Siddhartha Dalal
siddhartha.dalal@gmail.com, 908-458-7626

Major Appointments:

2017-*Present* **Columbia University, Professor of Practice, School of Professional Studies, Affiliated Faculty, Dept. of Statistics, College of Arts & Science**

2012-Present **Army Science Board, Member-** One of 20 scientists appointed by Sec. of Defense

2013-2017 **AIG, Inc., Chief Data Scientist & Sr. VP of Advanced R&D**

2013-2014 **Columbia Technology Ventures, Executive in Residence**, *Advised Faculty & student startups*

2007-2012 **RAND Corporation, Chief Technology Officer & Sr. Advisor to RAND President on Technology; RAND Graduate School of Public Policy, Professor,** PhD Advisor to 2 PhD students

2011-2013 **Praedicat, Inc**., **Board of Directors**, 1st ever spinoff from RAND Corporation in its 64 years history

2003–2007 **Xerox; Vice President of Research,** Worldwide Imaging & Software Services Research

1980-2002 **Bellcore/Bell Labs***,* **Exec. Director, Chief Scientist**, Information Analysis & Services Research

Advisory Boards: Army Science Board (*2012-present*)**, Stevens Inst. BI&A** (2016-Present), **Cambridge Univ. Risk Studies** *(2014-17)***, UCLA School of Engineering** (2010-12)**; Clemson Univ. Risk Engineering & Systems Analytics** (2016-17), **RIT College of Computing** *(2004-07)*

ACADEMIC AND PROFESSIONAL HONORS AND ACTIVITIES

- **Columbia SPS Dean's Faculty Excellence Award (2021)** given to a faculty "who exemplify, at the highest levels, the attributes of academic, scholarly, and professional excellence"
- **US Army, Meritorious Civilian Service Medal (2021)** for outstanding contributions to Army and DoD
- **University of Rochester, Distinguished Scholar Medal & Commencement speaker** *(2004)*
- **Bellcore, Fellow** (1998), Highest honor to a Technical Staff for outstanding research and business impact
- **Telcordia Technologies** *(1999),* **CEO Award**
- **Journal of American Statistical Association, Associate Editor** *(1994-96)*
- **American Statistical Association** (1990)**, Elected Fellow**
- **National Academy of Sciences:** Member of several panels, coauthored NRC reports: Statistical Software Engineering, and Testing of Defense Systems
- **Army Science Board,** Appointed by Sec. of Defense– one of 20 scientists to advise Army on technologies,

Best Paper Awards

- **Frank Wilcoxon Prize,** *American Society for Quality (1999), Best Paper, Technometrics*
- **IEEE Computer Society***,* ISSRE *(1996),* published as a featured article in *IEEE Software.*
- **American Statistical Assoc.***, Outstanding Applications Paper in the field of Statistics (1988 – 1989). Risk Analysis of Space Shuttle Challenger Disaster- work done for National Academy of Sciences*
- **Jacob Wolfowitz Prize***, American Journal of Mathematics & Management Sciences (1983).*

Commercial Spinoff*:* Principal Technology & spinoff architect of the first ever spinoff from RAND in its 64 years history, www.praedicat.com, Created strategy for commercialization/dissemination of RAND IP

Defense Clearance: Department of Defense Clearance- Top Secret

Recent Grants:
- Columbia University: Grants from DSI and Statistics Dept, 2019-21
- DHS #DHS-2009-ST-061-CC1002-06 (2013), Consultant, Testing Nuclear Detection Algorithms
- AHRQ- HHSA-290-2007-10062   (2010-12), Co-PI, Updating of Evidence based studies by using machine learning technologies
- CQI EL- RWJ : ID 67890 (2011-13), Robert Wood Johnson Foundation and RAND Corporation, Co-PI for Expert Elicitation Method, Analysis and Machine Learning, Defining Continuous Quality Improvement
- NSF-SES- 0922754 (2009-12), National Science Foundation, Co-PI   10/1/09 - 9/31/12 Thinking Inside the Box: Assessing Algorithms for the Discovery of Policy Relevant Scenarios
- R305U08003 National Institute of Education (2009-12): Co-PI, Simultaneous Statistical Inference in Evaluating Teacher Performance
- ARI-MA: NSF- CBET-0736134, (2007-8): National Science Foundation, Consultant. Sensor Management Problems of Nuclear Detection

