Automatic object recognition from still imagery, insensitive to clutter and partial occlusion, is an unsolved computer vision problem with countless applications to military readiness. Ambiguity of segmentation of complex images into objects is the major stumbling block. Incorporation of certain structural features of the primate early visual system into computational models has been suggested as a potential solution. However, little is known about effects of these features on segmentation performance of either humans or computational models. For this, in this project, we have quantified importance of lateral neural connectivity for image context analysis. We showed that...
Final Report: Improving image segmentation with adaptive, recurrent, spiking neural network models of the primary visual cortex

ABSTRACT

Automatic object recognition from still imagery, insensitive to clutter and partial occlusion, is an unsolved computer vision problem with countless applications to military readiness. Ambiguity of segmentation of complex images into objects is the major stumbling block. Incorporation of certain structural features of the primate early visual system into computational models has been suggested as a potential solution. However, little is known about effects of these features on segmentation performance of either humans or computational models. For this, in this project, we have quantified importance of lateral neural connectivity for image context analysis. We showed that simple models of lateral connectivity in computational models make their performance comparable to those of humans.

Enter List of papers submitted or published that acknowledge ARO support from the start of the project to the date of this printing. List the papers, including journal references, in the following categories:

(a) Papers published in peer-reviewed journals (N/A for none)

Received  Paper

05/19/2017  1 Vijay Singh, Martin Tchernookov, Rebecca Butterfield, Ilya Nemenman, Rongrong Ji. Director Field Model of the Primary Visual Cortex for Contour Detection, PLoS ONE, (): . doi: 1,041,544.00

TOTAL:  1

Number of Papers published in peer-reviewed journals:

(b) Papers published in non-peer-reviewed journals (N/A for none)

Received  Paper

TOTAL:

Number of Papers published in non peer-reviewed journals:

(c) Presentations
Number of Presentations: 0.00

Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received  Paper

TOTAL:

Number of Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received  Paper

TOTAL:

Number of Peer-Reviewed Conference Proceeding publications (other than abstracts):

(d) Manuscripts

Received  Paper

TOTAL:

Number of Manuscripts:

Books

Received  Book

TOTAL:
### Patents Submitted

### Patents Awarded

### Awards

**Graduate Students**

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**Names of Faculty Supported**

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**Names of Under Graduate students supported**

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Main goal of the project was to analyze the importance of (simplified models of) lateral connectivity, observed in the primate visual system, on the performance of artificial image segmentation programs. We achieved the goal of showing that such models reach performance of human subjects on segmentation studies. A publication in PLoS ONE documented the finding.

Automatic object recognition from still imagery, insensitive to clutter and partial occlusion, is an unsolved computer vision problem with countless applications to military readiness. Ambiguity of segmentation of complex images into objects is the major stumbling block. Incorporation of certain structural features of the primate early visual system into computational models has been suggested as a potential solution. However, little is known about effects of these features on segmentation performance of either humans or computational models. For this, in this project, we have quantified importance of lateral neural connectivity for image context analysis. We showed that such models reach performance of human subjects on segmentation studies.