



Moses Charikar

Donald E. Knuth Professor and Professor, by courtesy, of Mathematics
Computer Science

Bio

BIO

Moses Charikar is the Donald E. Knuth professor of Computer Science at Stanford University. He obtained his PhD from Stanford in 2000, spent a year in the research group at Google, and was on the faculty at Princeton from 2001-2015. He is broadly interested in the design and analysis of algorithms with an emphasis on approximation algorithms for hard problems, metric embeddings and algorithmic techniques for big data. He won the best paper award at FOCS 2003 for his work on the impossibility of dimension reduction, the best paper award at COLT 2017 and the 10 year best paper award at VLDB 2017. He was jointly awarded the 2012 Paris Kanellakis Theory and Practice Award for his work on locality sensitive hashing, and was named a Simons Investigator in theoretical computer science in 2014.

ACADEMIC APPOINTMENTS

- Professor, Computer Science
- Professor (By courtesy), Mathematics

HONORS AND AWARDS

- Paris Kanellakis Theory and Practice Award, ACM (2012)
- Simons Investigator in Theoretical Computer Science, Simons Foundation (2014)
- 10 year best paper award, VLDB (2017)
- Best paper award, COLT (2017)
- Best paper award, FOCS (2003)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Scientific Advisory Board member, Simons Institute for the Theory of Computing (2015 - present)

PROFESSIONAL EDUCATION

- B.Tech., Indian Institute of Technology, Bombay , Computer Science and Engineering (1995)
- Ph.D., Stanford University , Computer Science (2000)

PATENTS

- Moses Charikar, Deepa Ramakrishna. "United States Patent 9,684,974 Lossless compression of fragmented image data", EMC Corporation, Jun 20, 2017
- Moses Charikar, Deepa Ramakrishna. "United States Patent 9,558,566 Lossless compression of fragmented image data", EMC Corporation, Jan 31, 2017
- Moses Charikar, Deepa Ramakrishna. "United States Patent 9,495,390 Format identification for fragmented image data", EMC Corporation, Nov 15, 2016
- Moses Charikar, Deepa Ramakrishna. "United States Patent 9,384,218 Format identification for fragmented image data", EMC Corporation, Jul 5, 2016
- Kai Li, Qin, Lv, Moses Charikar. "United States Patent 7966327B2 Similarity search system with compact data structures", The Trustees Of Princeton University, Jun 21, 2011

- Ran Canetti, Moses Charikar, Sridhar Rajagopalan, S. Ravikumar, Amit Sahai, Andrew Tomkins. "United States Patent US7222362B1 Non-transferable anonymous credentials", IBM, May 22, 2007
- Moses Charikar. "United States Patent US7158961 B1 Methods and apparatus for estimating similarity", Google, Inc, Dec 31, 2001

LINKS

- Google Scholar page: <https://scholar.google.com/citations?user=zX3ba1kAAAAAJ>
- DBLP page: <https://dblp.uni-trier.de/pers/hd/c/Charikar:Moses>
- Semantic Scholar page: <https://www.semanticscholar.org/author/Moses-Charikar/1745732?sort=velocity>

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Approximation algorithms for discrete optimization problems with provable guarantees; convex optimization approaches for non-convex combinatorial optimization problems; efficient algorithmic techniques for processing, searching and indexing massive high-dimensional data sets; efficient algorithms for computational problems in high-dimensional statistics and optimization problems in machine learning; low-distortion embeddings of finite metric spaces.