Teaching Supervision: Principal Doctoral Advisor to 2 PhD students at RAND Graduate School and 3 MS students at Columbia University
Education: University of Rochester; **PhD** (Statistics) & **MBA** (Marketing; 1st in class of 109)

External Interactions:
Invited Talks:
Hundred+ invited talks at academic societies, universities and industry organizations

Key Talks since 2006:
- International Congress of Imaging (2006)- ***Plenary Speaker***, *The Ubiquitous Imaging*
- TTI/Vanguard (2007): *Ubiquitous Imaging: Where are we? What are the challenges?*
- Interface of Computing Science and Statistics (2008): ***Plenary Speaker***, *Risk and Public Policy*
- RAND Board of Trustees (2010): *Revolutionizing Policy Analysis with Information Analytics*
- Qatar Computing Research Inst. (2012): *Human Guided Information Analytics for Policy Analysis*
- AIG Board of Directors (2015): *Transforming AIG through Intelligence Amplification*
- American Statistical Assoc., ***SPAIG Lecture*** (2015): *Improving global security through real-time analysis of complex risks*
- Machine Learning in Finance (2016): Columbia Center for Financial Eng. and DSI, *Transformation of the Insurance Industry: New Trends in Data, Analytics and Risk*
- MIT Inst. for Data, Systems & Society (2016): *Use of unconventional data for high severity long tailed events*
- MIT CDIOQ Symposium (2017): ***Plenary Speaker***, *A Journey to Transform Insurance Industry Using Data Science*
- Seventh IMS/FIPS Conference (2017): ***Plenary Speaker***, *Machine Learning in Insurance*

- Stevens Institute (2017): **University Seminar,** *Artificial Intelligence is Sexy! What is it? Facts vs Fiction*
- Data West (2017): **Plenary Speaker**, *Deep Analytics for Reduction of Risks*
- American Statistical Assoc. Annual Meeting- (2018)- *Deep Analytics: Computer Vision, NLP & Sensors*
- International Conference on Mathematics and Statistics(2018), **Plenary Speaker**, *Deep Analytics*
- Data West (2018): **Keynote Speaker**, *Advances in Deep Analytics and its applications*
- TIE Washington (2021): Plenary panel on Blockchains

Media Coverage since 2006:
- Imaginginfo (2006): Pictures Will Someday Speak More Than a Thousand Words http://www.imaginginfo.com/web/online/News/Pictures-Will-Someday-Speak-More-Than-a-Thousand-Words/3$1670
- Computerworld (2006): It's all about the Image. https://www.computerworld.com/article/2554491/computer-hardware/it-s-all-about-the-image.html
- Information Week (2011): Medical Data Mining strengthens Drug Safety https://www.informationweek.com/healthcare/patient-tools/medical-data-mining-strengthens-drug-safety/d/d-id/1097759
- Washington Post (2011): Rand turns to the crowd for research; https://www.slideshare.net/slideshow/embed_code/key/BHuVDHp3DyZL9E
- Phys.Org (2015) Improving global security through real-time analysis of complex risks; https://phys.org/news/2015-08-global-real-time-analysis-complex.html
- Interview –Significance (2016): From Risk to Resiliency, A publication by *Royal Statistical Society* (2016) http://onlinelibrary.wiley.com/doi/10.1111/j.1740-9713.2016.00883.x/abstract
- SearchDataManagement (2017), Learning from Disaster, http://searchdatamanagement.techtarget.com/opinion/Making-connections-Big-data-algorithms-walk-a-thin-line
- SiliconANGLE(2017)- How machine learning will spark revolution in Insurance? https://siliconangle.com/blog/2017/07/15/machine-learning-will-spark-revolution-insurance/
- Business Insider(2019)- Researchers from Columbia and Rutgers crunched the data and found no bias from The New York Times in its Trump coverage, https://www.businessinsider.com/data-finds-no-b__ias-in-new-york-times-trump-coverage-2019-10
- Risk Management (2019)- The Latest Technology to Mitigate Property Risks: http://www.rmmagazine.com/2019/12/02/the-latest-technology-to-mitigate-property-risks/

