

Vidhya Navalpakkam

216-76, Division of Biology, Caltech, Pasadena, CA 91125, USA

vidhya@caltech.edu

<http://www.klab.caltech.edu/~vidhya>

RESEARCH INTERESTS

What draws people's attention and gaze when they view complex visual displays? What are the underlying neural computations that enable us to detect objects of interest amidst clutter? My research interests are in the intersection of biological vision, cognitive psychology and neuroeconomics. Specific aims include developing a behavioral and computational understanding of how different factors like task demands, prior knowledge of display statistics, reward incentives and visual saliency compete to control attention and gaze. In particular, can the brain and behavior be understood in terms of optimizing some quantity that is useful to the organism? I explore these questions using a combination of applied theory (Bayesian statistics, Signal Detection theory, models of visual saliency), and experiments (eye tracking, psychophysics).

Keywords: modeling, neuron, behavior, visual attention, visual search, decisions, salience, reward, prior knowledge, bottom-up, top-down, psychophysics, eye-tracking

EDUCATION

Postdoctoral Scholar Jan 2007-present
California Institute of Technology, Pasadena, CA
Advisors: Dr. Christof Koch, Dr. Pietro Perona

Visiting Postdoctoral Scholar, Stanford Aug 2009-present
Host: Dr. Fei-Fei Li

Ph.D, Computer Science Fall 2006
University of Southern California (USC), Los Angeles, CA
Advisor: Dr. Laurent Itti

B.Tech, Computer Science Fall 2001
Indian Institute of Technology (IIT), Kharagpur, India

SELECTED PUBLICATIONS

V.Navalpakkam, C. Koch, A. Rangel, P. Perona, **Optimal reward harvesting in complex perceptual environments**, In: *Proceedings of National Academy of Sciences*, in press.

V.Navalpakkam, C. Koch, P. Perona, **Homo economicus in visual search**, In: *Journal of Vision*, 9(1):31, pp.1-16, Jan 2009.

V. Navalpakkam, L. Itti, **Search goal tunes visual features optimally**, In: *Neuron*, Vol. 53, No. 4, pp. 605-617, Feb 2007. (see preview, **Paying Attention to Neurons with Discriminating Taste** by A. Pouget and D. Bavelier, In: *Neuron* 2007, Vol. 53, No. 4, pp. 473-475, Feb 2007. *Faculty of 1000 Biology*: evaluations for Navalpakkam V & Itti L *Neuron* 2007 Feb 15 53 (4):605-17.

V. Navalpakkam, L. Itti, **Top-down attentional selection is fine-grained**, In: *Journal of Vision*, Vol. 6, No. 11, pp. 1180-1193, Oct 2006.

V. Navalpakkam, L. Itti, **An Integrated Model of Top-down and Bottom-up Attention for Optimal Object Detection**, In: *IEEE Computer Vision and Pattern Recognition (CVPR)*, 2006.

V. Navalpakkam, L. Itti, **Optimal cue selection strategy**, In: *Neural Information Processing Systems (NIPS)*, 2005.

V. Navalpakkam, M. A. Arbib, L. Itti, **Attention and Scene Understanding**, In: *Neurobiology of Attention*, (L. Itti, G. Rees, J. K. Tsotsos Ed.), pp. 197-203, San Diego, CA: Elsevier, 2005.

V. Navalpakkam, L. Itti, **Modeling the influence of task on attention**, *Vision Research*, Vol. 45, No. 2, pp. 205-231, 2005. (top cited paper in *Vision Research* since 2005)

V. Navalpakkam, L. Itti, **A Goal Oriented Attention Guidance Model**, *Lecture Notes in Computer Science*, Vol. 2525, pp. 453-461, Nov 2002.

**SELECTED
TALKS**

Where to look? Dissociating the roles of reward, salience and attention, In: IBM Almaden, Oct 2009; Harvard Medical School, Sep 2009; Vision Science Society, May 2009; UC Santa Barbara, Apr 2009.

Homo economicus in visual search, In: *Vision Science Society*, May 2008; Smith-Kettlewell Eye Research Institute, San Francisco, Apr 2008.

Search goal tunes visual features optimally: Harvard Medical School, Feb 2008; Salk Institute, La Jolla, Dec 2007; Smith-Kettlewell Eye Research Institute, San Francisco, Jul 2007.

Optimality of human visual search behavior, In: *Joint Symposium on Neural Computation (JSNC)*, May 2007.

A theory of optimal feature gain modulation during visual search, In: *Computational and Systems Neuroscience (Cosyne)*, March 2006.

Modeling the influence of target and distractor knowledge on visual search, In: *Proc. Society for Neuroscience Annual Meeting (SFN'04)*, Oct 2004.

Towards a Unified Model for Attention and Recognition, In: *Proc. Society for Neuroscience Annual Meeting (SFN'03)*, Nov 2003.

A Goal Oriented Attention Guidance Model, In: *Biologically Motivated Computer Vision workshop (BMCV)*, Nov 2002.

**HONORS/
SERVICE**

Coordinator, CNS seminars at Caltech Fall 2008-present

Co-wrote NSF grant (Senior Personnel), PI: Christof Koch Fall 2008-2011

Co-organizer, symposium on “**Understanding the interplay between reward and attention**” at the Vision Science Society (VSS) conference at Naples, Florida Summer 2010

Co-organizer, workshop on “**Mechanisms of visual attention: a critical appraisal**” at NIPS, Whistler, Canada Fall 2007

Program Committee member, WAPCV 2007, 2008 (Workshop on Attention Performance and Computer Vision)

Women in Science and Engineering (WiSE) Merit Fellowship, University of Southern California (USC) Fall 2006-2007

Organizer, symposium on “**Integrating Top-down and Bottom-up Visual Attention**” at the Vision Science Society (VSS 2006) conference at Sarasota, Florida Summer 2006

Student travel fellowship for VSS 2006 (among top 10 student projects) Spring 2006

Reviewer: Vision Research, Journal of Computational Neuroscience, Perception & Psychophysics, Journal of Vision

REFERENCE

Dr. Christof Koch, koch@klab.caltech.edu

Dr. Pietro Perona, perona@caltech.edu

Dr. Antonio Rangel, rangel@caltech.edu

Dr. Laurent Itti, itti@usc.edu