Himanshu Shukla

Contact Information

Postgraduate (Dual Degree)
Indian Institute of Technology (IIT) Kanpur, India
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Nationality: Indian (Passport No.: K2472420)
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Research Interests

Number Theory (algebraic, analytic and computational aspects), Modular Forms, Arithmetic of Elliptic Curves. I am also interested in problems related to Algebra and Combinatorics, and Diophantine Approximation.

Education

Tata Institute of Fundamental Research (TIFR), Mumbai, India *(Jun '17)*

Visiting Student Research Program (VSRP-2017) candidate for reading in modular forms under Prof. N. Fakhruddin.

Indian Institute of Science Education & Research (IISER) Pune, India *(Dec '15)*

Visiting student for reading in Algebraic Number Theory under Dr. Debargha Banerjee.

Indian Institute of Technology (IIT) Kanpur, India *(Jul '13 – Jul '18)*

Bachelor of Technology (B.Tech.) in Computer Science and Engineering and Master of Sciences (M.S.) in Mathematics (Dual Degree) with CPI/GPA=8.8 (PG - 9.7 & UG - 8.6) on a scale of 10.0.

All India Senior School Certificate Examination (Intermediate), CISCE India *(May '13)*

- Secured overall 95.6% and **Institute Rank 2** with an aggregate of **97.3%** in science subjects (Physics, Chemistry and Mathematics) & **100%** in Computer Science.

All India Secondary School Examination (Matriculation), CISCE India *(May '11)*

- Secured overall 95.0% and **Institute Rank 2** with **97%** in Computer Applications and an aggregate of **94.5%** in Science and Mathematics.

Awards & Recognitions

- Awarded **Bhagwandas Sanghi Gold Medal** for being the best dual degree student in the Department of Mathematics and Statistics, IIT Kanpur. *(Jun '18)*
- Awarded **Yogendra Nath and Sushma Gupta Scholarship** for academic performance in Computer Science and Engineering department. *(Feb '16)*
- Awarded **Summer Undergraduate Research Grant of Excellence (SURGE)** for summer project under Prof. Satyadev Nandakumar. *(May '15 – Jul '15)*
- Awarded **Academic Excellence Award** by IIT Kanpur for achieving **10.0/10.0** GPA in first two semesters at IIT Kanpur. *(Dec '14)*
- Received **Dr. D. R. Bhagat Scholarship** for academic excellence at IIT Kanpur in the Computer Science and Engineering department. *(Feb '14)*
- Awarded **INSPIRE Fellowship**, by the Government of India for being in **Top 1% nationwide** in ISC Board Exams. *(Jul '13)*
- Secured an All India Rank of **659 (99.6 percentile)** in IIT-JEE (Advanced) 2013. *(Jun '13)*
- Secured an All India Rank of **10** in NEST (National Entrance Screening Test) for NISER (National Institute of Science Education and Research) in 2013. *(Jun '13)*
- Secured an All India Rank of **3185 (99.8 percentile)** in IIT-JEE (Mains) 2013. *(Apr '13)*
- Achieved an All India Rank of **26 (99.99 percentile)** in SCRA (Special Class Railway Apprentices) Exam 2013. *(Jan '13)*
- Achieved an All India Rank of **325** in KVPY Exam 2013. *(Nov '12)*
- Among **top 1% nationwide** in NSEC (National Standard Examination in **Chemistry**) and NSEA (National Standard Examination in **Astronomy**) and **top 1% statewide** in NSEP (National Standard Examination in **Physics**) 2012. *(Nov '12)*

Publications/ Preprints

- On Resource-Bounded versions of the van Lambalgen's theorem (joint work with Diptarka Chakraborty and Satyadev Nandakumar), 14^{th} *International Conference on Theory and Applications of Models of Computation (TAMC-2017).*
- Definable Combinatorics with Dense Linear Orders (joint work with A. Jain and A. S. Kuber) *Archive for Mathematical Logic*, (accepted).
- On Definable Functions of Atomless Boolean Algebras (joint work with A. S. Kuber) *(in preparation).*

Teaching & Scribes

- Teaching Assistant for the course **Abstract Algebra (CS203B)** under Prof. Manindra Agarwal, IIT Kanpur. *(Aug '16 – Sept '16)*
- Compiled and contributed to scribed lectures of **Elliptic curves and applications in cryptography** at IIT Kanpur. *(Aug '16 – Dec '16)*
- Lecture series on **Galois theory** offered at *SIGTACS* (Special Interest Group on Theoretical Aspects of Computer Science), IIT Kanpur. *(Dec '16 – Apr '17)*

Workshops

- Workshop on *Theoretical and Computational aspects of Birch and Swinnerton Dyer Conjecture* held at ICTS Banglore, India.
- Workshop on *Perspectives in Complexity Theory and Cryptography* held at IISc Banglore, India.