Teaching

COURSES

2018-19

- Algorithmic Perspective on Machine Learning: CS 369L (Win)
- Artificial Intelligence: Principles and Techniques: CS 221 (Spr)
- Metric Embeddings and Algorithmic Applications: CS 369M (Aut)

2017-18

- Algorithmic Techniques for Big Data: CS 368 (Spr)
- Optimization and Algorithmic Paradigms: CS 261 (Win)

2016-17

- Design and Analysis of Algorithms: CS 161 (Aut)
- Hierarchies of Integer Programming Relaxations: CS 369H (Spr)

2015-16

- Algorithmic Techniques for Big Data: CS 369G (Spr)
- Theoretical Perspective on Machine Learning: CS 369L (Aut)
- Topics in Analysis of Algorithms: Advanced Approximation Algorithms: CS 369A (Win)

STANFORD ADVISEES

Postdoctoral Faculty Sponsor

Clement Canonne, Yuanzhi Li, Rad Niazadeh, Avishay Tal

Master's Program Advisor

Nitya Mani, William Marshall, Cameron Tew, Jingyi Zhong

Publications

PUBLICATIONS

- **Hashing-Based-Estimators for Kernel Density in High Dimensions**
Charikar, M., Siminelakis, P., IEEE
IEEE.2017: 1032–43
- **Learning from Untrusted Data**
Charikar, M., Steinhardt, J., Valiant, G., Hatami, H., McKenzie, P., King
ASSOC COMPUTING MACHINERY.2017: 47–60
- **Approximate Hierarchical Clustering via Sparsest Cut and Spreading Metrics**
Charikar, M., Chatziafratis, V., ACM
ASSOC COMPUTING MACHINERY.2017: 841–54
- **Local Guarantees in Graph Cuts and Clustering**
Charikar, M., Gupta, N., Schwartz, R., Eisenbrand, F., Koenemann, J.
SPRINGER INTERNATIONAL PUBLISHING AG.2017: 136–47
- **Targeted exploration and analysis of large cross-platform human transcriptomic compendia** *NATURE METHODS*
Zhu, Q., Wong, A. K., Krishnan, A., Aure, M. R., Tadych, A., Zhang, R., Corney, D. C., Greene, C. S., Bongo, L. A., Kristensen, V. N., Charikar, M., Li, K., Troyanskaya, et al
2015; 12 (3): 211-?
- **Improved Approximation Algorithms for Label Cover Problems** *ALGORITHMICA*
Charikar, M., Hajiaghayi, M., Karloff, H.
2011; 61 (1): 190-206
- **BEATING THE RANDOM ORDERING IS HARD: EVERY ORDERING CSP IS APPROXIMATION RESISTANT** *SIAM JOURNAL ON COMPUTING*
Guruswami, V., Hastad, J., Manokaran, R., Raghavendra, P., Charikar, M.
2011; 40 (3): 878-914
- **FITTING TREE METRICS: HIERARCHICAL CLUSTERING AND PHYLOGENY** *SIAM JOURNAL ON COMPUTING*
Ailon, N., Charikar, M.
2011; 40 (5): 1275-1291
- **$k(2)$ Spreading Metrics for Vertex Ordering Problems** *ALGORITHMICA*
Charikar, M., Hajiaghayi, M. T., Karloff, H., Rao, S.
2010; 56 (4): 577-604
- **LOCAL GLOBAL TRADEOFFS IN METRIC EMBEDDINGS** *SIAM JOURNAL ON COMPUTING*
Charikar, M., Makarychev, K., Makarychev, Y.
2010; 39 (6): 2487-2512
- **Near-Optimal Algorithms for Maximum Constraint Satisfaction Problems** *ACM TRANSACTIONS ON ALGORITHMS*
Charikar, M., Makarychev, K., Makarychev, Y.
2009; 5 (3)
- **Every Permutation CSP of arity 3 is Approximation Resistant** *PROCEEDINGS OF THE 24TH ANNUAL IEEE CONFERENCE ON COMPUTATIONAL COMPLEXITY*
Charikar, M., Guruswami, V., Manokaran, R.
2009: 62-73
- **MaxMin Allocation via Degree Lower-bounded Arborescences** *STOC'09: PROCEEDINGS OF THE 2009 ACM SYMPOSIUM ON THEORY OF COMPUTING*
Bateni, M., Charikar, M., Guruswami, V.
2009: 543-552
- **Integrality Gaps for Sherali-Adams Relaxations** *STOC'09: PROCEEDINGS OF THE 2009 ACM SYMPOSIUM ON THEORY OF COMPUTING*
Charikar, M., Makarychev, K., Makarychev, Y.

