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### Employment History

Jun. 2020 – present	Research Scientist and Team Lead (June 2020 - ) Google Research, Brain Team Toronto
Nov. 2017 – present	Faculty Member (and Associate Research Director, 2019-2020) Vector Institute for Artificial Intelligence
Oct. 2003 – present	Professor, Department of Computer and Mathematical Sciences, UTSC Department of Computer Science, University of Toronto
July. 2012 – June 2017	Chair, Department of Computer and Mathematical Sciences, University of Toronto Scarborough
Jan. 1999 – Oct. 2003	Member of Research Staff and Area Manager (as of Feb, 2000), Perceptual Document Analysis and Digital Video Analysis Groups Palo Alto Research Center (PARC)
July 1995 – Dec. 2002	Associate Professor Department of Computing and Information Science, Cross-appointed to Psychology and Electrical Engineering, Queen's University, Kingston
July 1996 – Aug. 1997	Visiting Research Scientist Image Understanding Group, Xerox Palo Alto Research Center (PARC)
July 1996 – Aug. 1997 Jan. 1994 – May 1994	Visiting Scholar Department of Psychology, Stanford University
July 1990 – June 1995	Assistant Professor Department of Computing and Information Science, Cross-appointed to Psychology, Queen's University, Kingston

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## Academic Degrees

- Ph.D.**      **Department of Computer Science, University of Toronto, 1991**  
Supervision: Allan D. Jepson  
Thesis: *Measurement of Image Velocity*
- M.Sc.**      **Department of Computer Science, University of Toronto, 1984**  
Supervision: Allan D. Jepson and John K. Tsotsos  
Thesis: *Early Processing of Spatiotemporal Visual Information*
- B.Sc.**      **Queen's University, 1982**  
Mathematics and Computer Science

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## Awards and Distinctions

- 2023      Highlight Paper Awards (x2), CVPR (top 2.5% of submitted papers)  
2022      Outstanding Paper Award, NeurIPS  
2021      Paper of the Year Award, Journal of Structural Biology  
2019      Lifetime Achievement Award,  
            Canadian Image Processing and Pattern Recognition Society  
2019      Canadian CIFAR Artificial Intelligence Chair  
2017      Faculty Member, Vector Institute  
2012 – 19      Senior Fellow, Canadian Institute for Advanced Research  
2010      Koenderink Prize in Computer Vision  
2009      Best Paper Award, British Machine Vision Conference  
2005 – 12      Fellow, Canadian Institute for Advanced Research  
2003      Best Paper Award, ACM Symposium on User Interface Software and Technology  
2003      Excellence in Science Award, Palo Alto Research Center  
2001      Best Paper Runner-Up, IEEE Conf. Computer Vision and Pattern Recognition  
1999      Marr Prize Honorary Mention, ICCV (runner-up for best paper)  
            IEEE International Conference on Computer Vision  
1996 – 99      Alfred P. Sloan Research Fellowship  
1985 – 87      NSERC Postgraduate Scholarship  
1982 – 84      NSERC Postgraduate Scholarship  
1982      NSERC Summer Research Grant  
1981 – 82      James H. Rattray Memorial Scholarship

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## Professional Activities

### Editorial Boards

- Advisory Board, *IEEE Trans. on Pattern Analysis and Machine Intelligence* (2009– )
- Associate Editor-In-Chief, *IEEE Trans. on Pattern Analysis and Machine Intelligence* (2005–2008)
- Associate Editor, *IEEE Trans. on Pattern Analysis and Machine Intelligence* (2000–2004)
- Guest Editor, *International Journal of Computer Vision*, Special Issue on Human Activity Understanding from 2D and 3D Data (2016)
- Guest Editor, *Computer Vision and Image Understanding*, Special Issue on Human Pose and Gesture (2016)
- Guest Editor, *Computer Vision and Image Understanding*, Special Issue on Motion Analysis (2005)

### Research Award Committees

- Best Paper Awards Committee, CVPR 2003, 2012, 2020
- Best Paper Awards Committee, ECCV 2012
- Best Paper Awards Committee, ICCV 2019
- Thomas S. Huang Memorial Award Selection Committee 2021, 2022

### Conference Chairs

- Program Co-Chair, European Conference on Computer Vision (2014)
- Program Co-Chair, Conference on Computer Vision and Pattern Recognition (2003)

### Senior Program Committees / Area Chair

- European Conference on Computer Vision (2012, 2020, 2022)
- Conference on Computer Vision and Pattern Recognition (2004, 2007-2010, 2012, 2022)
- International Conference on Computer Vision (2009, 2011, 2013, 2019, 2023)
- International Conference on Machine Learning (2004)
- Neural Information Processing Systems, NIPS (2007, 2008)

### Program Committees

- Asian Conference on Computer Vision, ACCV (2004)
- European Conference on Computer Vision, ECCV (2002, 2004, 2020)
- Workshop on Human Motion: Understanding, Modeling, Capture and Animation (2010)
- IAPR International Conference on Pattern Recognition, ICPR (2002, 2004)
- IEEE International Conference on Computer Vision, ICCV (1999, 2001, 2003, 2005)
- IEEE Conference on Computer Vision and Pattern Recognition, CVPR (1998, 2000, 2001, 2005, 2011, 2013, 2019, 2020, 2021)
- IEEE Workshop on Visual Motion (1991)
- IEEE Workshop on Motion and Video Computing (2002, 2007)
- IEEE Workshop on Statistical Methods for Video Processing (2003)
- IEEE Workshop on Event Mining: The Detection and Recognition of Events in Video (2003)
- IEEE Workshop on Spatial Coherence for Visual Motion Analysis (2004)
- Vision Interface, VI (1993, 1996, 1997, 2000)
- Conference on Articulated Motion and Deformable Objects (2006)
- Canadian Conference on Computer and Robot Vision, CRV (2004, 2005, 2006)
- Robotics Systems and Science, RSS (2006)
- NIPS Workshop on Evaluation of Articulated Human Motion and Pose Estimation (2006)
- CVPR Workshop on Evaluation of Human Motion and Pose Estimation (2007)
- ICCV Inverse Rendering Workshop (2015)

### Conference Reviewing

Most annual and biannual vision conferences (CVPR, ECCV, and ICCV) since 1990, and machine learning conferences (ICML, ICLR, NeurIPS), along with miscellaneous vision workshops, and related conferences occasionally (SIGGRAPH, IJCAI, AAAI, etc.).

