

# Satyadev Nandakumar

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## CURRENT POSITION

Associate Professor, Department of Computer Science and Engineering, IIT Kanpur.  
June 2018-Present.

Visiting Associate Professor, Department of Computer Science and Engineering, IIT Palakkad.  
September 2021-July 2022.

Assistant Professor, Department of Computer Science and Engineering, IIT Kanpur.  
June 2010 – June 2018.

## EDUCATION

- Ph.D. in Computer Science, Iowa State University, Ames, IA, USA, December 2009.  
Title of Dissertation: *Dynamics, Measure and Dimension in the Theory of Computing*. GPA – 4.0/4.0 (Advisor – Dr. Jack Lutz)
- M.S. in Computer Science, Iowa State University, Ames, IA, USA, December 2003. GPA – 4.0/4.0 (Advisor – Dr. Suresh C. Kothari)
- B.Tech (Bachelor of Technology) in Computer Science and Engineering from Regional Engineering College, Calicut, India, June 2000, first class with distinction.

## RESEARCH AREAS

- Algorithmic Information Theory, Kolmogorov complexity, and effective fractal dimension.
- Effective symbolic measure-theoretic and topological dynamical systems
- Normal numbers, continued fractions, finite-state dimension.
- Computability and complexity in analysis
- Computational complexity theory, pseudorandomness.

## RESEARCH FUNDING

- Google Funding for CCR 2017.
- DST SERB Young Scientist, 2014-2017.
- Initiation grant from IIT Kanpur, 2010-2012.

## INVITED LECTURES

- “*Equidistribution: Arithmetic, Computational and Probabilistic Aspects*”, NUS, Singapore, May 2019.
- MFO, “*Computability Theory*”, Oberwolfach, January 2018.
- Aspects of Computation, Institute of Mathematical Sciences, National University of Singapore, August 2017.
- Banff International Research Centre-Casa Matemática Oaxaca. Workshop on Effective Symbolic Dynamics, Oaxaca, Mexico, December 2016.
- Conference on Computability, Complexity and Randomness, Honolulu, Hawaii, USA, January 2016.

- Asian Logic Conference, Mumbai, 2015.
- NII Shonan workshop on Algorithmic Information Theory, Shonan, Japan, September 2014.
- ARA workshop on Algorithmic Randomness and Analysis, Gotemba, Japan, September 2014.

#### **INVITED WORKSHOPS**

- Erwin Schrödinger Institute workshop on *Normal Numbers*, Vienna, November 2016.
- Dagstuhl workshop on *Algorithmic Information Theory*, Schloss Dagstuhl, January 2012.

#### **SPONSORED RESEARCH VISITS**

- Institute of Mathematical Sciences, NUS, Singapore, April-May 2016.
- Nanyang Technological University, Singapore, June 2016. (Host: Dr. Keng-Meng Ng, Department of Mathematics, NTU)
- Victoria University Wellington and University of Auckland, New Zealand, January-April 2015. (Hosts: Dr. Rod Downey, Department of Mathematics, VUW and Dr. André Nies, Department of Computer Science, University of Auckland)
- IMS Singapore, National University of Singapore, June 2014. (Host: Dr. Yang Yue, Department of Mathematics, NUS).

#### **Ph. D DEGREES SUPERVISED**

- Diptarka Chakraborty (co-supervised with Manindra Agrawal, 2012-2016), now Assistant Professor, School of Computing, National University of Singapore.

#### **CURRENT Ph.D. STUDENTS**

- Chandra Shekhar Tiwari (2021-Present)
- Akhil S. (2021-Present)
- Subin P. (2018-Present)
- Prateek Vishnoi. (2016-Present)

#### **POSTGRADUATE (M.Tech/M.S.) THESES SUPERVISED**

- 30 students supervised (2 co-supervised) in the Department of Computer Science and Engineering, and 1 M.S. student co-supervised in the Department of Mathematics, IIT Kanpur.

#### **UNDERGRADUATE RESEARCH SUPERVISION**

- 12 undergraduate B. Tech theses supervised, 3 SURGE projects, including two best SURGE project winners.