2009: 283-292

- **Aggregating Inconsistent Information: Ranking and Clustering** *JOURNAL OF THE ACM*
Ailon, N., Charikar, M., Newman, A.
2008; 55 (5)
- **Online Multicast with Egalitarian Cost Sharing** *SPAA'08: PROCEEDINGS OF THE TWENTIETH ANNUAL SYMPOSIUM ON PARALLELISM IN ALGORITHMS AND ARCHITECTURES*
Charikar, M., Karloff, H., Mathieu, C., Naor, J. (., Saks, M.
2008: 70-76
- **Sizing Sketches: A Rank-Based Analysis for Similarity Search** *SIGMETRICS'07: PROCEEDINGS OF THE 2007 INTERNATIONAL CONFERENCE ON MEASUREMENT & MODELING OF COMPUTER SYSTEMS*
Wang, Z., Dong, W., Josephson, W., Lv, Q., Charikar, M., Li, K.
2007; 35 (1): 157-168
- **On finding frequent elements in a data stream** *APPROXIMATION, RANDOMIZATION, AND COMBINATORIAL OPTIMIZATION: ALGORITHMS AND TECHNIQUES*
Charikar, M., Chen, K., Farach-Colton, M.
2007; 4627: 584-?
- **On the advantage over random for maximum acyclic subgraph** *48TH ANNUAL IEEE SYMPOSIUM ON FOUNDATIONS OF COMPUTER SCIENCE, PROCEEDINGS*
Charikar, M., Makarychev, K., Makarychev, Y.
2007: 625-633
- **Local global tradeoffs in metric embeddings** *48TH ANNUAL IEEE SYMPOSIUM ON FOUNDATIONS OF COMPUTER SCIENCE, PROCEEDINGS*
Charikar, M., Makarychev, K., Makarychev, Y.
2007: 713-723
- **Improved Approximation for Directed Cut Problems** *STOC 07: PROCEEDINGS OF THE 39TH ANNUAL ACM SYMPOSIUM ON THEORY OF COMPUTING*
Agarwal, A., Alon, N., Charikar, M.
2007: 671-680
- **On the integrality ratio for the asymmetric traveling salesman problem** *MATHEMATICS OF OPERATIONS RESEARCH*
Charikar, M., Goemans, M. X., Karloff, H.
2006; 31 (2): 245-252
- **Clustering with qualitative information** *JOURNAL OF COMPUTER AND SYSTEM SCIENCES*
Charikar, M., Guruswami, V., Wirth, A.
2005; 71 (3): 360-383
- **On the impossibility of dimension reduction in $l(1)$** *JOURNAL OF THE ACM*
Brinkman, B., Charikar, M.
2005; 52 (5): 766-788
- **The smallest grammar problem** *13th Annual ACM/SIAM Symposium on Discrete Algorithms*
Charikar, M., Lehman, E., Liu, D., Panigrahy, R., Prabhakaran, M., Sahai, A., Shelat, A.
IEEE-INST ELECTRICAL ELECTRONICS ENGINEERS INC.2005: 2554-76
- **Improved combinatorial algorithms for facility location problems** *SIAM JOURNAL ON COMPUTING*
Charikar, M., Guha, S.
2005; 34 (4): 803-824
- **Fitting tree metrics: Hierarchical clustering and phylogeny** *46TH ANNUAL IEEE SYMPOSIUM ON FOUNDATIONS OF COMPUTER SCIENCE, PROCEEDINGS*
Ailon, N., Charikar, M.
2005: 73-82
- **Sampling bounds for stochastic optimization** *APPROXIMATION, RANDOMIZATION AND COMBINATORIAL OPTIMIZATION: ALGORITHMS AND TECHNIQUES*