Service to Columbia University Community-
- Chair of Several Review Committees
- Several seminars on different topics to start a practice based research program by creating collaborations across including SPS, Law, Social Sciences, Medicine and Statistics
- Talks- Columbia
    - Deep Analytics for risk reduction- SPS Faculty
    - AI is Sexy, What is it? Facts vs Fiction- SPS students and faculty
    - NLP for Social Sciences- Computational Social Science group
    - Deep Analytics: From NLP, Computer Vision to Sensors, Statistics Department

- Committees: SPS Resource Allocation; Research Awards Committee, Curriculum: Applied Analytics, Actuarial Science; Sports Management Recruitment; Faculty Review
- Other activities: Panel- Block Chains Applications; Judged Datafests, Statistics Dept

Siddhartha Dalal's technical contributions: *Summary, Publications, Monographs, & Patents*

Summary: Siddhartha Dalal has made numerous contributions in the field of *Data Sciences and Services* with over 100 co-authored publications including four monographs and several patents covering the areas of data mining and machine learning, statistics, risk analytics, econometrics, software and network engineering. He is a recipient of four best-paper awards by well-known professional societies.

Over the past 3 years at Columbia, Sid besides developing new courses in Machine Learning and Blockchains, has published several papers and patents including on Risk measurements for workplace safety using sensors, identifying ransomware actors on Bitcoin networks, and how to measure media bias in journalism.

Over the past 4 years at **AIG**, Sid envisioned and created an entire R&D team from scratch. He worked on a number of proprietary R&D projects focused on deep learning and computer vision [102.103] methods to identify damage and risky objects from pictures, sensors to mitigate risks, and NLP to recognize causes of risks across millions of legal and medical documents. All these resulted in a new paradigm of risk quantification and mitigation that was well recognized across AIG and the insurance industry. He also represented the AIG's data science community as their Chief Data Scientist to internal, external and client forums. He was the *first researcher* ever to give a major address to AIG Board of Directors on *Transforming AIG through Intelligence Amplification*.

In prior five years at **RAND** he developed a new direction in "big data" involving online data mining and crowd sourcing methods. Specific applications include a new crowd sourcing generalization of Delphi Method (http://www.washingtonpost.com/blogs/think-tanked/post/rand-turns-to-the-crowd-for-research/2011/06/16/). This resulted in a new RAND system called "ExpertLens™" [2,4,6,11,15] used by many projects at RAND. He and a colleague created a patent pending NLP based system called "OpportunityLens™" [99], which scouted Internet for research grants/contracts and matched them with individual RAND researchers based on semantic analysis and machine learning. He with others developed several NLP based risk analysis methods. One of those resulted in the first commercial spinoff in RAND's 64 years history http://praedicat.com/; another predicted drug safety by mining of hundreds of thousands medical research papers [14, 98] (see: http://www.informationweek.com/healthcare/patient-tools/medical-data-mining-strengthens-drug-safety/d/d-id/1097759). The Southern California Evidence-based Practice Center (EPC) started using RAND's new "EvidenceLens™" system based on Active Learning built by his team for more efficiently developing clinical decision rules [7,8]. In other collaborations, Sid developed a new method for making the "teacher's pay for performance" more equitable [12,13] and algorithms for sensor-based detection of illicit nuclear material entering USA [16]. Several DoD related research topics are discussed in [9,10,90,109]. He gave a major presentation to RAND Board of Trustees on *Back to Future: Revolutionizing Policy Analysis*.

Prior notable contributions include (1) an investigation of the Space Shuttle Challenger disaster [58, 63, 64], which led to the creation of an award-winning statistical method now used in textbooks to teach probabilistic risk analysis, as well as the establishment of a risk analysis business at Bellcore and a probabilistic risk analysis group at NASA, and (2) the invention of a new paradigm of testing in the field of *model-based testing,* called *"combinatorial design testing"* using a new class of combinatorial experimental designs. The latter earned best-paper awards from the IEEE and American Society for Quality as well as several patents [e.g., 33, 38, 39, 40, 42, 44, 46, 48, 51,91,92]. It resulted in the first commercial test generation system (AETG System) and SAS

