

DORON TAL – Curriculum Vitae

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EDUCATION

- **Ph. D.**, *Boston University*. Department of Cognitive and Neural Systems. Mentor: Eric L. Schwartz, Computational Vision and Robotics Laboratory
- **M. Eng.**, *Cornell University*. Department of Computer Science. Mentor: Alberto M. Segre, Artificial Intelligence Laboratory
- **B. A.**, *Cornell University*. Majors: Computer Science & Philosophy. Minor: Cognitive Studies

SELECTED PROJECTS

- *Rapid learning in four legged robot locomotion policies*: Automatically teach a robot to walk, first in simulation, then in real life. Also used machine learning to (a) evaluate physical robot designs according to performance in simulation, (b) to automatically learn servo-couplings that work best for these robots (NASA Ames. Videos: 1, 2, 3).
- 3D camera localization using vision-based simultaneous localization and mapping: Robot 3D localization, with a single grayscale camera, a single light source, known terrain heights and albedos and an Extended Kalman Filter (NASA Ames. Video).
- *Two dimensional image segmentation*: Partitioning an image into parts of homogeneous color or texture - implemented UC Berkeley's Normalized Cuts algorithm as an open source library, extended the algorithm to include color as a cue. Helped compile a database of human image segmentations.
- *A simple biological model of neuron arithmetic*: Using the Integrate And Fire circuit for a model of a neuron we showed how, by modifying the refractory period of a neuron or its time constant, the neuron can shift its behavior from adding its inputs to multiplying them.
- *Neural circuit for image segmentation*: my thesis has a model that ascribes the orientation singularities observed in visual cortex a function: image segmentation. Simple blurring of the input image edge response produces orientation singularities that segment the image into parts. We postulate that in the brain these orientation singularities form and change in response to an onchanging input-image and that they topographically represent segmented surfaces in the image, plus their shape.

EMPLOYMENT HISTORY

- Sr. Research Engineer, **Cornell Tech** Dec. 2017 - Present
(1) Built the Cornell Tech Directory App for people to find out about each other - this included an API server with its database (EC2 node), and a client-app static file server (S3 bucket). It was implemented in Ionic / Angular / Typescript for the client with Django REST Framework

and PostgreSQL on the server; (2) Implemented computer vision algorithms to recognize and estimate the pose of a Lego brick (Python & OpenCV); (3) Built a video portal to connect two places far apart with cameras, projectors and Raspberry Pi boards (Linux / Python / OpenCV). Co authored three, accepted, publications related to these projects.

- President, **Tracktunes, Inc.** Jul. 2013 - Present. *Tracktunes, Inc. is a benefit corporation devoted to building technology that help performing and composing musicians find each other, collaborate, share and sell music.*
- Sr. Vision Scientist, **Videosurf, Inc.** (acquired by **Microsoft**). August, 2007 - October, 2010. *Computer vision algorithms for video search, facial pose estimation and object segmentation out of videos; text entity extraction and automatic tagging of video data with Freebase articles and relationships.*
- Computer Vision Research Scientist, **Paravue, Inc.**, Oakland, CA. February, 2007 - August, 2007. *Fast image segmentation algorithms on megapixel images, for automatic clipping of objects from images for later labeling and for Paravue's Turbomask (TM) Adobe Photoshop auto-clipping plugin.*
- Research Scientist, USRA/RIACS at **NASA Ames Research Center**, Moffett Field, CA. March, 2002 – April, 2006. *3D vision based SLAM (Video). Combined robotics with computer vision for mapping and localization; implemented stereo vision and camera calibration for Autonomous Rotorcraft Project on UAV's hardware; interfaced the UAV's sensors to a reactive planner for automatic machine diagnostics; machine learning for robot controller symmetry optimization; machine learning for automatic robot design; articulated robot physics based simulation used ODE, Open Inventor and accurate friction models for ground-foot interaction; built second quadruped robot "RTQ".*
- Director, **VisBot, Inc.** Berkeley, CA. August, 2001 – August, 2003. *Built first quadruped prototype and taught it various walking gaits with Andrew Ng and Greg Williams at UC Berkeley.*
- Postdoctoral Fellow, NIH funded, Vision Group at **University of California, Berkeley**, CA. February, 2000 – June, 2001. *Image segmentation with Jitendra Malik, implemented the "Normalized Cuts" algorithm and augmented it with color processing capability, developed metrics for benchmarking both human and machine segmentations of images.*
- Research Scientist and founding member, **Visionics Corporation**. Jersey City, NJ. July, 1997 – January, 2000. *Face detection, high-accuracy face alignment, tracking moving heads, low level image processing and enhancement for face recognition. Visionics is known today as "L1 Identity Solutions, Inc."*
- Postdoctoral Fellow, **Mount Sinai School of Medicine**. Neuroscience Laboratory. New York, NY. September, 1997 – June, 1997. *Optical imaging in striate cortex*

of cat and monkey, and pattern recognition in optical imaging data.

