

# CURRICULUM VITAE

Fuchang (Frank) Gao

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## EDUCATION:

Ph.D., Mathematics, 1999, University of Connecticut  
M.S., Mathematics/Actuarial Science, 1996, University of Connecticut

## EXPERIENCE:

Professor, Department of Mathematics, University of Idaho, 2012-present  
Associate Professor, Department of Mathematics, University of Idaho, 2005-2012  
Assistant Professor, Department of Mathematics, University of Idaho, 1999-2005

## AWARDS:

Distinguished Faculty of College of Science, University of Idaho 2016

## EXTERNAL GRANTS:

"Integrating Physics and Generative Machine Learning Models for Inverse Materials Design"	Oct. 2019-Sept. 2021
PI, National Science Foundation	\$312,016
"Persistence of Random Processes"	Sept. 2012-Feb. 2018
PI, Simons Foundation Collaboration Grant	\$35,000
"Small Deviations and Geometric Quantifications"	Aug. 2004-July 2008
PI, National Science Foundation	\$84,600
"Life at Interfaces and the Biocomplexity of Extreme Environments"	Feb. 2002-Jan. 2005
Co-Investigator, National Science Foundation EPSCoR Grant	\$9,000,000

## COURSE DEVELOPED:

Analysis of Deep Learning  
Python for Data Science (co-developed with Linh Nguyen)

## GRADUATE STUDENTS ADVISED:

Shuomin Wang (M.S. May 2003)  
Jaimos Skriletz (M.S. May 2004)  
Xue Zhong (M.S. May 2005)  
John Bailly (M.S. 2007)  
Zhenxia Liu (Ph.D. 2013)  
James Cockreham (Ph.D. 2016)  
Daniel Furman (M.S. Current)

## REFEREED PUBLICATIONS:

Gao, F. A probabilistic characterization of negative definite functions. *HDP VIII Progress in Probability*. (to appear) (2019)  
Gao, F. and Lai, M-J. A new  $H^2$  regularity of the solution to Dirichlet problem of the Poisson equation with an application. *Acta Math Sinica*. (to appear) (2019)

- Cockreham, J. and Gao, F. Metric entropy of class of sets with positive reach. *Constr. Approx* **47** (2018), no. 2, 357–371.
- Gao, F; Wellner, J.A. Metric Entropy of Convex Functions on  $R^n$ . *Constr. Approx.* **46** (2017), no. 3, 565–592.
- Cockreham, J; Gao, F. and Yang, Y. Metric entropy of  $\ell_q$ -hulls in Banach spaces of type  $p$ . *Proc. of Amer. Math. Soc.* **145** (2017), no. 12, 5205–5214.
- Chen, X. and Gao, F. A reverse Gaussian correlation inequality by adding cones. *Statistics & Probability Letters* **123** (2017) 84-89.
- Gao, F.; Yang, X. Upper tail probabilities of integrated Brownian motions. *Sci. China Math.* **58** (2015), no.5, 1091–1100.
- Gao, F; Liu Z; Yang, X. Conditional persistence of Gaussian random walks. *Electron. Commun. Probab.* **19** (2014), no. 70, 1–9.
- Wang, Z.; Paterlini, S; Gao, F. and Yang, Y. Adaptive minimax regression estimation over sparse  $\ell_q$ -hulls. *J. Mach. Learn. Res.* **15** (2014), 1675–1711.
- Gao, F. Optimality of CKP-inequality in the critical case. *Proc. Amer. Math. Soc.* **142** (2014), no. 3, 909–914.
- Gao, F; Liu, Z; Yang, X. Comparison for upper tail probabilities of random series. *J. Korean Stat. Soc.* **42** (2013) 443-450.
- Gao, F. Bracketing entropy of high dimensional distributions. *Progress in Probability*, **66** (2013), 3-17.
- Dembo, A; Ding, J; Gao, F. Persistence of iterated partial sums. *Ann. Inst. H. Poincaré Probab. Statist.* **49** (2013), no. 3, 873-884.
- Aurzada, F; Gao, F; Kühn, T; Li, W.V.; Shao, Q-M. Small deviations for a family of smooth Gaussian processes. *J. Theoret. Probab.* **26** (2013), no. 1, 153–168.
- Gao, F. A simple proof of the right-hand rule. *College Math. J.* **44** (2013), no. 3, 227–229.
- Gao, F; Wellner, J.A. Global rates of convergence of the MLE for multivariate interval censoring. *Electron. J. Stat.* **7** (2013), 364–380.
- Gao, F; Ing, C-K; Yang, Y. Metric entropy and sparse linear approximation of  $\ell_q$ -hulls for  $0 < q \leq 1$ . *J. Approx. Theory* **166** (2013), 42–55.
- Gao, F; Han, L; Schilling, K. On the rate of convergence of iterated exponentials. *J. Appl. Math. Comput.* **39** (2012), no. 1-2, 89–96.
- Gao, F. and Han, L. Implementing the Nelder–Mead Simplex Algorithm with Adaptive Parameters. *Comput. Optim. Appl.* **51** (2012), no. 1, 259–277.
- Gao, F. Li, V.W. and Wellner, J. How many Laplace transforms of probabilities densities are there? *Proc. Amer. Math. Soc.* **138** (2010), no. 12, 4331–4344.
- Gao, F. Exact Value of the  $n$ -term approximation of a diagonal operator. *J. Approx. Theory* **162** (2010), no. 4, 646–652.
- Gao, F. and Wellner, J. Rate of convergence of the Maximum Likelihood Estimator of a  $k$ -monotone density. *Sci. China Ser. A*, **52** (2009), no. 7, 1525–1538.