system (AETG Web) from Bellcore. These techniques are now commonly used at many enterprises across the world. Sid coined the phrase *Statistical Software Engineering* and was a co-author of the NRC report [87] of the same name published by the National Academy of Sciences. Besides several empirical and modeling papers [e.g., 43, 47, 53] in this area, the research has concentrated on new approaches for determining when to stop testing software using stochastic dynamic optimization [52, 55, 56, 66]. He also jointly developed new analytical marketing methodologies for modeling consumer behavior and predicting demand of new products and services based on *discrete choice models* and *diffusion models* [31, 41, 49, 50, 57, 68, 70, 83]. The papers on approximation of Bayesian priors showed that without a loss of generality one need not go beyond a more computable class of learning models for expressing uncertainties — now used in Neural Networks and Bayesian unsupervised learning [73, 77, 80]. The work on how long to sample to select the best of k alternatives solved a 20-year long-standing problem in Ranking and Selection literature [85]. He has also co-authored several papers on new information and network services and methods for improving the underlying platforms for performance, reliability, scalability, and integrability [e.g., 22, 23, 26, 28, 29, 29, 37, patents 91-97].

Sid has also done extensive strategy and technology consulting. It includes legal arbitration [112], structuring research for US Army [90], E-commerce strategy at Boeing, setting plants in South America for Sybron, demand modeling, and EMF exposure [106] at AT&T, and on wind tunnel experiments for aircraft [72] at Pratt & Whitney.

His publications have appeared in many journals, including computer engineering (*IEEE TSE and, IEEE Software)*, statistics (*J. Am. Statist. Assoc., Ann. Appl. Statist., Ann. Appl. Prob., Biometrika, Sankhya)*, quality (*Technometrics)*, and econometrics and marketing (*Econometrics, J. Marketing Science, Management Science).*

Refereed Publications in Journals and Conferences

1. Dalal, S., Wang, Z & Shabrawal, S, (2021) Identifying Ransomware Actors on Bitcoin Networks. Accepted for publication: *2nd International Conference on Machine Learning, IOT and Blockchain (MLIOB 2021)*

2. Dalal, S., Lesk, M, & Adlim B. (2021) A Sentimental Journey Through Newspaper Stories. *9th Computation and Journalism Symposium*

3. Dalal, S., Bassu, D. (2020) Deep Analytics for Workplace Risk and Disaster Management, IEEE-*IBM J. Research and Development,* Volume 64, 14:1
https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8867981

4. Dalal, S., Adlim, B, & Lesk, M(2019) How to measure relative bias in media coverage, Significance- a joint publication of Royal Statistical Society and American Statistical Association, October, 19-23,
https://rss.onlinelibrary.wiley.com/doi/pdf/10.1111/j.1740-9713.2019.01316.x

5. Rai, S., Dalal, S. (2018) Process Wind Tunnel For Improving Insurance Business Processes, Informs Business Analytics Conference, April 2018

6. Dalal, S., Jain, A and Kantor P. (2015) Testing Radiation Portal Algorithms Using Factor Covering Combinatorial Designs. IEEE International Conference on Technologies for Homeland Security. IEEE eXplore.

7. Savitsky, T. and Dalal, S. (2014), Bayesian Semi-parametric Analysis of Multi-rater Ordinal Data, with Application to Prioritizing Research Goals from Suicide Prevention Data, *J. Roy. Statist. Soc.*

8. Kellermann, A, Saultz, J., Mehrotra, A., Jones, S., Dalal, S. (2013), Primary Care Technicians: A Solution to The Primary Care Workforce Gap, *Health Affairs, 32,* 1993-1998

9. Claassen, C., Pearson, J., Khodyakov D. , Satow, P., Gebbia, R., Berman, A., Reidenberg, D, Molock, S., Carras M., Lento, R., Sherrill, J., Pringle, B., Dalal, S., Insel, T.(2014), Reducing the Burden of Suicide in US, *Am. J. Preventive Medicine.*

10. Dalal, S., Han, B., Lempert, R., Jaycocks A. and Hackbrath A. (2013), Improving Scenario Discovery using Orthogonal Rotations, *J. Environmental Modeling and Software, 48,* 49-64

11. Rubenstein, L. Khodyakov D., Hempel S., Danz, M., Salem-Schatz S., Foy, R. O'Neill S., Dalal, S., Shekelle, P. (2013), "How can we recognize Continuous Quality Improvement?", *Ann. Internal Medicine*