- Research Assistant, **Boston University, Department of Cognitive and Neural Systems, Computational Vision and Robotics Laboratory**. September, 1993 – January, 1997. *Graduate Research: (1) human and animal segmentation of visual imagery; (2) a model of how neurons can either multiply or add their inputs, depending on two common parameters; (3) structure and function of vortex formation in mammalian brains.*
- Research Engineer, **Xerox Corporation – Rochester Research Center**, Rochester, NY. January 1992 – July, 1992. *Co-author of "ask", Xerox's natural language company information database program.*

SELECTED PUBLICATIONS

- Tal, D. (2006). Evaluating symmetry variations in quadruped trot gait locomotion controllers. *IEEE International Conference on Robotics and automation: Submitted to ICRA '07.*
- Lutz R., Patterson-Hine A., Nelson S., Frost C. R., Tal D. and Harris, R. (2006). Using Obstacle Analysis to Identify Contingency Requirements on an Unpiloted Aerial Vehicle. *Requirements Engineering Journal*, Springer Verlag. *Accepted Sept., 2006.*
- Tal, D. (2005). Robot and Locomotion-Controller Design Optimization for a Reconfigurable Quadruped Robot. Universities Space Research Association Technical Report 05-29.
- Lutz R., Patterson-Hine A., Nelson S., Frost C. R. and Tal D. (2005). Identifying Contingency Requirements Using Obstacle Analysis. *13th IEEE Requirements Engineering Conference 2005.*
- Tal D. and Malik J. (2001). Combining Color, Texture and Contour for Image Segmentation. Technical Report, UC Berkeley Computer Science Department.
- Martin D., Fowlkes C., Tal D. and Malik J. (2001). A database of human segmented natural images and its application to evaluating segmentation algorithms and measuring ecological statistics. *ICCV 2001.*
- Tal D. and Schwartz E. L. (1997). Topological singularities in cortical orientation maps: the sign theorem correctly predicts orientation column patterns in primate striate cortex *Network: Computation in Neural Systems* 8(2),229-238.
- Tal D. and Schwartz E. L. (1997). Computing with the leaky integrate and fire model: logarithmic computation and multiplication. *Neural Computation* 9,305-318.
- Tal D. and Schwartz E. L. (1996). Statistical analysis and parametrization of experimental and theoretical vortex maps in primate striate cortex (oral presentation). *Invest. Ophthalm. & Vis. Sci. Suppl.* 37(3), 938.
- Tal D. and Schwartz E. L. (1995). Computing with the integrate and fire neuron: Multiplication, addition and phase detection. *Technical Report CAS/CNS-95-024*, Boston University.

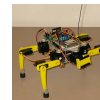
- Tal D. and Schwartz E. L. (1994). Weber-Fechner transduction – a logarithmic compressive nonlinearity is a generic property of integrate and fire neurons (paper presentation). *Proceedings of the INNS World Congress on Neural Networks*. IV, 350.
- Gaudio P., Olson S., Tal D., and Fischl B. (1993). A neural network model of dynamic receptive field reorganization. *Society for Neuroscience Abstracts*, 19 (1), 809.

SOFTWARE

- Hybrid web apps. Music collaboration and recording app. (HTML/CSS/Javascript/Ionic/Angular/Python/Postgres/AWS). Tracktunesd Inc and others, 2013-2018.
- Textual data mining and analysis - matching any phrase in YouTube video description text with Wikipedia page titles: if there is an unambiguous match, we turn the phrase in the video description into a link to the Wikipedia article. Videosurf Inc, 2010.
- The Normalized Cuts image segmentation algorithm (C++, Matlab). University of California at Berkeley, Department of Computer Science, 2000.
- Face tracking and head alignment algorithms (Matlab, C++), Visionics Inc., 1997.

HARDWARE

- Yellowbot: Built in collaboration with Andrew Ng and Gregory Williams at UC Berkeley to test machine learning algorithms for quadruped walking. In 2003, it was donated to Stanford's robotics lab. (Videos: 1, 2, 3)



- Rough Terrain Quadruped (RTQ): First outdoor version, developed at NASA Ames Research Center. This robot is physically symmetric along front/hind, left/right up/down axes. It has many improvements in durability and weight reduction over yellowbot.



- Rough Terrain Quadruped II (RTQ2). Further physical improvements: stronger lower legs, spring-suspension lower-leg shocks and a water-sealed box for power and electronics.