Gao, F. Metric entropy  $k$ - monotone functions via small deviation probability of integrated Brownian motions. *Electr. Comm. Probab.* **13** (2008): paper No. 12, 121-130.

Blei, R.C; Gao, F; and Li, V.W. Metric entropy of high dimensional distributions. *Proc. of Amer. Math. Soc.* **135** (2007): 4009-4018.

Gao, F and Wellner, J. Metric entropy of monotonic functions. *J. Multivari. Anal.* **98** (2007), no.9, 1751-1764.

Gao, F and Li, V.W. Small ball probabilities for the Slepian Gaussian fields. *Trans. Amer. Math. Soc.* **359** (2007), 1339-1350.

Gao, F and Li, V.W. Logarithmic-level comparison for small deviation probabilities. *J. Theoret. Probab.* **19** (2006), 535-556.

Gao, F. Non-zero boundaries of Leibniz half-space. *Proc. of Amer. Math. Soc.* **133** (2005), no. 6, 1757-1762.

Blei, R.C. and Gao, F. On the combinatorial dimensions. *Random Structure and Algorithm.* **26** (2005), No. 1-2, 146-159.

Gao, F., Hannig, J., Lee, T-Y and Torcaso, F. Exact  $L(2)$  small balls of Gaussian processes. *J. Theor. Probab.* **17**, No. 2 (2004), 503-520.

Gao, F. Metric entropy of absolute convex hulls in Hilbert spaces. *Bull. London Math. Soc.* **36** (2004), 460-468.

Gao, F. The mean of a maximal likelihood estimator associated with Brownian bridges. *Electr. Comm. Probab.* **8** (2003): paper No. 1, 1-5.

Gao, F., Hug, D. and Schneider, R. Intrinsic volumes and polar sets in spherical space. *Mathematicae Notae. Ano XLI (2001/02)* Vol. 1. (2003) 159-176.

Gao, F., Hannig, J., Lee, T-Y and Torcaso, F. Laplace transforms via Hadamard factorization. *Electronic J. Probab.*, **8** (2003): paper No. 13, 1-20.

Gao, F., Hannig, J. and Torcaso, F. Integrated Brownian motions and exact  $L(2)$  small balls. *Ann. Probab.* **31**(2003): 1320-1337.

Gao, F., Hannig, J. and Torcaso, F. Comparison Theorems for Small Deviations of Random Series. *Electronic J. Probab.* **8** (2003): paper No. 21. 1-17.

Gao, F. Metric entropy of convex hulls. *Israel J. Math.* **123** (2001), 359-364.

Gao, F. and Vitale, R.A. Intrinsic volumes of the Brownian motion body. *Discrete Comput. Geom.* **26** (2001), No. 1, 41-50.

Gao, F. A characterization of random Bloch functions. *J. Math. Anal. Appl.* **252** (2000), No. 2, 959-966.

Gao, F. Maximal operators and Hilbert transforms along convex curves. *J. Math. Res. Exposition* **10** (1999), No. 2, 262-264.

## CONFERENCES & PRESENTATIONS

Deep Learning Summit. Montreal, Canada. Oct. 24-25, 2019.

Topological Methods in Machine Learning and Artificial Intelligence. Charleston, SC, May 18-23, 2019.

Geometric Functional Analysis and Applications, at MSRI in Berkeley, CA. Nov. 11-17, 2017.

Bayesian Modeling for Spatial and Spatio-Temporal Data. Santa Cruz, CA. Aug 13-19. 2017

International Conference on Machine Learning and 2017 International Conference on Wavelet Analysis and Pattern Recognition. Ningbo, China. July 2017.

Deep Learning Summit in Boston, MA. May 24-25, 2017.

AIM SQuaRE workshop: Persistence Probability. San Jose, CA, Mar. 11-18, 2017.

The 4th IMS Asia Pacific Rim Meeting (IMS-APRM). Hong Kong, China. June 2016. (Title of the invited talk: Metric entropy of convex functions in  $R^n$ .)