12. Dalal, S., Shakelle, P., Hempel, S., Newberry, S., Motala, A., Shetty, K. (2013), "A Pilot Study Using Machine Learning and domain knowledge to facilitate Systematic Review Updating", *J. of Medical Decision Making, 343-55*

13. Hempel, S. Shetty, K, Shekelle, P., Rubinstein, L., Danz, M., Johensen, B., Dalal, S. (2012), "Machine Learning Methods in Systematic Reviews: Identifying Quality Improvement Intervention Evaluations", AHRQ Publication No. 11-EHC045-EF. Rockville, MD

14. Shah, A. and Dalal, S. (2012), 'Combinatorial Enlargement of Ground-Truth Datasets and Efficient Evaluation of Segmentation Algorithms', *ACM International Workshop on Visual Interfaces for Ground Truth Collection in Computer Vision Application*

15. Mason, R., McInnis, B. and Dalal, S. (2012), "Machine Learning for Automatic Identification of Terrorist Incidents in Worldwide News Media", *IEEE Conference on Intelligence and Security Informatics*.

16. Khodyakov, D., S Hempel, L Rubenstein, P Shekelle, R Foy, S Salem-Schatz, S O'Neill, M Danz and S Dalal (2012). "Conducting Online Expert Panels: A Feasibility and Experimental Replicability Study", Biomed Central

17. Han, B., Dalal, S. and McCaffrey, D. (2012) "Simultaneous One-sided Tests with Application to Education Evaluation Systems" *J. Educational & Behavioral Statistics, 37,* 114-136

18. Han, B. and Dalal S. (2012) "A Bernstein-type Estimator for Monotonic Density with Application to P-value Adjustments". *Computational Statistics and Data Analysis, 55,* 427-437

19. Shetty K. and Dalal S. (2011), "Using Information Mining of the Medical Literature to Improve Drug Safety", *J. American Medical Informatics Assoc.,*18(5):668-7

20. Dalal, S., Khodyakov, D., Srinivasan, R., Strauss, S. & Adams J. (2011) ExpertLens: A System for Eliciting Opinions from a Large Pool of Non-Collocated Experts with Diverse Knowledge; *J. Technology Forecasting and Social Change*

21. Dalal, S. R. and Han, B.. (2010): Detection of radioactive material entering international ports: A Bayesian approach to radiation portal data, *Annals of Applied Statistics, 4,* 1256-1271

22. Dalal, S. R. and Mallows, C. M. (2008). Optimal Stopping with exact confidence on remaining defects, *Technometrics*, *vol. 50, pp 397-406*

23. Lott, C., Jain, A. and Dalal, S. (2005). Modeling requirements for combinatorial software testing. *Advances in Model Based Software Testing (A-Most), Special Workshop in ICSE, IEEE. ACM SIGSOFT Software Engineering Notes, vol. 30, pp 1-7*

24. Dalal, S. (2003). Software Reliability Models: A Selective Survey and New Directions. Chapter in *Handbook of Reliability Engineering*, H. Phang, ed. Springer-Verlag*, New York.*

25. Dalal, S. R., Egan, D., Ho, Y. and Rosenstein, M. (2003). The Promise and Challenge of Mining Web Transaction Data. Chapter in *Handbook of Statistics,* **22.**   R. Khatree and C. R. Rao, eds. Elsevier, New York.

26. Verykios, V., Elmagarmid, V., Cochinwala, M. and Dalal, S. (2003). Improving data quality in practice. *Proc. Distributed and Parallel Databases* **13**, 135-160.

27. Shim, H., Kornievskaia, O., Di Crezenso, G., Patton, G. and Dalal, S. (2002). Efficiently providing secure, spontaneous, multimedia conferencing in SEC system*. Proc. IEEE ICC 2002 conference,* New York, NY. pp 2479-2483

28. Dalal, S. R., Ho, Y., Jain, A. and McIntosh, A. (2002). Application performance assurance using end-to-end user level monitoring. Invited Paper*, IEEE International Conference on Dependable Systems and Networks*, *pp 694-706,* Washington, DC.