### Journal Reviewing

#### *Frequent reviewing:*

Computer Vision and Image Understanding;  
IEEE Transactions on Image Processing;  
IEEE Transactions on Pattern Analysis and Machine Intelligence;  
Image and Vision Computing;  
International Journal of Computer Vision;  
Vision Research

#### *Occasional reviewing:*

Artificial Intelligence; Electronics Letters; Electronic Imaging; IEEE Transactions on Robotics and Automation; IEE Proceedings: Vision, Image and Signal Processing; IUCrJ; Journal of the Optical Society of America; Journal of Visual Communication and Image Representation; Optical Engineering; Pattern Recognition Letters; Psychological Research; Psychological Science; Nature; Nature Molecular Biology; Nature Methods; Nature Communications; Visual Neuroscience

### Other Technical Reviewing

ACM Distinguished Dissertation Awards;  
Kluwer Academic Press: Robotics Monograph Series;  
NSERC Discovery and Strategic Grant Proposals;  
FCAR Grant Proposals;  
NSF Grant Proposals

### Membership Activities

ARVO (Assoc. Research on Vision and Ophthalmology),  
Senior Member, IEEE (Inst. Electrical and Electronic Engineers),  
Chair, IEEE Computers & Communications Kingston Chapter (1994/95)

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## Research Contributions

### Books and Book Chapters

- Fleet, D.J., Pajdla, T., Schiele, B., and Tuytelaars, T. (Editors), **Proceedings of the 13th European Conference on Computer Vision**, Parts I–VII, Zurich, Switzerland, September 6-12, 2014. Lecture Notes in Computer Science, Volumes 8689–8695, Springer
- Fleet, D.J. (2011) Motion models for people tracking. **Guide to Visual Analysis of Humans: Looking at People**, T. Moeslund, A. Hilton, V. Krueger, L. Sigal (editors). Springer, pp. 171–198.
- Brubaker, M.A., Sigal, L. and Fleet, D.J. (2009) Video-based people tracking. **Handbook of Ambient Intelligence and Smart Environments**, H. Nakashima, H. Aghajan, J.C. Augusto (editors). Springer Verlag, pp. 57–88.
- Fleet, D.J. and Weiss, Y. (2005) Optical flow estimation. **Mathematical Models of Computer Vision: The Handbook**, N. Paragios, Y. Chen, and O. Faugeras (editors), Springer Verlag, Chapter 15, pp. 239-258
- Fleet, D.J., Black, M.J. and Nestares, O. (2002) Bayesian inference of visual motion boundaries. **Exploring Artificial Intelligence in the New Millennium**, G. Lakemeyer and B. Nebel (editors), Morgan Kaufmann Press (edited volume containing the invited Distinguished Papers from IJCAI 2001), pp. 139–173
- Weiss, Y. and Fleet, D.J. (2001) Velocity likelihoods in biological and machine vision. In **Probabilistic Models of the Brain: Perception and Neural Function**, R.P.N. Rao, B.A. Olshausen and M.S. Lewicki (editors), MIT Press, pp. 81–100.
- Fleet, D.J., Heeger, D.J. and Wagner, H. (1997) Neural encoding of binocular disparity. In **Computational and Biological Mechanisms of Visual Coding**, M. Jenkin and L. Harris (editors), Cambridge University Press, pp. 103-130
- Fleet, D.J. (1992) **Measurement of Image Velocity**. Kluwer Academic Publishers, Norwell MA
- Tsotsos, J.K., Fleet, D.J., Jepson, A.D. (1988) Towards a theory of motion understanding in man and machine. In **Motion Understanding: Robot and Human Vision**, W. Martin and J. Aggarwal (editors), Kluwer Academic Publishers, pp. 353-417

### Refereed Journal Publications

- Tu, T., Azizi, S., Driess, D., Schaekermann, M., Amin, M., Chang, P.-C., Carroll, A., Lau, C., Tanno, R., Ktena, I., Mustafa, B., Chowdhery, A., Liu, Y., Kornblith, S., Fleet, D.J., Mansfield, P., Prakash, S., Wong, R., Virmani, S., Semturs, C., Mahdavi, S., Green, B., Dominowska, E., Barral, J., Webster, D., Corrado, G.S., Matias, Y., Singhal, K., Florence, P., Karthikesalingam, A., Natarajan, V. (2023) Towards generalist biomedical AI, (in submission)
- Azizi, S., Kornblith, S., Saharia, C., Norouzi, M., Fleet, D.J. (2023) Synthetic data from diffusion models improves ImageNet classification, *Transactions on Machine Learning Research* (TMLR; to appear)
- Dousty, M., Bandini, A., Eftekhari, P., Fleet, D.J., and Zariffa, J. (2023) Grasp analysis in the home environment as a measure of hand function after cervical spinal cord injury, *Neurorehabilitation and Neural Repair* 37 (7), 466474.