#### **CONFERENCE PROGRAM COMMITTEES AND EDITORSHIPS**

- Program Committee Co-chair: Conference on Computability, Complexity and Randomness (CCR) , 2017
- Program Committee Member for Indian Conference on Logic and its Applications (ICLA) 2017.

#### **TEACHING**

- New Courses developed:
  - CS 687: Algorithmic Information Theory
  - CS 698D: Special Topics in Data Compression.
- Other Postgraduate courses taught:
  - CS 744: Pseudorandom Generators
- Computer Science Undergraduate Core Courses taught:

- Esc101 : Fundamentals of Computing. 2013 (instructor), Summer 2014 (co-instructor), Summer 2015 (co-instructor).
- CS 350: Principles of Programming Languages (2011, 2012, 2014, 2015)
- CS 202A: Computer Science Laboratory II (2016)
- CS 330: Operating Systems (Summer 2012)
- Courses taught in other departments:
  - Math 404A: Analysis II (2017)

## **PROFESSIONAL HONORS**

- Department of CSE, IIT Kanpur ACA Best Faculty Award by the graduating batch of 2014.

## **OUTREACH AND ONLINE EDUCATION**

- Taught the NPTEL MOOC on "Introduction to Programming in C" in 2014, 2015, 2017, 2018 and 2019 (approx. enrolment : about 1,20,000 till date)
- Instructor for Python Programming in the online B.Sc. in Data Science by IIT Madras, 2021-

## **OTHER PROFESSIONAL SERVICE**

- Journals Refereed – Theoretical Computer Science, Information and Computation.
- Conferences Refereed – ICALP, FSTTCS, STOC, STACS.

## **INSTITUTE SERVICE**

- Department Post-graduate Committee convener, Department of Computer Science and Engineering, 2020-Present
- Chairperson, Senate Scholarships and Prizes Committee, 2019-Present
- Member, Internal Complaints Committee, 2020-Present
- Member, Senate Student Affairs Committee, 2018-2019.
- **Organizing Vice-chairman, JEE (Advanced) 2018.**
- Warden of Hall 2 (May 2014-January 2018)
- Admissions-in-charge, Department of Computer Science and Engineering, 2012-2014.

## **CONSULTANCY**

- Uttar Pradesh Jal Nigam (State Water Authority), 2018-19

## **INDUSTRY EXPERIENCE**

- Source Allies Inc., Des Moines, Iowa, USA, January 2010 to March 2010 as Software Engineering apprentice.
- Sasken Communications Technologies Ltd., Bangalore, India, July 2000 to August 2001 as Software Engineer

## **ACADEMIC HONORS**

- Teaching Excellence Award, Sp. 2004, Iowa State University.
- Stood second overall in class for the undergraduate course in Computer Science, Regional Engineering College, Calicut.
- National Talent Search Examination Scholarship, 1994, awarded to less than 1000 students annually, all over India
- Ranked eighth in the Secondary School Leaving Exam (conducted by the Govt. of Kerala State, India), 1994. More than half a million students appeared for this examination.

