Biographical sketch of Lyudmila Sakhanenko[1]

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Education:

- May 2002, PhD, Department of Mathematics and Statistics, University of New Mexico, Albuquerque, NM; GPA: 4.0/4.0: diploma with distinction, Major: Statistics, Concentration: Probability Theory and Statistics, Dissertation: "Asymptotic theory of symmetry tests for a multivariate distribution", Advisor: Vladimir Koltchinskii, PhD.

- June 1998, BS, Department of Mechanics and Mathematics, Novosibirsk State University, Novosibirsk, Russia; GPA: 5.0/5.0, diploma with honors; top 0.5% of 250 students, Major: Mathematics, Concentration: Probability Theory and Mathematical Statistics.

Positions Held:

- 2021–present, Interim Chair, Department of Statistics and Probability, MSU

- 2019–present, Professor, Department of Statistics and Probability, MSU

- 2010–2019, Associate Professor, Department of Statistics and Probability, MSU

- 2002–2010, Assistant Professor, Department of Statistics and Probability, MSU

- 1998–2002, Teaching Assistant, Department of Mathematics and Statistics, UNM

Technical Skills: General skills in mathematics, probability theory, statistics and computing. Specific expertise in:

- Mathematics: functional analysis; stochastic, empirical, U-, Gaussian processes; tensor algebra.

- Statistics: bootstrap; testing; curve estimation; U-statistics; learning theory; functional data analysis, non- and semi- parametric statistics.

- Programming languages: Matlab and C.

- Statistical softwares: Minitab, Excel.

- Text formatting and office computing: LaTex, Word and Excel.

- Foreign languages: Russian (native).

Research Interests: Theory of empirical processes with applications to statistics including

- bootstrap tests (with financial applications);

- density estimation (with possible biological applications);

- integral curve estimation (with DT-MRI and HARDI applications);

- statistical learning theory;

- functional data analysis.

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[1]Updated October 2, 2022

Honors and Awards:

- NSF grants in 2021-2024, 2020, 2016-2019, 2012-2015, 2008-2011

- MSU awards: Academic Advancement Network Fellowship in 2021 (gave up due to serving as Interim Chair), The College of Natural Science Teacher-Scholar Award in 2010, Intramural Research Grant in 2004-2005

- UNM awards: Research, Project, and Travel Grants in 2002, 2001, 2000

Publications in Refereed Journals

1. Sakhanenko, L., Chakraborty, N. (2023) Novel multiplier bootstrap tests for high-dimensional data with applications to MANOVA, *Computational Statistics and Data Analysis*, Vol 178, https://doi.org/10.1016/j.csda.2022.107619

2. Goo, J., Sakhanenko, L., Zhu, D. (2022) A chi-square type test for time-invariant fiber pathways of the brain. In press by *Statistical Inference for Stochastic Processes* https://doi.org/10.1007/s11203-022-09268-6

3. Banerjee, C., Sakhanenko, L., Zhu, D. (2022) Global rate optimality of integral curve estimators in high order tensor models. Accepted by *Theory of Probab. Appl.* 25 pages

4. Banerjee, C., Sakhanenko, L., Zhu, D. (2022) Supplemental Material: Global rate optimality of integral curve estimators in high order tensor models. Accepted by *Theory of Probab. Appl.* 25 pages

5. Shen, X., Jiang, C., Sakhanenko, L., Lu, Q. (2021) Asymptotic properties of neural network sieve estimators. Submitted, 46 pages.

6. Shen, X., Jiang, C., Sakhanenko, L., Lu, Q. (2021) A goodness of fit type test based on neural network sieve estimators. In press by *Statistics & Probability Letters*, Vol. 174, https://doi.org/10.1016/j.spl.2021.109100.

7. Sakhanenko, L., DeLaura, M., Zhu, D. (2021) Nonparametric model for a tensor field based on High angular resolution diffusion imaging (HARDI). *Statistical Inference for Stochastic Processes*, 24, pages 445-476.

8. Cao, G., Sakhanenko, L., Yang, L., Carmichael, O. (2020) Spline estimation of integral curves from noisy vector field data. Revised, 40 pages.