- Azizi, S., Culp, L., Freyberg, J., Mustafa, B., Baur, S., Kornblith, S., Chen, T., MacWilliams, P., Mahdavi, S.S., Wulczyn, E., Babenko, B., Wilson, M., Loh, A., Chen, P.C., Liu, Y., Bavishi, P., McKinney, S., Winkens, J., Roy, A.G., Beaver, Z., Ryan, F., Krogue, D., Etemadi, M., Telang, U., Liu, Y., Peng, L., Corrado, G.S., Webster, D.R., Fleet, D.J., Hinton, G., Hounsby, N., Karthikesalingam, A., Norouzi, M., Natarajan, V. (2023) Robust and efficient medical imaging with self-supervision, *Nature Biomedical Engineering* 7 (6), 756779.
- Punjani, A. and Fleet, D.J. (2023) Mapping the Motion and Structure of Flexible Proteins from Cryo-EM, *Nature Methods*, Research Briefing, May (invited)
- Punjani, A. and Fleet, D.J. (2023) 3DFlex: Determining structure and motion of flexible proteins from Cryo-EM, *Nature Methods*, 20 (6), 860-870.
- Dousty, M., Fleet, D.J., and Zariffa, J. (2023) Hand grasp classification in egocentric video after cervical spinal cord injury *IEEE Journal of Biomedical and Health Informatics*, 1-11
- Saharia, C., Ho, J., Chan, W., Salimans, T., Fleet, D.J. and Norouzi, M. (2022) Image super-resolution via iterative refinement, *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 45(4): 4713–4726
- Fleet, D.J. (2022) Editorial, 2021 JSB Paper of the Year, 3D Variability Analysis, *Journal of Structural Biology* 214 (4), 107894a (invited)
- Ho, J., Saharia, C., Chan, W., Fleet, D.J., Norouzi, M and Salimans, T. (2022) Cascaded Diffusion Models for High Fidelity Image Generation, *Journal of Machine Learning Research* 23(47):1-33
- Punjani, A. and Fleet, D.J. (2021) 3D Variability Analysis: Directly resolving continuous flexibility and discrete heterogeneity from single particle cryo-EM images. *Journal of Structural Biology*, 213 (2021) 107702. **[JSB Paper of the Year Award]**
- Punjani, A., Zhang, H. and Fleet, D.J. (2020) Non-Uniform Refinement: Adaptive regularization improves single particle cryo-EM reconstruction. *Nature Methods*, 17 (12), 1214-1221.
- Punjani, A., Zhang, H., Rubinstein, J., Brubaker, M., and Fleet, D.J. (2018) Algorithmic advances in single particle cryo-EM data processing. *Microscopy and Microanalysis* 24 (S1), 868-869
- Punjani, A., Rubinstein, J., Fleet, D.J. and Brubaker, M.A. (2017) cryoSPARC: Algorithms for rapid unsupervised cryo-EM structure determination. *Nature Methods*, 14 (3): 290-296.
- Punjani, A., Brubaker, M.A., and Fleet, D.J. (2016) Building proteins in a day: Efficient 3D molecular reconstruction. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 39(4):706-718, 2017.
- Cao, Y., Brubaker, M., Fleet, D.J., and Hertzmann, A. (2015) Efficient optimization for sparse Gaussian process regression. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 37(12):2415-2427.
- Cadotte, A., Cadotte, D.W., Livne, M., Cohen-Adad, J., Fleet, D.J., Mikulis, D. and Fehlings, M.G. (2015) Spinal cord segmentation by one dimensional normalized template matching: A novel, quantitative technique to analyze advanced magnetic resonance imaging data. *PLoS ONE*, 10(10): e0139323 (doi: 10.1371/journal.pone.0139323)
- Cadotte, D., Cadotte, A., Cohen-Adad, J., Fleet, D.J., Livne, M., Wilson, J.R., Mikulis, D., Nugaeva, N., and Fehlings, M.G. (2014) Characterizing the location of spinal and vertebral levels in the human cervical spinal cord. *American Journal of Neuroradiology*, December, 2014, A4192.

- Norouzi, M., Punjani, A., and Fleet, D.J. (2014) Fast exact search in Hamming space with multi-index hashing. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 36(6):1107–1119
- Memisevic, R., Sigal, L., and Fleet, D.J. (2012) Shared kernel information embedding for discriminative inference. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 34(4):778–790
- Livne, M., Sigal, L., Troje, N., and Fleet, D.J. (2012) Human attributes from video-based pose tracking. *Computer Vision and Image Understanding*, 116:648–660
- Macrini, D., Dickinson, S., Fleet, D.J., and Siddiqi, K. (2011) Shape categorization using bone graphs. *Computer Vision and Image Understanding*, 115(8):1187–1206
- Macrini, D., Dickinson, S., Fleet, D.J., and Siddiqi, K. (2011) Bone Graphs: Medial shape parsing and abstraction. *Computer Vision and Image Understanding*, 115(7):1044–1061
- de La Gorce, M., Fleet, D.J., Paragios, N. (2011) Hand tracking with occlusion, lighting and texture. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 33(9):1793–1805
- Wang, J., Fleet, D.J. and Hertzmann, A. (2010) Optimizing walking controllers with uncertain user inputs and environments. *ACM Transactions on Graphics (SIGGRAPH)*, 29(4), Article 73
- Brubaker, M.A., Fleet, D.J. and Hertzmann, A. (2010) Physics-based pose tracking with the Anthropomorphic Walker. *International Journal of Computer Vision*, 87(1):140–155
- Wang, J., Fleet, D.J. and Hertzmann, A. (2009) Optimizing walking controllers. *ACM Transactions on Graphics (SIGGRAPH Asia)*, 28(5), Article 168
- Levinshtein, A., Stere, A., Kutulakos, K., Fleet, D.J., Dickinson, S. and Siddiqi, K. (2009) TurboPixels: Fast superpixels using geometric flows. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 31(12):2290–2297
- Wang, J., Fleet, D.J. and Hertzmann, A. (2008) Gaussian process dynamical models. *IEEE Transactions on Pattern Analysis and Machine Intelligence* 30(2):283–298
- Urtasun, R., Fleet, D.J. and Fua, P. (2006) Motion models for 3D people tracking. *Computer Vision and Image Understanding* 104(2):157–177
- Nunes, P., Haines, N., Kuppaswamy, V., Fleet, D.J. and Stewart, B. (2006) Synaptic Vesicle Mobility and Presynaptic F-Actin Are Disrupted in an NSF Allele of *Drosophila*. *Molecular Biology of the Cell* 17:4709–4719
- Jepson, A.D., Fleet, D.J. and El-Maraghi, T. (2003) Robust on-line appearance models for vision tracking. *IEEE Transactions on Pattern Analysis and Machine Intelligence* 25(10):1296–1311
- Backus, B., Fleet, D.J., Parker, A.J. and Heeger, D.J. (2001) Human cortical activity correlates with stereoscopic depth perception. *Journal of Neurophysiology* 86:2054–2068
- Haussecker, H.W. and Fleet, D.J. (2001) Estimating optical flow with physical models of brightness variation. *IEEE Transactions on Pattern Analysis and Machine Intelligence* 23(6):661–673
- Gurnsey, R., and Fleet, D.J. (2001) Texture space. *Vision Research* 41(3):745–757
- Black, M.J. and Fleet, D.J. (2000) Probabilistic detection and tracking of motion boundaries. *International Journal of Computer Vision* 38(3):229–243

