

PARUL AGARWAL

Senior Undergraduate
Dept. of Computer Science and Engineering
Indian Institute of Technology, Kanpur, India
E-mail: parulag@iitk.ac.in , parulagarwal89@gmail.com

G-205, GH1
IIT Kanpur-208016
Phone: + (91) 9005751932
<http://home.iitk.ac.in/~parulag>

Education

Degree / Certificate	Institution	Year	CPI / Percentage	Rank
Mtech	Indian Institute of Technology, Kanpur, India	2013*		
B.Tech	Indian Institute of Technology, Kanpur, India	2013*	8.9/ 10.0** (3.56 / 4.00)	
Class 12 : CBSE Board	Kalka Public School, New Delhi, India	2007	88.8%	
Class 10 : ICSE Board	Christu Jyoti Convent School, Baghpat, UP, India	2005	92.8%	

*expected year of graduation **after completion of 7th semester

Scholastic Achievements

- One among 20-25 finalists from all over India invited to attend Finale Conclave at Google India Bangalore office for Google India Anita Borg Memorial Scholarship 2012. Finalists were selected based on the strength of candidates' academic background and demonstrated leadership.
- Scholarships:
 - Selected for scholarship to attend the workshop organized by the National University of Singapore (NUS) School of Computing (SoC) in May'12 among undergraduate and graduate students from all over Asia
 - Selected among the 50 students from IIT Kanpur, CalTech, Rice University and École Centrale Paris for the SURGE Scholarship (Summer Undergraduate Research Grant for Excellence) for May - July 2010
 - Awarded Merit-cum-Means Scholarship for meritorious performance for academic years 2009-'10, 2010-'11 and 2011-'12
 - Awarded FIITJEE Talent Search Examination (FTSE) Scholarship for qualifying FTSE organized at national level for two consecutive years with AIR 283 and AIR 236 in 2006 and 2007 respectively
 - Awarded scholarship for excellence in Institute of General Studies for Children (IGSC) Scholarship Examination held in December 2002 at National level
- Selected among the 50 students from IIT Kanpur, CalTech, Rice University and École Centrale Paris in the SURGE Programme (Summer Undergraduate Research Grant for Excellence) for May - July 2010.
- Selected among the 60 students across India in IPTSE Winter School 2010 organised by Carnegie Mellon University at IIIT and awarded 2nd Best Project Award.
- Awarded Best Poster Presentation Award among 800 students in Eureka, the paper presentation contest of Techkriti 2011, the annual inter-collegiate technical festival of IITK.
- Selected for best three in poster presentation in Eureka and third position in SOFTKriti-The Open Software Contest, Techkriti 2012.
- Awarded for Most Innovative Design Award in NIRMAAN- National Bridge Design Challenge organised in Techkriti 2010 among 35 teams from across the country.
- Awarded Merit-cum-Means Scholarship for past three years
- Received special appreciation on my work "Graph500 on BlueGene/P", summer internship at IBM IRL, Delhi. Work was selected in top 16 research projects among 62 research works done at IBM, India in summers 2011
- Paper on "Emotion Detection from Speech" accepted for poster presentation in Grace Hopper Celebration 2011 held at Portland, Oregon US
- Awarded Best Paper Presentation on paper "Locally Linear SVMs" in course CS685 among 25 presentations.
- Achieved an All India Rank 408 (AIR) in IIT-JEE'08 in which more than 320,000 students appeared (99.99 percentile)
- Secured 448th Rank in AIEEE'07 in which nearly 750,000 students appeared (99.99 percentile). Scored the highest amongst female students in Delhi with a state rank of 43
- Secured All India Rank 132 in National Level Science Talent Search Examination-2007, Unified Council (99.99 percentile)
- Got certificate of merit from the Indian Association of Chemistry Teachers for excellent performance in Indian Standard Examination in Chemistry 2006-2007
- Got certificate of merit from the Indian Association of Physics Teachers for excellent performance in Indian Standard Examination in Physics 2006-2007
- Qualified FIITJEE Talent Search Examination 2006(AIR 283) and 2007(AIR 236) organized at national level
- Awarded first Position in high school for all-round performance in academic year 2004-2005.
- Got Certificate of excellence in IGSC Scholarship Examination held in December 2002 at National level.
- Awarded the best essay in All India Essay Competition conducted by Education News Magazine, Hyderabad.