9. Banerjee, C., Sakhanenko, L., Zhu, D. (2020) Lower bounds for accuracy of estimation in magnetic resonance high angular resolution diffusion imaging data. *Journal of the Indian Society for Probability and Statistics* **21(1)**, 1–41.

10. Zhang, Y-C., Sakhanenko, L. (2019) The Naive Bayes Classifier For Functional Data. *Statistics & Probability Letters*. v. 152, 137–146.

11. Sakhanenko, L. (2019) Testing a multivariate distribution for generalized skew-ellipticity. *Theory of Probab. Appl.* v. 64, No 2, 358–374. https://doi.org/10.4213/tvp5224

12. Balakrishna, N., Koul, H. L., Ossiander, M., Sakhanenko, L. (2019) Fitting a pth order parametric generalized linear autoregressive multiplicative error model. *Sankhya B.* **81**, pp. 103–122.

13. Sakhanenko, L., DeLaura, M., Zhu, D. (2018) Commentary: Estimation of Integral Curves from High Angular Resolution Diffusion Imaging (HARDI) Data. *Neurological Disorders and Therapeutics.* Mar, 2(1), pp. 1–5.

14. Sakhanenko, L. and DeLaura, M. (2017) A comparison study of statistical tractography methodologies for Diffusion Tensor Imaging. *International Journal of Statistics: Advances in Theory and Applications*, 1(1), 93-110.

15. Sakhanenko, L. (2017) In search of an optimal kernel for a bias correction method for density estimators. *Statistics & Probability Letters* 122, 42–50.

16. Pilipenko, A. and Sakhanenko, L. (2016) On a limit behavior of one-dimensional random walk with non-integrable impurity. *Theory of Stochastic Processes* Vol. 20 (36), no. 2, 97 - 104

17. Carmichael, O. and Sakhanenko, L. (2016) Integral curves from noisy diffusion MRI data with closed-form uncertainty estimates. *Statistical Inference for Stochastic Processes*, vol. 19(3), pp. 289–319.

18. Geng, P. and Sakhanenko, L. (2015) Parameter estimation for the logistic regression model under case-control study. *Statistics & Probability Letters* 109, 168–177.

19. Sakhanenko, L. (2015) Rate Acceleration for Estimators of Integral Curves from Diffusion Tensor Imaging (DTI) Data. *Statistics & Probability Letters* 107, 286–295.

20. Sakhanenko, L. (2015) Using the Tractometer to assess performance of a new statistical tractography technique. *Journal of Nature and Science*, **1**(7): e130, 1–12, http://www.jnsci.org/content/130

21. Carmichael, O. and Sakhanenko, L. (2015) Estimation of integral curves from high angular resolution diffusion imaging (HARDI) data. *Linear Algebra and its Applications* 473, 377–403. Special issue on Statistics.

22. Sakhanenko, L. (2015) Asymptotics of suprema of weighted Gaussian fields with applications to kernel density estimators. *Theory of Probab. Appl.* v. 59, No 3, 415–451.

23. Sakhanenko, L. (2013) How to choose the number of gradient directions for estimation problems from noisy diffusion tensor data. *Festschrift for Hira Koul* Lahiri, S., Schick, A., SenGupta, A., Sriram, T.N. (Eds), Springer Contemporary Developments in Statistical Theory, pp. 305–311.

24. Sakhanenko, L. (2012) Numerical issues in estimation of integral curves from noisy diffusion tensor data. *Statistics & Probability Letters* 82, 1136–1144.

25. Sakhanenko, L. (2011) Global rate optimality in a model for Diffusion Tensor Imaging. *Theory of Probab. Appl.*, 55, 1, 77–90.

26. Sakhanenko, L. (2010) Lower bounds for accuracy of estimation in Diffusion Tensor Imaging. *Theory of Probab. Appl.*, 54, 1, 168–177.