- Fleet, D.J., Black, M.J., Yacoob, Y., and Jepson, A.D. (2000) Design and use of linear models for image motion analysis. *International Journal of Computer Vision* 36(3):171–193
- Lippert, J., Fleet, D.J., and Wagner, H. (2000) Disparity tuning as simulated by a neural net. *Biological Cybernetics* 83(1):61–72
- Black, M.J., Fleet, D.J., and Yacoob, Y. (2000) Robustly estimating changes in image appearance. *Computer Vision and Image Understanding* 78(1):8–31
- Langley, K., Fleet, D.J., and Hibbard, P.B. (1999) Stereopsis from contrast envelopes. *Vision Research* 39(14):2313–2324.
- Langley, K., Fleet, D.J., and Hibbard, P.B. (1998) Linear and nonlinear transparencies in stereopsis. *Proceedings of the Royal Society London B*. 265:1837–1845.
- Gurnsey, R., Fleet, D.J. and Potechin, C. (1998) Second-order motions contribute to vection. *Vision Research* 38(18):2801–2816
- Fleet, D.J., Wagner, H., and Heeger, D.J. (1996) Neural encoding of binocular disparity: Energy models, position-shifts and phase-shifts. *Vision Research* 36(12):1839–1857
- Langley, K., Fleet, D.J., and Hibbard, P.B. (1996) Linear filtering precedes nonlinear processing in early vision. *Current Biology* 6(7):891–896
- Fleet, D.J. and Langley, K. (1995) Recursive filters for optical flow. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 17(1):61–67
- Fleet, D.J. and Langley, K. (1994) Computational analysis of non-Fourier motion. *Vision Research*, 34(22):3057–3079
- Barron, J.L., Fleet, D.J., and Beauchemin, S.S. (1994) Performance of optical flow techniques. *International Journal of Computer Vision*, 12(1):43–77
- Fleet, D.J. and Jepson, A.D. (1993) Stability of phase information. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 15(12):1253–1268
- Jepson, A.D. and Fleet, D.J. (1991) Phase singularities in scale-space. *Image and Vision Computing Journal*, 9(5):338–343
- Fleet, D.J., Jepson, A.D., and Jenkin, M. (1991) Phase-based disparity measurement. *Computer Vision, Graphics and Image Processing: Image Understanding*, 53(2):198–210
- Fleet, D.J. and Jepson, A.D. (1990) Computation of component image velocity from local phase information. *International Journal of Computer Vision*, 5(1):77–104
- Fleet, D.J. and Jepson, A.D. (1989) Hierarchical construction of orientation and velocity selective filters. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 11(3):315–325
- Fleet, D.J., and Jepson, A.D. (1985) Spatiotemporal inseparability in early vision: centre-surround models and velocity selectivity. *Computational Intelligence*, 1(3):89–102
- Fleet, D.J., Hallett, P.E., and Jepson, A.D. (1985) Spatiotemporal inseparability in early visual processing. *Biological Cybernetics*, 52(2):153–164



## Refereed Conferences/Workshops: Papers in Proceedings / Online

- ICCV*: IEEE International Conference on Computer Vision, IEEE Press  
*CVPR*: IEEE Conference on Computer Vision and Pattern Recognition, IEEE Press  
*ICIP*: IEEE International Conference on Image Processing, IEEE Press  
*ECCV*: European Conference on Computer Vision, Springer Verlag  
*BMVC*: British Machine Vision Conference  
*NeurIPS*: Advances in Neural Information Processing Systems  
*ICML*: International Conference on Machine Learning, ACM Press  
*ICLR*: International Conference on Learning Representations (online)  
*UAI*: Uncertainty in Artificial Intelligence

- Clark, K., Vicol, P., Swersky, K., and Fleet, D.J.: Directly fine-tuning diffusion models on differentiable rewards. (submitted; preprint arXiv:2309.17400)
- Saxena, S., Hermann, C., Hur, J., Kar, A., Norouzi, M., Sun, D., and Fleet, D.J.: The surprising effectiveness of diffusion models for optical flow and monocular depth estimation. *NeurIPS*, New Orleans, December 2023.
- Jabri, A., Fleet, D.J., and Chen, T.: Scalable adaptive computation for iterative generation. *ICML*, Honolulu, July 2023.
- Liao, R., Kornblith, S., Ren, M., Fleet, D.J. and Hinton, G.: Gaussian-Bernoulli RBMs without tears. (submitted)
- Chen, T., Li, L., Saxena, S., Hinton, G. and Fleet, D.J.: A generalist framework for panoptic segmentation of images and videos. *ICCV*, Paris, October 2023 (16 pages).
- Sabour, S., Vora, S., Duckworth, D., Krasin, I., Fleet, D.J., and Tagliasacchi, A.: RobustNeRF: Ignoring distractors with robust losses. *CVPR*, Vancouver, June 2023 (16 pages). **[Highlight Paper]**
- Wang, S., Saharia, C., Montgomery, C., Pont-Tuset, J., Noy, S., Pellegrini, S., Onoe, Y., Laszlo, S., Fleet, D.J., Soricut, R., Baldrige, J., Norouzi, M., Anderson, P., Chan, W.: Imagen Editor and EditBench: Advancing and evaluating text-guided image inpainting. *CVPR*, Vancouver, June 2023 (12 pages). **[Highlight Paper]**
- Ho, J., Chan, W., Saharia, C., Whang, J., Gao, R., Gritsenko, A., Kingma, D.P., Poole, B., Norouzi, M., Fleet, D.J. and Salimans, T.: Imagen Video: High definition video generation with diffusion models. arXiv preprint arXiv:2210.02303 (18 pages)
- Shekarforoush, S., Lindell, D.B., Fleet, D.J., and Brubaker, M.A.: Residual multiplicative filter networks for multiscale reconstruction. *NeurIPS*, New Orleans, December 2022 (14 pages)
- Saharia, C., Chan, W., Saxena, S., Li, L., Whang, J., Denton, E., Ghasemipour, S., Ayan, B.K., Mahdavi, S., Lopes, R., Salimans, T., Ho, J., Fleet, D.J., and Norouzi M.: Photorealistic text-to-image diffusion models with deep language understanding. *NeurIPS*, New Orleans, December 2022 (15 pages) **[Outstanding Paper Award]**
- Ho, J., Salimans, T., Gritsenko, A., Chan, W., Norouzi, M., and Fleet, D.J.: Video diffusion models. *NeurIPS*, New Orleans, December 2022 (15 pages)
- Chen, T., Saxena, S., Li, L., Lin, T.Y., Fleet, D.J., and Hinton, G.E.: A unified sequence interface for vision tasks. *NeurIPS*, New Orleans, December 2022 (13 pages)