29. Cochinwala, M., Dalal, S., Elmagarmid, V. and Verykios, V. (2002). Record matching: past, present and future. *Proc. Data Engineering.*

30. Dalal, S. R. (2003). Challenges in the information sciences for statisticians. In: *Crossing Boundaries: Statistical Essays in Honor of Jack Hall,* J. Kolassa and D. Oakes, eds, pp 209-216. Institute of Mathematical Statistics Lecture Notes Monograph Series, Vol. **43.**

31. Kashyap, V., Dalal, S., Tukey, P. and Behrens, C. (2001). Professional Service Automation: A semantics-based approach for knowledge management. *9th IFIP International Conference on Database Semantics (DS-9).Knowledge Management and Intelligent Enterprises Ed. Fong, pp 10-29*

32. Kashyap, V., Dalal, S. and Behrens, C. (2001). Professional Services Automation: A knowledge management approach using LSI and domain specific ontologies. *14th Annual International Florida Artificial Intelligence Research Symposium, FLAIRS 2001, pp 300-304*

33. Maitra, R. and Dalal, S. R. (2001). Pay-phones, parking-meters, vending machines and Bayesian prediction of fill-times. *J. Amer. Statist. Assoc.* **96,** 476-487.

34. H. Shim, G., Patton, M., Long, C., Chung, C. and Dalal, S. (2001). An example of using presence and availability in an enterprise for spontaneous, multiparty, multimedia communications. *Proc. 2nd IP-Telephony Workshop (IPTEL 2001).*

35. Sinha, L., Dalal, S., Hausman, R. and Mullen, T. (2000). The value of combinatorial auctions in telecom trading. *INFORMS Conference by The Institute for Operations Research and Management Science.*

36. Sherman, R., Ho, Y. and Dalal, S. R. (2000). Conditions for convergence of Monte Carlo EM sequences with an application to product diffusion modeling. *Econometrics 2,* 248-267.

37. Dalal, S , Jain, A., Patton, G. and Rathi, M. (1999) . Engineering of two web-enabled commercial software services. *IEEE ICSE Workshop on Web Engineering pp 213-222.*

38. Dalal, S., Jain, A., Karunanithi, N., Leaton, J., Lott, C., Patton, G. and Horowitz, B. (1999). Model-based testing in practice*. Proc. International Conference on Software Engineering*, *IEEE ICSE-99, pp285-294*

39. Dalal, S. R., Hamada, M., Matthews, P. and Patton, G. (1999). Using defect patterns to uncover opportunities for improvement. *Proc. Apps. Software Measurement Conference*, San Jose, CA.

40. Dalal, S. R., Egan, D., Ho, Y. and Rosenstein, M. (1999). Mining gold from e-commerce transactions. Invited Paper, *Proc. International Statistical Institute's Conference on E-Commerce Measurement.*

41. Dalal, S. R., Hamada, M. and Wang, T. J. (1999) How to improve performance of software systems: A methodology and a case study for tuning performance. *Annals of Software Engineering* **8***,* 53-84.

42. Carman, D., Dalal, S., Farrell, R., Jain, A. and Karunanithi, N. (1998). A test generation factory for testing year 2000 compliance. *Proceedings of Quality Week,* San Francisco.

43. Dalal, S., Jain, A., Karunanithi, N., Leaton, J. and Lott, C. (1998). Model-based testing of a highly programmable system. *IEEE ISSRE 1998, pp 174-178*.

44. Dalal, S. R., Jain, A., Patton, G., Rathi, M. and Seymor, P. (1998). AETG^{SM} Web: A web based service for automatic efficient test generation from functional requirements. *Proceedings of Second IEEE Workshop on Industrial Strength Formal Specification Techniques.*

45. Dalal, S. R. and Mallows, C. M. (1998). Factor-covering designs for testing software. *Technometrics* **40***, 234-243. **Winner of Frank Wilcoxon Prize from Amer. Soc. for Quality for the Best Paper** – **1998.**

46. Dalal, S. R., Ho, Y. and Sherman, R. (1998). Learning from experience to improve early forecasts: A Bayesian maximum likelihood approach. In: *Business and Economics for the 21st Century, Volume II*, pp 338-353. Business and Economics Society International, Worcester, MA.

47. Cohen, D. M., Dalal, S. R, Fredman, M. L. and Patton, G. C. (1997). The AETG system: An approach to testing based on combinatorial designs. *IEEE Transactions of Software Engineering* **23**, 437-444

48. Dalal, S. R., Lyu, M. and Mallows C. L. (1998). Software Reliability ─ An Introduction. Chapter in *Encyclopedia of Biostatistics - 1997.* P. Armitage and T. Colton (eds.), vol. 5, Wiley, pp. 4550-4555. Wiley, New York.