27. Sakhanenko, L. (2009) Testing group symmetry of a multivariate distribution. *Symmetry*, 1(2), 180–200; doi:10.3390/sym1020180

28. Koltchinskii, V., Sakhanenko, L. (2009) Asymptotics of Statistical Estimators of Integral Curves. *High Dimensional Probability V: The Luminy Volume* Houdré, Koltchinskii, Mason, and Peligrad (Eds), IMS Collections, Beachwood, Ohio, pp. 326–337.

29. Sakhanenko, L. (2008) Testing for Ellipsoidal Symmetry: A comparison study. *Computational Statistics & Data Analysis*, 53, 565–581.

30. Koltchinskii, V., Sakhanenko, L., Cai, S. (2007) Integral Curves of Noisy Vector Fields and Statistical Problems in Diffusion Tensor Imaging: Nonparametric Kernel Estimation and Hypotheses Testing. *Annals of Statistics*, Vol. 35, No. 4, 1576–1607.

31. Koul, H., Sakhanenko, L. (2005) Goodness-of-fit testing in regression: A finite sample comparison of bootstrap methodology and Khmaladze transformation. *Statistics & Probability Letters* 74, 290–302.

32. Giné, E., Koltchinskii, V., Sakhanenko L. (2004) Kernel Density Estimators: Convergence in distribution for weighted sup-norms. *Probability Theory and Related Fields*, vol. 130, No. 2, 167–198.

33. Giné, E., Koltchinskii, V., Sakhanenko, L. (2003) Convergence in distribution of Self-Normalized Sup-Norms of Kernel Density Estimators. *High Dimensional Probability III.* Hoffmann-Jorgensen, Marcus and Wellner (Eds), Birkhauser, Boston, pp. 241–253.

34. Borisov, I., Sakhanenko, L. (2001) The central limit theorem for generalized von Mises statistics with degenerate kernels. (Russian) *Mat. Tr.* 4, no. 1, 3–17.

35. Koltchinskii, V., Sakhanenko, L. (2000) Testing for ellipsoidal symmetry of a multivariate distribution. *High Dimensional Probability II.* E. Giné, D. Mason and J. Wellner (Eds) Progress in probability, Birkhäuser, Boston, pp. 493–510.

36. Borisov I., Sakhanenko L. (2000) The Central Limit Theorem for generalized canonical von Mises statistics. *Siberian Advances in Mathematics* vol. 10, No. 4, 1–14.

Presentations on seminars and conferences:

1. Statistical Tractography, Women in Statistics and Data Science 2022, St. Louis, October 2022 (Contributed talk, presenter: Juna Goo).

2. Statistical tractography: an integral curve estimation for DTI/HARDI, JSM2022, Washington DC, August 2022.

3. Multiplier bootstrap tests for High dimensional data with applications to MANOVA, Computational and Methodological Statistics conference, London, UK, December 2021 (Contributed virtual talk, presenter: Nilanjan Chakraborty).

4. Section on mentoring moderator for 2021 AGEP-GRS conference, virtual, August 2021.

5. Statistical tractography: an integral curve estimation for DTI/HARDI, Fred Hutch Cancer Research Center, Biostatistics seminar series, December 2020.

6. Testing for no change in a time-dependent ensemble of integral curves. Bernoulli-IMS One World Symposium 2020, virtual, August 2020.

7. Nonparametric Model for a Tensor Field Based on HARDI. JSM2019, Denver, Colorado, July 2019.

8. Lower Bounds for Accuracy of Estimation in High Angular Resolution Diffusion Imaging Data. JSM2019, Denver, Colorado, July 2019. (Contributed talk, presenter: Chitrak Banerjee)

9. Extension of Integral Curves Estimation to a Time-Dependent Tensor Field Model. JSM2019, Denver, Colorado, July 2019. (Contributed poster, presenter: Juna Goo)

10. Integral Curve Estimation for High Angular Resolution Diffusion Imaging. Michigan State Symposium on Mathematical Statistics and Applications, MSU, Sept. 2018. Invited talk.