- Sun, D., Herrmann, C., Reda, F., Rubinstein, M., Fleet, D.J., and Freeman, W.T.: Disentangling architecture and training for optical flow. *ECCV*, Tel Aviv, October 2022 (18 pages)
- Saharia, C., Chan, W., Chang, H., Lee, C., Ho, J., Salimans, T., Fleet, D.J. and Norouzi, M.: Palette: Image-to-image diffusion models. *ACM SIGGRAPH*, Vancouver, August 2022 (9 pages)
- Greff, K. et al.: Kubric: A scalable dataset generator. *CVPR*, New Orleans, June 2022 (11 pages)
- Chen, T., Saxena, S., Li, L., Fleet, D.J., and Hinton, G.E.: Pix2seq: A language modeling framework for object detection. *ICLR*, April 2022 (10 pages)
- Dousty, M., Fleet, D.J., and Zariffa, J.: Postural analysis of the hand in individuals with spinal cord injury using egocentric video. *National Spinal Cord Injury Conference*, November 2021 (8 pages)
- Sabour, S., Tagliasacchi, A., Yazdani, S., Hinton, G.E., and Fleet, D.J.: Unsupervised part representation by Flow Capsules. *ICML*, July 2021 (10 pages)
- Wei, C., Rudzicz, F., Fleet, D.J., Grantcharov, T., and Taati, B.: Intraoperative Adverse Event Detection in Laparoscopic Surgery: Stabilized Multi-Stage Temporal Convolutional Network with Focal-Uncertainty Loss. *Conf. Machine Learning for Healthcare, PMLR*, 149:124, 2021 (24 pages)
- Norouzi, S., Fleet, D.J. and Norouzi, M.: Exemplar VAEs for Exemplar based Generation and Data Augmentation. *NeurIPIS*, December 2020 (10 pages)
- Ullrich, K., Berg, R., Brubaker, M.A., Fleet, D.J., and Welling, M.: Differentiable probabilistic models of scientific imaging with the Fourier slice theorem. *UAI*, September 2019 (arXiv:1906.07582) (8 pages)
- Faghri, F., Fleet, D.J., Kiros, J.R., and Fidler, S.: VSE++: Improved visual-semantic embeddings with hard negatives. *BMVC*, Newcastle, September 2018 (14 pages)
- Livne, M., Sigal, L., Brubaker, M. and Fleet, D.J.: Walking on thin air: Environment-free physics-based markerless motion capture. *Candaian Conference on Robot and Computer Vision (CRV)*, June 2018
- Asgarian, A., Ashraf, A.B., Fleet, D.J. and Taati, B.: Subspace selection to suppress confounding source domain information in AAM transfer learning. *Int. J. Conf. Biometrics (IJCB)*, Oct 2017
- Sabour, S., Cao, Y., Faghri, F. and Fleet, D.J.: Adversarial manipulation of deep representations. *ICLR*, Puerto Rico, May 2016 (9 pages)
- Norouzi, M., Collins, M.D., Johnson, M., Fleet, D.J. and Kohli, P.: Efficient non-greedy optimization of decision trees. *NIPS*, Montreal, December 2015 (9 pages)
- Brubaker, M.A., Punjani, A. and Fleet, D.J.: Building proteins in a day: Efficient 3D molecular reconstruction *CVPR*, Boston, June 2015 (10 pages)
- Pons-Moll, G., Fleet, D.J., and Rosenhahn, B.: Posebits for human pose estimation. *CVPR*, Columbus, June 2014 (9 pages)
- Cao, Y., Brubaker, M., Fleet, D.J., and Hertzmann, A.: Efficient optimization for sparse Gaussian process regression. *NIPS*, Lake Tahoe, December 2013 (9 pages)
- Norouzi, M. and Fleet, D.J.: Cartesian k-means. *CVPR*, Portland, June 2013 (8 pages)
- Norouzi, M., Fleet, D.J., and Salakhutdinov, R.: Hamming space metric learning. *NIPS*, Lake Tahoe, December 2012 (9 pages)

- Norouzi, M., Punjani, A. and Fleet, D.J.: Fast search in Hamming space with multi-index hashing. *CVPR*, Providence, June 2012 (8 pages)
- Norouzi, M., and Fleet, D.J.: Minimal loss hashing for compact binary codes. *ICML*, Bellevue, June 2011 (8 pages)
- Manfredotti, C., Fleet, D.J., Hamilton, H.J. and Zilles, S.: Simultaneous tracking and activity recognition. *Int. Conf. Tools with A.I.* Boca Raton, November 2011
- Sigal, L., Fleet, D.J., Troje, N. and Livne, M.: Human attributes from 3D pose tracking. *ECCV*, Crete, September 2010 (14 pages)
- Taylor, G., Sigal, L., Fleet, D.J. and Hinton, G.: Dynamical binary latent variable models for 3D pose tracking. *CVPR*, San Francisco, June 2010 (8 pages)
- Manfredotti, C., Fleet, D.J., and Messina, E.: Relations to improve multi-target tracking in an activity recognition system. *Int. Conf. on Imaging for Crime Detection and Prevention*, London, December 2009
- Brubaker, M., Sigal, L. and Fleet, D.J.: Estimating contact dynamics. *ICCV*, Kyoto, October 2009 (8 pages)
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### **Lightly Refereed Workshops/Symposia: Papers in Proceedings**

- Ho, J., Salimans, T., Gritsenko, A., Chan, W., Norouzi, M. and Fleet, D.J.: Video Diffusion Models *ICLR Workshop on Deep Generative Models for Highly Structured Data* April 2022
- Saharia, C., Chan, W., Chang, H., Lee, C., Ho, J., Salimans, T., Fleet, DJ. and Norouzi, M.: Palette: Image-to-Image Diffusion Models. *NeurIPS Workshop on Deep Generative Models and Downstream Applications* December 2021
- Faghri, F., Vasconcelos C., Fleet D.J., Pedregosa, F., and Le Roux, N.: Bridging the Gap Between Adversarial Robustness and Optimization Bias. *ICLR Workshop on Security and Safety in Machine Learning Systems*, May 2021
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- Livne, M., Swerskey, K. and Fleet, D.J.: High Mutual information in representation learning with symmetric variational inference. *NeurIPS Workshop on Bayesian Deep Learning*, Vancouver, 2019
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### Conferences with Published Abstracts

