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Continuum neural dynamics models for visual object identification[1] VIJAY SINGH, MARTIN TCHERNOOKOV, Dept. of Physics, Emory University, ILYA NEMENMAN, Dept. of Physics & Dept. Of Biology, Emory University — Visual object identification has remained one of the most challenging problems even after decades of research. Most of the current models of the visual cortex represent neurons as discrete elements in a largely feedforward network arrangement. They are generally very specific in the objects they can identify. We develop a continuum model of recurrent, nonlinear neural dynamics in the primary visual cortex, incorporating connectivity patterns and other experimentally observed features of the cortex. The model has an interesting correspondence to the Landau-DeGennes theory of a nematic liquid crystal in two dimensions. We use collective spatiotemporal excitations of the model cortex as a signal for segmentation of contiguous objects from the background clutter. The model is capable of suppressing clutter in images and filling in occluded elements of object contours, resulting in high-precision, high-recall identification of large objects from cluttered scenes.

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