11. Adaptive Classification on Partial Linear Models. JSM2018, Vancouver, Canada, July-August 2018. (Contributed poster, presenter: Chitrak Banerjee)

12. Statistical Estimation of Fibers from HARDI and DTI data. CMU Applied Mathematics Seminar, Central Michigan University, April 2018. (Contributed talk, presenter: Michael DeLaura)

13. Estimation of integral curves from HARDI data. Bernoulli World Congress in Probability and Statistics. University of Toronto, Fields Institute, Toronto, Canada. July 2016.

14. Statistical estimation of integral curves: Fiber tracking inference. University of North Carolina, Gillings School of Global Public Health (via WebEx), September 2015.

15. Statistical estimation of integral curves from some imaging techniques. Applied mathematics Seminar, Mathematics, MSU. February 2014.

16. Estimation of integral curves based on DTI data. Statistics in Applications Forum as part of the International Year of Statistics 2013. MSU, October 2013.

17. Spline Estimation of Integral Curves from Noisy Vector Field Data. JSM 2013. Montreal, Canada. August 2013.

18. Estimation of integral curves from noisy diffusion tensor data. 4th International Conference on Porous Media & Annual Meeting of the Interpore. Purdue University, West Lafayette. May 2012.

19. Integral Curve Estimation: Methodology and Applications to Diffusion Tensor Imaging. Neuroimaging seminar, Radiology, MSU. April 2012.

20. Estimation of integral curves based on DTI data. JSM2011, Miami Beach. August 2011.

21. Estimation of integral curves with application to Diffusion Tensor Imaging, Seeing the future with imaging science, National Academies Keck Futures Initiative Conference, Irvine, November 2010.

22. Integral Curve Estimation in Diffusion Tensor Imaging. JSM2010, Vancouver, Canada. August 2010.

23. Integral Curve Estimation in Diffusion Tensor Imaging. City College of New York. Mathematics department colloquium. February 2010.

24. Integral Curve Estimation: Methodology and Applications to Diffusion Tensor Imaging. Universite du Maine, LeMans, France, Asymptotical Statistics of Stochastic Processes VII workshop, March 2009.

25. Integral Curve Estimation: Methodology and Applications to Diffusion Tensor Imaging. Michigan State University, Statistics and Probability colloquium. November 2008.

26. Estimation of integral curves in Diffusion Tensor Imaging. Bucknell University, Texas Panamerican University, Marshall University. Colloquium. February-March 2006.

27. Integral Curves of Noisy Vector Fields and Statistical Problems in Diffusion Tensor Imaging: Nonparametric Kernel Estimation and Hypotheses Testing. Michigan State University, Statistics and Probability colloquium. September 2005.

28. Integral Curves of Noisy Vector Fields and Statistical Problems in Diffusion Tensor Imaging. 4th International Conference on High Dimensional Probability, St. John's College, New Mexico, June 2005.

29. Weighted sup-norms for density estimates. Hawaii International conference on Statistics. June 2004.

30. Convergence in distribution of weighted sup-norms of kernel density estimators. Michigan State University, Statistics and Probability colloquium. September 2003.

31. Michigan State University, Graduate Students Research Orientation. Density estimates. September 2003.

32. Bootstrap tests for ellipsoidal symmetry of a multidimensional distribution with applications to finance theory. Hawaii International Conference on Statistics, Honolulu, June 2003.

33. Testing for symmetry. Department of Statistics and Probability Colloquium, MSU, February 2002.

34. Testing for ellipsoidal symmetry (with applications to finance theory). Mathematics and Statistics Department Non-parametric Statistics Seminar Series, UNM, February 2001.

35. Testing for ellipsoidal symmetry of a multivariate distribution. 5th World Congress of the Bernoulli Society for Mathematical Statistics and Probability and 63rd Annual Meeting of the IMS, Guanajuato, Mexico, May 2000.

36. Testing for ellipsoidal symmetry of a multivariate distribution. 2nd International Conference on High Dimensional Probability, University of Washington, August 1999.

37. The limit theorems for von Mises statistics with asymmetrical kernels. The 36th International Scientific Student Conference, Novosibirsk, Russia, April 1998.