*ARVO: Association for Research in Vision and Ophthalmology Annual Meeting*

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*OSA: Optical Society of America Annual Meeting*

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Fleet, D.J. and Jepson, A.D.: Stability of Phase Information. RPL-TR-9105

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## Patents

US Patent App. 17/938,139 Image-to-Image Mapping by Iterative De-Noising C Saharia, M Norouzi, W Chan, H Chang, DJ Fleet, CA Lee, J Ho, T Salimans (Filed: Apr. 6, 2023)

US Patent App. 17/391,150, 18/155,420 Image Enhancement via Iterative Refinement based on Machine Learning Models C Saharia, J Ho, W Chan, T Salimans, D Fleet, M Norouzi (Filed: May 18, 2023)

Patent US 11,680,914: "Methods and systems for 3D structure estimation using non-uniform refinement", Ali Punjani, David Fleet, Haowei Zhang (Filed: Oct 2018; Awarded June 20, 2023).

Patent EP 3459049: "Methods and systems for image alignment of at least one image to a model", Ali Punjani, Marcus Brubaker and David Fleet (Awarded Nov 11, 2022).

Patent US 10,282,513, US 11,515,002 B2: "Methods and system for 3D structure estimation", Marcus Brubaker, Ali Punjani and David Fleet (Filed: October 13, 2016; Awarded April 13, 2017, Nov. 29, 2022).

Patents US 9,830,732 and 10,242,483: "Methods and systems for image alignment of at least one image to a model", Ali Punjani, Marcus Brubaker and David Fleet (Filed: May 16, 2017; Awarded March 26, 2019).

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Patent EP 1,318,477: "Robust on-line appearance models for visual tracking", Allan D. Jepson, David J. Fleet, and Thomas F. El-Maraghi (Filed: Dec. 6, 2002, Awarded: Mar. 22, 2006)

Patent US 6,954,544: "Visual motion analysis method for detecting arbitrary numbers of moving objects in image sequences", Allan D. Jepson, David J. Fleet, and Michael J. Black (Filed: May 22, 2002, Awarded: Oct. 11, 2005).

Patent US 6,903,751: "System and method for editing electronic images" Eric Saund, Tom Moran, Dan Larner, James Mahoney, David Fleet, Chris Popat (Filed: Mar. 22, 2002, Awarded: June 7, 2005).

Patent EP 0,912,042: "Method for Embedding Signals in a Color Image", David J. Fleet, David J. Heeger, Todd A. Cass, David L. Hecht (Filed: Oct. 16, 1998; Awarded: Aug. 4, 2004)

Patent US 5,949,055: "Automatic Geometric Image Transformations Using Embedded Signals", David J. Fleet, David J. Heeger, Todd A. Cass, David L. Hecht (Filed: Oct. 23, 1997; Awarded: Sept. 7, 1999)

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## Invited Conference/Workshop/Keynote Presentations

- Fleet, D.J. and Punjani, A.: 3D Flexible Refinement for Single Particle Cryo-EM. *International Symposium on Visual Computing*, Lake Tahoe, October 2023 [Keynote]
- Fleet, D.J. and Punjani, A.: 3D Flexible Refinement for Single Particle Cryo-EM. *NeurIPS Workshop on Machine Learning in Structural Biology*, December 2022 [Keynote]
- Fleet, D.J. and Punjani, A.: 3D Flexible Refinement for Single Particle Cryo-EM. *SIAM Conference on Imaging Science*, Berlin, March 2022
- Fleet, D.J.: Multi-view reconstruction of biomolecules. Annual Conference on Vision and Intelligent Systems. Waterloo [Keynote], November, 2019 [Keynote]
- Punjani, A. and Fleet, D.J.: New Methods and Developments in CryoSPARC. Gordon Conference on 3D Electron Microscopy, Rhode Island, June 2018
- Punjani, A., Fleet, D.J., Brubaker, M. and Rubinstein, J.: Overview of cryoSPARC V2. Symposium on Frontiers and Careers in Cryo-EM, California NanoSystems Institute at UCLA, May 2018
- Punjani, A., Fleet, D.J. & Brubaker, M.A.: Advances in cryoSPARC for Cryo-EM. Gordon Conference on 3D Electron Microscopy, Switzerland, June 2017
- Fleet, D.J.: Multi-view reconstruction using Cryo-EM. *German Conference on Pattern Recognition*, September 2016 [Keynote]
- Punjani, A., Rubinstein, J., Fleet, D.J. & Brubaker, M.A.: Algorithms for reducing the computational burden of Cryo-EM. *Gordon Conference on 3D Electron Microscopy*, Hong Kong, June 2016.
- Punjani, A., Rubinstein, J., Fleet, D.J. & Brubaker, M.A.: Outlier rejection methods and branch-and-bound image alignment in cryoSPARC. *Gordon Conference on 3D Electron Microscopy*, Hong Kong, June 2016 [Poster].
- Fleet, D.J.: Estimation of human pose and interaction using physics-based models. *At the Intersection of Vision, Graphics, Learning and Sensing*, Cambridge, May 2012
- Fleet, D.J.: Hashing for large-scale image retrieval. *International Workshop on Computer Vision*, Sicily, May 2012
- Fleet, D.J.: Tracking and understanding human motion. *British Machine Vision Conference*, September 2011 [Keynote]
- Fleet, D.J.: Physics-Based models for human motion analysis. *ECCV Workshop on Human Motion: Understanding, Modeling, Capture and Animation*, September 2010 [Keynote]
- Fleet, D.J.: Tracking human pose and motion. *IEEE CVPR Workshop on Evaluation of Human Motion and Pose Estimation*, June 2007 [Keynote]
- Fleet, D.J.: Motion models for 3D human tracking. *BIRS Workshop on Mathematical Methods in Computer Vision*, Banff, October 2006
- Fleet, D.J.: Vision as Bayesian Inference: Looking at people. *APICS Conference on Mathematics and Computer Science*, University of Cape Breton, October 2006 [Keynote]