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- Charikar, M., Chekuri, C., Pal, M.
2005; 3624: 257-269
- **Resource optimization in QoS multicast routing of real-time multimedia** *IEEE-ACM TRANSACTIONS ON NETWORKING*
Charikar, M., Naor, J., Schieber, B.
2004; 12 (2): 340-348
 - **Clustering to minimize the sum of cluster diameters** *JOURNAL OF COMPUTER AND SYSTEM SCIENCES*
Charikar, M., Panigrahy, R.
2004; 68 (2): 417-441
 - **Finding frequent items in data streams** *THEORETICAL COMPUTER SCIENCE*
Charikar, M., Chen, K., Farach-Colton, M.
2004; 312 (1): 3-15
 - **Incremental clustering and dynamic information retrieval** *SIAM JOURNAL ON COMPUTING*
Charikar, M., Chekuri, C., Feder, T., Motwani, R.
2004; 33 (6): 1417-1440
 - **The advantage of network coding for improving network throughput** *2004 IEEE INFORMATION THEORY WORKSHOP, PROCEEDINGS*
Agarwal, A., Charikar, M.
2004: 247-249
 - **Minimizing wirelength in zero and bounded skew clock trees** *SIAM JOURNAL ON DISCRETE MATHEMATICS*
Charikar, M., Kleinberg, J., Kumar, R., Rajagopalan, S., Sahai, A., Tomkins, A.
2004; 17 (4): 582-595
 - **On the integrality ratio for asymmetric TSP** *45TH ANNUAL IEEE SYMPOSIUM ON FOUNDATIONS OF COMPUTER SCIENCE, PROCEEDINGS*
Charikar, M., Goemans, M. X., Karloff, H.
2004: 101-107
 - **Maximizing quadratic programs: extending Grothendieck's inequality** *45TH ANNUAL IEEE SYMPOSIUM ON FOUNDATIONS OF COMPUTER SCIENCE, PROCEEDINGS*
Charikar, M., Wirth, A.
2004: 54-60
 - **On the impossibility of dimension reduction in $l(1)$** *44TH ANNUAL IEEE SYMPOSIUM ON FOUNDATIONS OF COMPUTER SCIENCE, PROCEEDINGS*
Brinkman, B., Charikar, M.
2003: 514-523
 - **Clustering with qualitative information** *44TH ANNUAL IEEE SYMPOSIUM ON FOUNDATIONS OF COMPUTER SCIENCE, PROCEEDINGS*
Charikar, M., Guruswami, V., Wirth, A.
2003: 524-533
 - **A constant-factor approximation algorithm for the k-median problem** *31st Annual ACM Symposium on Theory of Computing*
Charikar, M., Guha, S., Tardos, E., Shmoys, D. B.
ACADEMIC PRESS INC ELSEVIER SCIENCE.2002: 129-49
 - **Query strategies for priced information** *32nd Annual ACM Symposium on Theory of Computing*
Charikar, M., Fagin, R., Guruswami, V., Kleinberg, J., Raghavan, P., Sahai, A.
ACADEMIC PRESS INC ELSEVIER SCIENCE.2002: 785-819
 - **Algorithms for capacitated vehicle routing** *SIAM JOURNAL ON COMPUTING*
Charikar, M., Khuller, S., Raghavachari, B.
2002; 31 (3): 665-682
 - **New algorithms for subset query, partial match, orthogonal range searching, and related problems** *AUTOMATA, LANGUAGES AND PROGRAMMING*
Charikar, M., Indyk, P., Panigrahy, R.
2002; 2380: 451-462