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50. Dalal, S. R. and Mallows, C. M. (1996). Covering designs. *Proceedings of Interface Conference*, Sydney, Australia.

51. Cohen, D. M, Dalal, S. R. and Patton, G. C. (1996). AETG system, a combinatorial design approach to testing. *Proceedings STAR Conference*, Orlando, Florida.

52. Lyu, M., Yu, S., Yu, J., Keramidas, E. and Dalal, S. (1995). ARMOR, a tool for assessing risky modules. *IEEE International Symposium on Software Fault Tolerance, pp137-142*.

53. Cohen, D. M., Dalal, S. R. and Patton, G. (1995). The Automatic Efficient Test Generator (AETG) system in protocol and interoperability testing*.. Proceedings of 12th International Symposium on Software Testing,* IEEE, Washington, DC.

54. Dalal, S. R. and Weerahandi, S. (1995). Estimation of innovation diffusion models with applications to consumer durables. *Marketing Letters* **6**, 123-136.

55. Weerahandi, S. and Dalal, S. R. (1994). A choice model approach to the diffusion of a service: Forecasting Fax penetration by market segments. *J. Marketing Science.* Vol. 11, pp. 39-53

56. Cohen, D. M., Dalal, S. R., Kajla, A. and Patton, G. (1994). The Automatic Efficient Test Generator (AETG) system. In: *Fifth International Symposium on Software Reliability Engineering (ISSRE)*, IEEE Computer Society, pp 303-309.

57. Dalal, S. R. and McIntosh, A.M. (1994). When to stop testing for large software systems with changing code. *IEEE Trans. Software Engineering* **20**, 318-323.

58. Dalal, S. R., Horgan, J. R. and Kettenring, J. R. (1993). Reliable software and communication: Software quality, reliability, and safety. *IEEE J. Special Areas in Communication*s **12** ,.33-39.

59. Cohen, M. L., Dalal , S. R. and Tukey, J. W. (1993). Robust, smoothly heterogeneous variance regression. *J. Roy. Statist. Soc., Series C: Appl. Statist*. **42**, 339-353.

60. Dalal, S. R. and Mallows, C. L. (1992). Buying with exact confidence. *Ann. Appl. Probab*. **2**, 752-765.

61. Dalal, S. R. and Mallows, C. L. (1992). When to stop testing software? Some exact and asymptotic results. In: *Bayesian Analysis in Statistics and Econometrics*, P. K. Goel and N. S. Iyengar, eds.. pp 267-276. Lecture Notes Series, Springer-Verlag, New York.

62. Dalal, S. R. and Weerahandi, S. (1992). Some approximations for the moments of a process used in diffusion of new products. *Statist. & Probab. Letters* **15**, 181-189.

63. Dalal, S. R. and Hoadley, A. B. (1991). Comments on ``Problems in extrapolation illustrated with space shuttle O-ring data''. *J. Amer. Statist. Assoc*. **86.** 921-922.

64. Dalal, S. R. and Mallows, C. L. (1990). Some graphical aids for deciding when to stop testing software. *IEEE J. Special Areas in Communications, Special issue on Software Quality & Productivity* **8**, 169-175.

65. Gelfand, A. E. and Dalal, S. R. (1990). A note on overdispersed exponential families *Biometrik*a **77**, 55-64.

66. Dalal, S. R. (1990). Simultaneous confidence bands for regression with unknown unequal variances. *Technometrics* **32**, 173-186.

67. Dalal, S. R., Lee, J. C. and Sabavala, D. J. (1990). Empirical Bayes prediction for a compound Poisson-multinomial process. *Statist. & Probab. Letters* **9**, 385-389.

68. Dalal, S. R., Fowlkes, E. B. and Hoadley, A. B. (1989). Lessons learned from Challenger: A statistical perspective. *Stats* **1-2**, 3-6, 20-21.

69. Dalal, S. R., Fowlkes, E. B. and Hoadley, A. B. (1989). Risk analysis of the space shuttle: Pre-Challenger prediction of failure. *J. Amer. Statist. Assoc*. **84**, pp 945-957**. ASA *Award for the Outstanding Paper in the Field of Statistics*, 1988-1989.**

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