- Fleet, D.J.: Gaussian process dynamical models for modeling and tracking human motion. *Workshop on Learning, Representation and Context for Human Sensing in Video*, New York, June 2006
- Fleet, D.J.: Inference of visual motion boundaries. *Early Cognitive Vision Workshop*, Isle of Skye, Scotland, May 2004 [Keynote]
- Fleet, D.J.: Bayesian inference of visual motion boundaries on random fields. *Vision Interface 2003*, Halifax, June 2003 [Keynote]
- Fleet, D.J.: Appearance models for visual tracking. *Workshop on Recent Advances and Future Trends in Computer Vision*, Stanford University, March 2002
- Fleet, D.J. and Black, M.J.: Bayesian inference of visual motion boundaries. *IJCAI: International Joint Conference on Artificial Intelligence*, Seattle, August 2001 [Distinguished Paper Track],
- Fleet, D.J.: Bayesian image sequence analysis. *Workshop on Image Sequence Processing for Studying Dynamic Systems*, University of Heidelberg, Germany, Sept. 2000
- Fleet, D.J.: Bayesian detection and tracking of motion boundaries. *BASICS: Banff Annual Seminar in Cognitive Science*, May 2000
- Fleet, D.J.: Binocular energy models and the encoding of binocular disparity. *Annual Meeting of the Optical Society of America*, Long Beach, October 1997
- Fleet, D.J., Black, M.J., and Jepson, A.D.: Learning parameterized models for optical flow. *Workshop on Image Sequence Processing for Studying Dynamic Systems*, Heidelberg, Germany, June 1997
- Fleet, D.J.: Extraction and representation of binocular disparity. *International Conference on Visual Coding*, Toronto, June 1995
- Fleet, D.J.: Models of binocular interaction and disparity estimation. *Computational Neuroscience of Stereoscopic Depth Perception*, Max-Planck Inst. for Biological Cybernetics, Germany, July 1994
- Fleet, D.J. and Jepson, A.D.: Hierarchical construction of velocity-tuned filters, *University of Toronto Symposium on Vision*, Toronto, May 1986

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## Other Invited Workshop/Symposium Presentations and Panels

- Fleet, D.J. and Punjani, A.: Representing 3D density and motion of macromolecular structures from Cryo-EM. *BIRS Workshop on 3D Representation*, July 2023
- Fleet, D.J. and Punjani, A.: 3D Flexible Refinement for Single Particle Cryo-EM. *Computational Cryo-EM*, Flatiron Institute, Simons Foundation, July 2023
- Punjani, A., and Fleet, D.J.: Fourier-shell cross-validation. *NYC Computational Cryo-EM Summer Workshop*, Flatiron Institute, August 2019
- Fleet, D.J., Punjani, A., and Zhang, H.: Non-local refinement for Cryo-EM structure determination. *Machine Learning for Cryo-EM*, New York Structural Biology Center, April 2018
- Fleet, D.J., Punjani, A., and Brubaker, M.: Branch and Bound Optimization for Cryo-EM. *CIFAR Annual Meeting for Program on Learning in Machines and Brains*. Dec., 2017
- Fleet, D.J., Punjani, A., and Brubaker, M.: Fast and accurate Cryo-EM structure determination. *CIFAR Workshop on Deep Learning and Medical Image Analysis*, Amsterdam, October 2016

- Fleet, D.J.: Cartesian k-means. *CIFAR Workshop on Neural Computation and Adaptive Perception*, Montreal, December 2014
- Fleet, D.J.: Physics-based models for people tracking. *Bellairs Workshop on Computer Animation*, Barbadoes, February 2011
- Fleet, D.J.: Gaussian Process models for human motion. *International Workshop on Recent Trends in Computer Vision*, Kyoto, June 2009
- Fleet, D.J.: Gaussian Process models for human motion. *CIAR Workshop on Neural Computation and Adaptive Perception*, Vancouver, December 2007
- Fleet, D.J.: People Tracking with Simplified Lower-Body Dynamics. *Workshop on Computer Vision*, CMU, Pittsburgh, April 2007
- Fleet, D.J.: Motion models for 3D people tracking. *CIAR Workshop on Neural Computation and Adaptive Perception*, Vancouver, December 2005
- Fleet, D.J.: Priors for people tracking from small datasets. *CIAR Workshop on People Tracking*, Toronto, July 2005
- Fleet, D.J.: Bayesian inference of visual motion boundaries. *CIAR Workshop: Learning to See*, Vancouver, December 2003
- Fleet, D.J.: Appearance model for visual tracking. *Computational Neuroscientists of Upper Canada (CNUC) Meeting*, Fields Institute, Toronto, October 2003
- Fleet, D.J.: Structure in motion. *IEEE Workshop on Motion and Video Computing, Panel on Visual Motion Analysis*, Orlando, December 2002
- Fleet, D.J., Black, M.J., and Nestares, O.: Probabilistic detection and tracking of motion boundaries. *Annual Interdisciplinary Conference*, Jackson Hole, WY, January 2001
- Haussecker, H. and Fleet, D.J.: Computing optical flow with physical models of brightness variation. *Bay Area Vision Meeting*, IBM Almaden, May, 2000
- Sidenbladh, H., Black, M.J., and Fleet, D.J.: Stochastic tracking of 3D human figures using 2d image motion. *Bay Area Vision Meeting*, IBM Almaden, May, 2000
- Barron, J.L., Fleet, D.J., Beauchemin, S.S., and Burkitt, S.: Performance of optical flow techniques. *IEEE Visual Motion Workshop: Experimental Session*, Princeton, October 1991
- Fleet, D.J.: Phase-based optical flow. *IEEE Visual Motion Workshop: Experimental Session*, Princeton, October 1991
- Fleet, D.J. and Jepson, A.D.: Computation of normal velocity from local phase information, *Univ. Buffalo Graduate Conf. in Computer Science*, March 1989 (Proceedings in SUNY Buffalo TR)
- Fleet, D.J. and Jepson, A.D.: Velocity extraction without form interpretation, *Canadian Institute for Advanced Research Workshop on Vision*, Halifax, March 1986

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## Invited Talks/Seminars/Colloquia