Successful Grant Activity:

- 2021-2024, Mathematical and statistical modeling and methodology for topics in Diffusion tensor imaging, NSF, PI, co-PI is Dr. Zhu (Radiology, MSU)

- 2020, Seminar on Stochastic Processes (SSP), NSF, co-PI, PI is Dr. Xiao (STT, MSU)

- 2018, AGEP Supplement, NSF, sole PI

- 2017, AGEP Supplement, NSF, sole PI

- 2016-2019, Nonparametric estimation of integral curves and surfaces, NSF, PI, co-PI is Dr. Zhu (Radiology, MSU)

- 2014-2016, AGEP Supplement, NSF, sole PI

- 2012-2015, Collaborative Research: Multidimensional Curve Estimation for Diffusion MRI, NSF, PI, co-PI is Dr. Carmichael (Neurology, UC Davis)

- 2008-11, Integral Curve Estimation: New Methodology and Applications to Tensor Diffusion Imaging, NSF, sole PI

- 2004-05, Density estimation in weighted norms with applications to ecology, MSU IGPR, sole PI

Teaching: 3 courses per year

- Undergraduate courses: STT442 (S21, Summer21, S20, S19, F16, S16, S14, S08), STT315 (two large lectures of 350 students, course coordinator role as well) (S13, S12, S11), STT200 (F09, S09, F08), STT351 (F09, S09, S08, Summer04, S04, S03, F02), STT231 (F04), MTH132 (S03)

- Graduate courses: STT951 (F20, S19, S17, S15), STT990 (Summer20, Summer06), STT953 (S20, S18), STT997 (F22, F21, F19, F18, F17, F14), STT873 (F19, F15), STT872 (S18, S15, S14), STT861 (F16, F05, F03), STT961 (F21, F15, F13), STT862 (S06, S04)

Mentoring:

- I was the PhD advisor of Dr. Yi-Chen Zhang (Graduated May 2018, ISUZU Technical center of America), Dr. Michael DeLaura (Graduated May 2019, teaching specialist at MSU), Dr. Juna Goo (Graduated April 2020, was Post doc at Fred Hutchinson Cancer Research Center, currently a tenure-track Assistant Prof at Boise State Univ), Dr. Chitrak Banerjee (Graduated April 2020, Wells Fargo); Dr. Nilanjan Chakraborty (Graduated July 2022, co-advisor was Dr. Koul (emeritus), Post doc at University of Washington in St. Loius)

- I served on PhD committees of 22 students; currently I am on 4 PhD committees;

- mentored many MS students during 2002-22, I was the MS academic advisor in STT during 2008-9.

Service:

- Department: Committee of the Whole (2002-22, 2016-17 president, 2013-15 secretary; it was called FAC before 2012, served as chair 2006-7 and secretary 2003-4), Statistics Prelim Exams (chair 2017-21, member 2012-16), Colloquium (2018-2021 chair, 2011-12 chair), Advisory committee (2019-21, 2015-16), Hannan scholar (2019-20), Personnel, Search (2014-20, 2010-11, 2007-8), Major Curriculum (2016-18, 2014-15, 2013-14 chair, 2009-11), Graduate support (2016-18, 2014-15), External review (2010-12), Master's exams committee (2004-9), Service course committee (2012-13), Grievance hearing board (2020-21), and a bunch of ad hoc subcommittees

- College: NatSci FAC (2019-21, 2005-9), CNS strategic planning for graduate education sub-committee (2018-19 co-chair), PRT (2020), Dean's Student Advisory Council (2006-7 Faculty Rep)

- Profession: a member of the steering committee and section moderator for 2021 AGEP-GRS conference https://aps.org/programs/education/graduate/conf2021/index.cfm (2021), moderator for computational statistics discussion room at Bernoulli-IMS One World Symposium (2020), member of the local scientific committee for Seminar on Stochastic Processes (March 2020), NSF panel (2022, 2019, 2013, 2009), National Academies Keck Futures Initiative Conference panel (2010), Session Chair on Hawaii International Conference on Statistics and Related Fields (2003); Associate editor of Statistics and Probability Letters (2013-current), member of editorial boards for the IMS collection series (2008-13), the IMS Lecture notes and monograph series (2008-10), Georgian electronic scientific journal (2021-current).