## PUBLICATIONS

### CONFERENCE PUBLICATIONS

1. Finite-State Relative Dimension and the Dimensions of AP Subsequences (joint work with Subin Pulari and Akhil S), *17<sup>th</sup> Annual Conference on Theory and Applications of Models of Computation 2022*, Tianjin, China, 2022.
2. Ergodic theorems and their converses for PSPACE functions (joint work with Subin Pulari), *46<sup>th</sup> International Symposium on the Mathematical Foundations of Computing Science*, Tallin, Estonia, 2021.
3. Randomness and Effective Dimension of Continued Fractions (joint work with Prateek Vishnoi), *45<sup>th</sup> International Symposium on the Mathematical Foundations of Computing Science*, Prague, Czech Republic, 2020.
4. On Resource-Bounded van Lambalgen's Theorems (joint work with Diptarka Chakraborty and Himanshu Shukla), *14<sup>th</sup> Annual Conference on Theory and Applications of Models of Computation*, Bern 2017.
5. Dimension, Pseudorandomness and Extraction of Pseudorandomness (joint work with Manindra Agrawal, Diptarka Chakraborty and Debarati Das), *35<sup>th</sup> Foundations of Software Technology and Theoretical Computer Science*, Bangalore 2015.
6. Multiple Recurrence and Algorithmic Randomness (joint work with Rodney G. Downey and André Nies), *10<sup>th</sup> International Conference on Computability and Randomness*, Heidelberg, Germany, 2015.
7. Ornstein Isomorphism and Algorithmic Randomness (joint work with Mrinalkanti Ghosh and Atanu Pal), *9<sup>th</sup> International Conference on Computability and Randomness*, Singapore, 2014.
8. Normality and Finite State Dimension (with Santosh Vangapelli), *8<sup>th</sup> International Conference on Computability, Complexity and Randomness (CCR)*, (Moscow, Russia, 2013)
9. Predictive Complexity and Generalized Entropy of Stationary Ergodic Games (with Mrinalkanti Ghosh), *23<sup>rd</sup> International Conference on Algorithmic Learning Theory (ALT)*, (Lyons, France, 2012).
10. Axiomatizing Resource Bounded Measure (with Xiaoyang Gu, Jack Lutz and James S. Royer), *7<sup>th</sup> Annual Conference on Computability in Europe (CiE)*, (Sofia, Bulgaria, 2011).

11. An Effective Ergodic Theorem and Some Applications, *40th ACM Annual Symposium on Theory of Computing*, (Victoria, Canada, May 2008).
12. A Characterization of Constructive Dimension, *Computability and Complexity in Analysis*, (Siena, Italy, July 2007).
13. Finite State Dimension and Real Arithmetic (with David Doty and Jack Lutz), *Proceedings of the Thirty-Third International Colloquium on Automata, Languages, and Programming* (Venice, Italy, July 9-16, 2006), Springer-Verlag, 2006, pp. 537-547.

## **JOURNAL PUBLICATIONS**

1. Ergodic Theorems and their converses for PSPACE functions (joint work with Subin Pulari), *Theory of Computing Systems*, accepted for publication, 2022.
2. On Continued Fraction Randomness and Normality (joint work with Prateek Vishnoi), *Information and Computation*, accepted for publication, 2022.
3. An analogue of Pillai's theorem for continued fraction normality and application to subsequences (joint work with Subin Pulari, Prateek Vishnoi and Gopal Viswanathan). *Bulletin of the London Mathematical Society*, 53(5):1414-1428, 2021.
4. A weak-2 generic which bounds a minimal degree, (joint work with Rod Downey). *Journal of Symbolic Logic*, 84(4): 1326-1347, 2019.
5. Martin-Löf randomness implies multiple recurrence in effectively closed sets, (joint work with Rod Downey and André Nies), *Notre Dame of Formal Logic*, 60(3):491-502, 2019.
6. Dimension, Pseudorandomness and Extraction of Pseudorandomness (joint work with Manindra Agrawal, Diptarka Chakraborty and Debarati Das), *Computability vol 6. no. 3*, pp. 277-305, 2017.
7. Normality and Finite-State Dimension of Liouville Numbers (joint work with Santosh Kumar Vangepalli.) *Special Issue for CCR 2013, Theory of Computing Systems*, 58 (3) 392-402, 2015.
8. Finite State Dimension and Real Arithmetic (with David Doty and Jack Lutz), *Information and Computation*, 205 (207), pp. 1640-1651, 2007.
9. A New Characterization of Constructive Dimension, *Mathematical Logic Quarterly*, 55(3), 271-286, 2009.

## **WORKSHOP PUBLICATIONS**

1. Axiomatizing Resource-Bounded Measure, (with Xiaoyang Gu, Jack Lutz and Jim Royer), *Logic in Computational Complexity*, Los Angeles, CA, August 2009.

## ARTICLES UNDER PREPARATION

1. Martingales and Restricted Ratio Betting (joint work with Sumedh Masulkar and Keng-Meng Ng)
2. Rényi Entropy and information Inequalities for two random variables (joint work with Sultan Alam)

## REFERENCES

*Available upon request.*