fractals. This special type of connectivity is shown to enable computationally efficient invariant feature detection. Computer simulations demonstrate the model's ability to account for a variety of physiological findings, including response properties and receptive-field shapes of inferotemporal (IT) neurons. In addition, the suggested model avoids the need of parallel adaptation of a large number of replicated connectivity patterns during learning of novel features. In a broader perspective, the connectivity patterns introduced in this model generate a unique type of distributed representation which might be relevant to other brain functions as well. BIO Morrie Furman received his PhD in Biomedical Engineering from the Technion IIT, Israel. His PhD work with Prof. M.Gur focused on modeling of visual motion processing during pursuit eye movements and on related perceptual illusions. His current research interests include modeling of visual processes, unsupervised learning and self organization in neural networks, chaos and fractal geometry in neural networks. REFS: Furman, M. and Gur, M. (2003) Self-organizing neural network model for motion processing in the visual cortex during smooth pursuit. Vision Research, 43: 2155-2171. Furman, M. and Gur, M. (2005) Alteration of the perceived path of a non-pursued target during smooth pursuit: Analysis by a neural network model.

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