International Conference APSP 2015 Changchun, China. June 2015. (Title of the invited talk: Some connections between small and large deviation of Gaussian processes.)

Discrepancy Theory at the Institute for Computational and Experimental Research in Mathematics. Providence, RI. Oct 2014. (Title of the invited talk: Bracketing entropy of high dimensional distributions.)

IMS-China International Conference on Statistics and Probability. July 2013. (Title of the invited talk: From Persistence to Brascamp-Lieb type inequalities.)

2010 International Conference on Applied Analysis. Shanghai, China. June 2010. (Title of the invited talk: An inequality of Haar Functions.)

Summer Program in Probability and Statistics. Hangzhou, China. May 2010. (Lecture series: Metric Entropy Methods in Probability.)

IMS-China International Conference in Statistics and probability. Hangzhou. China. June 2008. (Title of the invited talk: Rate of convergence of the Maximum Likelihood Estimator on shape-constrained function classes.)

Frontier Probability Days 2007. Colorado Springs. May 2007. (Title of the invited talk: Metric Entropy Estimate of some shape-constrained function classes and its small ball connection.)

Probabilistic and Combinatorial Approach in Analysis. Kent State University. August 2006. (Title of the invited talk: Entropy of high-dimensional monotonic functions.)

Joint IMS/CSSP International Conference on Statistics and Probability, Beijing, China. July 2005. (Title of the invited talk: Small deviation probability estimate via analytic methods.)

Conference on High Dimensional Probability (IV), Santa Fe. June 2005. (Title of the invited talk: Riesz product and small deviation of some Gaussian random fields.)

AMS Eastern Regional Conference, Probability Session. Newark. April 2005. (Title of the invited talk: Small ball probability of Slepian random fields.)

Second International Seminar in Probability, Shanghai, China. Sept. 2004. (Title of the invited talk: Geometric quantification via small deviation probability.)

Conference on Gaussian Measures and Geometric Convexity, Snowbird, Utah, July 2004. (Title of the invited talk: Analytic methods in small deviation probability.)

Fifth International India Statistics Conference, Athens, Georgia, May 2004. (Title of the invited talk: Biofilm modeling and related stochastic processes.)

Mini-workshop on Small Deviation of Stochastic Processes and Related Fields, Oberwolfach, Germany, October 2003. (Title of the contributed talk: Spherical intrinsic volumes and relations with small deviation probabilities.)

Thematic Programme on Asymptotic Geometric Analysis, Vancouver, BC, July 2002. (Title of the Metric entropy and the spaces of measures.)

Summer Internship Program in Probability, the Center of Mathematical Sciences, Madison. June 2001. (Title of the contributed talk: Intrinsic volumes of Brownian bridges.)

## **OTHER PRESENTATIONS**

"Geometric complexity and metric entropy" University of Georgia, Jan. 2017

"A probabilistic characterization of negative definite functions." Washington State University, March 2016.

"Compactness of  $q$ -hulls in Banach spaces of type  $p$ ." Washington State University, February 2015.

"Covering numbers of bounded convex functions on compact convex sets." Washington State University, November 2014.

"Contributions of Wenbo Li on small ball probability and metric entropy." IMS-China International Conference on Statistics and Probability. July 2013.

"From Persistence to Brascamp-Lieb type inequalities" University of Connecticut, March 2013.

"Persistence of partial sums of random walks" University of Minnesota, Minneapolis, Minnesota, March 2011.

"Rate of Convergence of MLE of a shape-constrained density." Stanford University. October 2009.

"Small ball probability of an infinitely differentiable Gaussian process." University of California at Berkeley. October 2009

"How many Laplace transformations of probability measures are there?" University of Delaware, March 2009.

"Diffusion-reaction and biofilm ecophysiology," University of Connecticut. March 2005.

"The convex hull problem and quantification of the Krein-Milman theorem," University of Idaho, September 2003.

"Metric entropy on convex hulls," University of Idaho, March 2000.

"Some problems on majorizing measures," SSP 2000, University of Utah, April 2000.

"On random Bloch functions," University of Idaho, November 1999.

## **SENERGESTIC ACTIVITIES:**

Initiated and co-organized the first University of Idaho Data Science Competition 2018, and served

as a co-chair of its judge committee.

Organizing or co-organizing weekly or bi-weekly Python for Data Science Club meetings/seminars since Fall 2017.

Organizing or co-organizing weekly or bi-weekly Machine Learning meetings since Fall 2018.

Organizing weekly geometry/analysis seminars (two semesters), weekly biofilm seminars (two years), and co-organizing weekly UI-WSU joint analysis seminars (two semesters).

Serving as a mentor for undergraduate student researchers

Serving as a judge in University of Idaho Student Research Expositions