

Steven Zucker CV

Steven W. Zucker is the David and Lucile Packard Professor of Computer Science at Yale University, and also Professor of Biomedical Engineering. He is a member of the Program in Applied Mathematics, which he directed from 2003 to 2009, and a member of the Interdepartmental Neuroscience Program. Currently he co-directs the Swartz Center, which fosters collaborative research and interdisciplinary training in computational and systems neuroscience.

Steve was elected a Fellow of the Royal Society of Canada, a Fellow of the Canadian Institute for Advanced Research, a Fellow of the IEEE, and (by)Fellow of Churchill College, Cambridge. He won the Siemens Award, several Best Paper prizes, and was recently named a Distinguished Investigator by the Paul G. Allen Family Foundation for research in crowd computing by bacteria.

Members of Zucker research group

Graduate Students

Luciano Dyballa (Computer Science)

Junjiajia Long (Physics; co-supervised with T. Emonet)

Yuzhe (Vincent) Zhao (Computational Biology and Bioinformatics)

Alumni

Daniel Holtmann-Rice Benjamin Kunsberg Reynard Le Ohad Ben-Shahar Pierre Breton David Jones Michael Langer Douglas Miller Kaleem Siddiqi Shamez Alibhai Jonas August Ohad Ben-Shahar Pierre Breton Chantal David Pavel Dimitrov Allan Dobbins Benoit Dubuc James Elder Andreas Glaser Harold Hubschman Patrick Huggins Lee Iverson Kamal Kant Gupta David Kashtan Ben Kimia Michael Langer Matthew Lawlor Yvan Leclerc Gang Li Edo Liberty Norah Link John Mohammed Pierre Parent Peter Sander Demetri Terzopoulos John Tsotsos Emma Alexander Tomas Izo

Research Interests:

Computational vision is at the heart of robotics and biomedicine, but it is primitive when compared with the human visual sense. Humans demonstrate, effortlessly, enormous visual flexibility and generality, unaware of human vision's staggering complexity. But more than one-third of the primate brain is dedicated to processing visual information.

How do we characterize the function of billions of neurons in algorithmic terms? Zucker is putting the requirements of vision systems together with insights from neurophysiology and applied mathematics to develop an abstract theory of computational vision. Based on differential geometry, his approach leads to methods of curve detection, shading and texture

analyses, stereo, color, and generic shape description. The key to studying and modeling vision is an interdisciplinary perspective, integrating computation, neuroscience, and mathematics.

Most quoted publications:

- Scene Labeling by Relaxation Operations Rosenfeld, A., Hummel, R.A., Zucker, S.W. IEEE Transactions on Systems, Man, and Cybernetics, 1976, 6(6), pp. 420–433 1,045 Citations

Geometric diffusions as a tool for harmonic analysis and structure definition of data: Diffusion maps Coifman, R.R., Lafon, S., Lee, A.B., ...Warner, F., Zucker, S.W. Proceedings of the National Academy of Sciences of the United States of America, 2005, 102(21), pp. 7426–7431 911 Citations

On the Foundations of Relaxation Labeling Processes Hummel, R.A., Zucker, S.W. IEEE Transactions on Pattern Analysis and Machine Intelligence, 1983, PAMI-5(3), pp. 267–287 618 Citations

Toward Efficient Trajectory Planning: The Path-Velocity Decomposition Kant, K., Zucker, S.W. The International Journal of Robotics Research, 1986, 5(3), pp. 72–89 514 Citations

Local scale control for edge detection and blur estimation Elder, J.H., Zucker, S.W. IEEE Transactions on Pattern Analysis and Machine Intelligence, 1998, 20(7), pp. 699–716 481 Citations

- Shock graphs and shape matching Siddiqi, K., Shokoufandeh, A., Dickinson, S.J., Zucker, S.W. International Journal of Computer Vision, 1999, 35(1), pp. 13–32 465 Citations

Region growing: Childhood and adolescence Zucker, S.W. Computer Graphics and Image Processing, 1976, 5(3), pp. 382–399 458 Citations

Shapes, shocks, and deformations I: The components of two-dimensional shape and the reaction-diffusion space, Kimia, B.B., Tannenbaum, A.R., Zucker, S.W., International Journal of Computer Vision, 1995, 15(3), pp. 189–224, 414 Citations

Evaluating the fractal dimension of profiles Dubuc, B., Quiniou, J.F., Roques-Carmes, C., Tricot, C., Zucker, S.W. Physical Review A, 1989, 39(3), pp. 1500–1512, 389 Citations

Trace Inference, Curvature Consistency, and Curve Detection Parent, P., Zucker, S.W. IEEE Transactions on Pattern Analysis and Machine Intelligence, 1989, 11(8), pp. 823–839 359 Citations

- Matching hierarchical structures using association graphs Pelillo, M., Siddiqi, K., Zucker, S.W. IEEE Transactions on Pattern Analysis and Machine Intelligence, 1999, 21(11), pp. 1105–1119, 311 Citations

Geometric diffusions as a tool for harmonic analysis and structure definition of data: Multiscale methods Coifman, R.R., Lafon, S., Lee, A.B., ...Warner, F., Zucker, S.W. Proceedings of the National Academy of Sciences of the United States of America, 2005, 102(21), pp. 7432–7437, 259 Citations

Hamilton-Jacobi skeletons, Siddiqi, K., Bouix, S., Tannenbaum, A., Zucker, S.W., International Journal of Computer Vision, 2002, 48(3), pp. 215–231, 5090510, 244 Citations

Endstopped neurons in the visual cortex as a substrate for calculating curvature, Dobbins, A., Zucker, S.W., Cynader, M.S., Nature, 1987, 329(6138), pp. 438–441, 231 Citations

Area and length minimizing flows for shape segmentation, Siddiqi, K., Lauzière, Y.B., Tannenbaum, A., Zucker, S.W., IEEE Transactions on Image Processing, 1998, 7(3), pp. 433–443 221 Citations

The effect of contour closure on the rapid discrimination of two-dimensional shapes, Elder, J., Zucker, S. Vision Research, 1993, 33(7), pp. 981–991, 196 Citations

A Three-Dimensional Edge Operator Zucker, S.W., Hummel, R.A. IEEE Transactions on Pattern Analysis and Machine Intelligence, 1981, PAMI-3(3), pp. 324–331, 172 Citations

Finding structure in Co-occurrence matrices for texture analysis, Zucker, S.W., Terzopoulos, D., Computer Graphics and Image Processing, 1980, 12(3), pp. 286–308, 161 Citations

Inferring Surface Trace and Differential Structure from 3-D Images, Sander, P.T., Zucker, S.W., IEEE Transactions on Pattern Analysis and Machine Intelligence, 1990, 12(9), pp. 833–854, 143 Citations

An Application of Relaxation Labeling to Line and Curve Enhancement, Zucker, S.W., Hummel, R.A., Rosenfeld, A., IEEE Transactions on Computers, 1977, C-26(4), pp. 394–403, 138 Citations