- **Dimension reduction in the l_1 norm** *FOCS 2002: 43RD ANNUAL IEEE SYMPOSIUM ON FOUNDATIONS OF COMPUTER SCIENCE, PROCEEDINGS*
Charikar, M., Sahai, A.
2002: 551-560
- **On semidefinite programming relaxations for graph coloring and vertex cover** *PROCEEDINGS OF THE THIRTEENTH ANNUAL ACM-SIAM SYMPOSIUM ON DISCRETE ALGORITHMS*
Charikar, M.
2002: 616-620
- **Finding frequent items in data streams** *AUTOMATA, LANGUAGES AND PROGRAMMING*
Charikar, M., Chen, K., Farach-Colton, M.
2002; 2380: 693-703
- **Delayed information and action in on-line algorithms** *INFORMATION AND COMPUTATION*
Albers, S., Charikar, M., Mitzenmacher, M.
2001; 170 (2): 135-152
- **On page migration and other relaxed task systems** *THEORETICAL COMPUTER SCIENCE*
Bartal, Y., Charikar, M., Indyk, P.
2001; 268 (1): 43-66
- **Algorithms for facility location problems with outliers** *12th Annual ACM-SIAM Symposium on Discrete Algorithms*
Charikar, M., Khuller, S., Mount, D. M., Narasimhan, G.
SIAM.2001: 642-651
- **Min-wise independent permutations** *30th Annual ACM Symposium on Theory of Computing*
Broder, A. Z., Charikar, M., Frieze, A. M., Mitzenmacher, M.
ACADEMIC PRESS INC ELSEVIER SCIENCE.2000: 630-59
- **On-line load balancing for related machines** *JOURNAL OF ALGORITHMS*
Berman, P., Charikar, M., Karpinski, M.
2000; 35 (1): 108-121
- **Minimum outage transmission over fading channels with delay constraint** *IEEE International Conference on Communications (ICC 2000)*
Negi, R., Charikar, M., Cioffi, J.
IEEE.2000: 282-286
- **Approximation algorithms for directed Steiner problems** *JOURNAL OF ALGORITHMS-COGNITION INFORMATICS AND LOGIC*
Charikar, M., Chekuri, C., Cheung, T. Y., Dai, Z., Goel, A., Guha, S., Li, M.
1999; 33 (1): 73-91
- **Minimizing wirelength in zero and bounded skew clock trees** *10th Annual ACM-SIAM Symposium on Discrete Algorithms*
Charikar, M., Kleinberg, J., Kumar, R., Rajagopalan, S., Sahai, A., Tomkins, A.
SIAM.1999: 177-184
- **Approximating a finite metric by a small number of tree metrics** *39th Annual Symposium on Foundations of Computer Science*
Charikar, M., Chekuri, C., Goel, A., Guha, S., Plotkin, S.
IEEE COMPUTER SOC.1998: 379-388
- **Delayed information and action in on-line algorithms** *39th Annual Symposium on Foundations of Computer Science*
Albers, S., Charikar, M., Mitzenmacher, M.
IEEE COMPUTER SOC.1998: 71-80
- **The finite capacity dial-a-ride problem** *39th Annual Symposium on Foundations of Computer Science*
Charikar, M., Raghavachari, B.
IEEE COMPUTER SOC.1998: 458-467
- **A derandomization using min-wise independent permutations** *2nd International Workshop on Randomization and Approximation Techniques in Computer Science (RANDOM 98)*
Broder, A. Z., Charikar, M., Mitzenmacher, M.

SPRINGER-VERLAG BERLIN.1998: 15–24

- **On-line load balancing for related machines** *5th International Workshop on Algorithms and Data Structures (WADS 97)*
Berman, P., Charikar, M., Karpinski, M.
SPRINGER-VERLAG BERLIN.1997: 116–125
- **Constrained TSP and low-power computing** *5th International Workshop on Algorithms and Data Structures (WADS 97)*
Charikar, M., Motwani, R., Raghavan, P., Silverstein, C.
SPRINGER-VERLAG BERLIN.1997: 104–115
- **On page migration and other relaxed task systems** *8th Annual ACM/SIAM Symposium on Discrete Algorithms*
Bartal, Y., Charikar, M., Indyk, P.
SIAM.1997: 43–52