- Non-Uniform Refinement for Cryo-EM**  
 Google Brain, Mountainview, Feb 2020

### **3D Multiview Reconstruction of Biomolecules**

University of Freiburg, June 2019  
Google Research, Zurich, May 2019  
University of British Columbia, November 2018

### **Teaching Computers to See**

TedxToronto, October 2014

### **Estimating Human Pose and Contact Dynamics**

Department of Computer Science Distinguished Talk, University of Manitoba, April 2013  
Department of Computer Science, University of Copenhagen, January 2012  
Institute for Information Processing, Leibniz University of Hannover, January 2012  
Max Plank Institute for Intelligent Systems, Tübingen, January 2012  
Department of Applied Mathematics, University of Bonn, December 2009  
Department of Applied Mathematics, Ecole Centrale de Paris, December 2009

### **Physics-Based 3D People Tracking**

Department of Science, UOIT, March 2011  
Department of Computer Science Colloquium, McGill University, February 2010  
Department of Computer Science, University of Aachen, December 2009  
Department of Computer Science, University of Darmstadt, December 2009  
Department of Applied Mathematics, Ecole Centrale de Paris, May 2008  
Honda Research Institute, Mountain View, CA, March 2008  
Computer Vision Colloquium, CSAIL, MIT, October 2007  
Department of Computer Science, Boston University, October 2007

### **Motion Models for 3D People Tracking**

Department of Computer Science Colloquium, Dartmouth College, April 2009  
Computer Vision Distinguished Seminar Series, EECS, University of Central Florida, February 2008  
Department of Computer Science, Swiss Federal Inst. of Technology Zurich (ETH), May 2006  
Department of Computing and Information Science, University of Pennsylvania, November 2005.  
Department of Computer Science, York University, November 2005

### **Appearance Models for Visual Tracking**

Computer and Communication Science, Swiss Federal Inst. of Technology Lausanne (EPFL), June 2004  
Department of Psychology, Queen's University, February 2004  
IBM Almaden Research Center, San Jose, October 2002  
Department of EECS, University of California at Berkeley, February 2002  
Fuji-Xerox Research Labs, Palo Alto, February 2002  
Department of Computer Science, Vision Seminar, Stanford University, February 2002

### **Bayesian People Tracking from Image Sequences**

Department of Computer Science, University of British Columbia, June 2002  
Department of Computer Science, University of Toronto, May 2002  
School of Computing, Queen's University, April 2002  
School of Computer Science, University of Waterloo, March 2002  
School of Engineering, University of California at Santa Cruz, November 2001

### **Bayesian Detection and Tracking of Motion Boundaries**

Los Alamos National Laboratory, Santa Fe, New Mexico, December 2000  
Department of Biology, Universität Aachen, September 2000  
Department of Computer Science, York University, August 2000

Xerox Research Center Europe, Cambridge, U.K., June 2000  
Department of Computer Science, University of Waterloo, March 2000  
Xerox Wilson Research Center, Rochester, NY, March 2000  
Department of Computer Science, University of Rochester, March 2000  
Department of Computing and Information Science, Queen's University, March 2000  
Department of EECS, University of California at Berkeley, February 2000  
Broad-Area Colloquium, Department of Computer Science, Stanford University, December 1999

#### **Parameterized Motion Models for Image Sequence Analysis**

Department of Computer Science, McGill University, Montreal, October 1998  
Department of Computing and Information Science, Queen's University, September 1998  
Xerox Palo Alto Research Center, August 1998

#### **Neural Basis of Stereo Depth Perception With fMRI**

Institute for Zoology, Aachen University, June 1997

#### **Embedding Invisible Information in Color Images**

Department of Computing and Information Science, Queen's University, March 1998  
Image Understanding Seminar, Xerox PARC, February 1997

#### **Neural Encoding of Binocular Disparity**

Department of Psychology, York University, September 1998  
Department of Psychology, Stanford University, November 1996  
Neuroscience Seminar Series, Queen's University, November 1995  
Smith-Kettlewell Research Institute, San Francisco, July 1995

#### **Computational Analysis of Non-Fourier Motion**

Interval Research Corp., Palo Alto, CA, January 1997  
Department of EECS, University of California at Berkeley, April 1994  
Department of Psychology, Stanford University, Stanford, March 1994  
Machine Perception Seminar, Xerox PARC, Palo Alto, February 1994  
Centre for Intelligent Machines, McGill University, Montreal, December 1993  
Department of Psychology, University College London, England, October 1993  
Max-Planck Institute for Biological Cybernetics, Tübingen, Germany, October 1993  
Department of Computer Science, University of Hamburg, Germany, October 1993

#### **Stability of Phase for Signal Matching**

Department of Electrical Engineering, University of Linköping, Sweden, June 1992  
Department of Psychology, University College London, England, May 1992  
Department of Computer Science, York University, Downsview, January 1992  
Department of Electrical Engineering, Yale University, New Haven, December 1991  
Department of Electrical Engineering, Brown University, Providence, December 1991  
Siemens Research Centre, Princeton, November 1991  
Department of Computer Science, University of British Columbia, Vancouver, June 1991  
Centre for Intelligent Machines, McGill University, Montreal, April 1991

#### **Phase-Based Measurement of Binocular Disparity**

Computer Science Department, University of Rochester, Rochester, November 1989

#### **Phase-Based Measurement of Image Velocity**

Center for Scientific Computation, University of Heidelberg, December 1990  
Department of Computer Science, Brown University, Providence, April 1990  
Department of Computing and Information Science, Queen's University, February 1990



Centre for Intelligent Machines, McGill University, Montreal, December 1989  
Department of Computer Science, University of Western Ontario, London, November 1989  
Fraunhofer Research Institute, Karlsruhe, West Germany, May 1989  
Department of Computer Science, University of Hamburg, West Germany, April 1989

**Measurement of Image Properties**

Department of Psychology, Cornell University, Ithica, April 1992  
Department of Psychology, Queen's University, Kingston, March 1990

**Spatiotemporal Inseparability in Early Visual Processing**

Department of Psychology, New York University, New York, June 1985  
Sarnoff Research Labs, Princeton, June 1985

**Velocity Extraction Using Velocity-Tuned Filters**

Computer Science Department, Carnegie-Mellon University, Pittsburg, June 1985