Talks

- On Resource-Bounded versions of the van Lambalgen's theorem, *14th TAMC, University of Bern*, Switzerland, 2017.
- Model theoretic Grothendieck rings of some structures with quantifier elimination at *Math–Stat Seminar, Department of Mathematics and Statistics, IIT Kanpur*, 2018.

Research Projects & Experiences

‡ – Report available on request.

Reading in elliptic curves
Under Dr. Somnath Jha, IIT Kanpur *(Aug '17 – Dec '17)*

- Read the book "Arithmetic of Elliptic Curves" by J. H. Silverman.

Cantor-Zassenhaus type algorithm for polynomial factoring over finite fields‡
Under Dr. Nitin Saxena & Dr. Rajat Mittal, IIT Kanpur *(Dec '15 – Apr '16)*

- Proposed and explored a *Cantor-Zassenhaus* type algorithm for factoring polynomials over finite fields.
- The algorithm assuming *Generalized Reimann's Hypothesis* factors polynomials.

Generalised form of Burgess' Lemma 2 and easier proof of deterministic bound on polynomial factoring over finite fields ‡ *(Jul '15 – Nov '15)*
Under Dr. Nitin Saxena & Dr. Rajat Mittal, IIT Kanpur

- Studied *Burgess' inequality* and extended *Burgess' Lemma 2* to arbitrary degree polynomials.
- Conducted experiments to check the distribution of quadratic residues and non-residues over $\mathbb{F}_p$.

Analogues of Miller-Yu theorem in resource bounded measures ‡ *(May '15 – Jul '15)*
Under Dr. Satyadev Nandakumar, IIT Kanpur (SURGE- 2015 Project)

- Studied different randomness paradigms and Martin Löf randomness.
- Studied Miller-Yu theorem and its analogues in resource bounded measures and derived resource bounded versions of the Chaitin's inequality.

Relevant courses

Design & Analysis of Algorithms	Algebra 2 (Field Theory)
Commutative Algebra	Representation Theory of Finite Groups
Arithmetic Complexity Theory	Algebraic Number Theory
Category Theory	Algebraic Topology
Elliptic Curves & applications in Cryptography	Course in Arithmetic (based on Serre's book)
Lie Algebras and their Representations	Vector Bundles and Characteristic Classes

Course & other projects

Relation Extraction for Matrix(type) entities in Introductory Programing Problems (Course project in Artificial Intelligence (CS365A))‡ *(Jan '15 – Apr '15)*

Under Dr. Amitabha Mukerjee, IIT Kanpur

- Did relation extraction for specific type of programing problems using *statistical machine translation*, given in introductory programming courses.
- Generated data and developed a *meta-language* for this data to train GIZA++.

Geometric Data Structures (Advanced track project for Data Structures and Algorithms course (CS210))‡ *(Aug '14 – Nov '14)*

Under Dr. Surender Baswana, IIT Kanpur

- Analysis of two data structures for Orthogonal Range Searching.
- Implementation of both, one using K-D tree $O(\sqrt(N))$ query time and $O(N)$ space and other using Augmented Red-Black tree with $O(log^2(N))$ query time and $O(N * log(N))$ space complexity.
- Proved their correctness and tested their performance on a randomly generated data set.

Autonomous Underwater vehicle *(May '14 – Jul '14)*

Under Robotics Club, IIT Kanpur

- Studied various kinds of degradation in Underwater image formations.
- Studied restoration algorithms in underwater environment.

Leadership Skills & Social Initiatives

Cheif Technical Advisor at Atventus Technologies *(Nov '16 – May '18)*

- Among one of the founding members of the company and responsible for handelling all major technical issues of the company.

Cadet, National Cadet Corps (NCC) *(Aug '13 – Apr '14)*

- Completed Training as a part of Physical Education (PE101 & PE102).

Technical Skills & Language Experience

Programming Languages & Software - C/C++, Python, MATLAB, JAVA, Octave, Sage, OpenCv, TkInter, LaTeX.

Hands on experience in *Data scrapping, testing & automation* (using selenium) as a part of work at **Atventus Technologies**. *(Jun ''16 – Jul '16)*

Fluent in English & Hindi.