Poster Publications

- **Grace Hopper Celebration 2011:** Work done on “Emotion Detection from Speech using Adaboost and SVMs” accepted in General Poster Presentation Track.
- **SURGE 2010:** Paper presented in SURGE 2010 on the work “Predicting tissue specific metabolic networks and building gene-regulatory networks”
- **Eureka 2011:** Awarded Best Poster Presentation Award among 800 entries in Eureka, the paper presentation contest of Techkriti 2011, the annual inter-collegiate technical festival of IITK. Work was in Data Mining and Bio-informatics on “Prediction of Enhancer Sites on DNA Sequences
- **Eureka 2012:** Awarded Third Best Poster Presentation Award among around 800 entries in Eureka, the paper presentation contest of Techkriti 2012, the annual inter-collegiate technical festival of IITK. Work was in Data Mining and Machine Learning on “Emotion Detection from Audio and Video”

Internships / Work Experience

HPC: Graph 500 on IBM's Supercomputer Blue Gene/P (IBM-IRL, May 2011 – July 2011) (OMP, MPI, C++)

Mentors: Dr. Yogish Sabharwal, Anamitra Roy Choudhury and Anshul Mittal, IBM India Research Labs, New Delhi

- Analysis of Graph 500 Benchmark 1 (“Search”) on IBM's Blue Gene Supercomputer Watson4P, ways to **optimize** it and its implementation
- Implemented and optimized BFS search on a large random graph of size 2^{38} vertices, with average degree of 16. It was tested on 32K nodes of supercomputer.
- The work was submitted to Graph 500 list for **November 2011 submission**.

The project was on optimization of Graph500 benchmark on IBM's supercomputer Blue Gene/P. Graph500 involves doing a breadth-first search (BFS) on a large, random sparse graph. The first step of the benchmark represents the graph (vertices and edges) in a distributed fashion. The second step involves doing the actual BFS and validating the results. I implemented and optimized BFS search on a large random graph of size 2^{38} vertices, with average degree of 16. It was tested on 32K nodes of supercomputer. Major part of my work was proposing and implementing two algorithms- a dynamic strategy for communication between supercomputer's nodes based on the number of graph vertices visited in each level and a strategy that focused on decompression of only those graph edges that were actually going to be used in any BFS level. Performance improved by 30%. I received special appreciation for my work as it was selected in top 16 research projects among 62 research works done at IBM, India in summers 2011.

Machine Learning: Emotion Recognition from Speech (CMU IPTSE Winter School, Dec 2010) (SVMs, AdaBoost, Matlab, Python)

Mentors: Dr. Bhiksha Raj, Carnegie Mellon University and Dr. Kishore S. Prahallad, IIITH India

- Involved extraction of new features from a given sample speech file, classification by machine learning using binary classifiers and selection of best features for various emotion pairs
- Introduced a new classification by integrating SVMs and AdaBoost
- Won **2nd Best Research Project Award**
- Paper accepted for poster presentation in **Grace Hopper Celebration 2011**

The work dealt with the extraction of new features from a given sample speech file, classification by machine learning using binary classifiers and selection of best features for various emotion pairs. We dealt with four emotion classes: Happy, angry, sad and neutral. We proposed and implemented a new classification technique by integrating SVMs and AdaBoost. Adaboost was used for classification as well as feature selection. We used a feature set of 70 features (extracted from tools and generated from spectrogram analysis) in adaboost classification and extracted top 10 features for classifiers of each emotion pair. SVMs were trained using the selected feature set and it was observed that computation cost of the system with 70 features dropped down drastically when we used new feature set of 10 features, with a little tolerance in performance. The accuracies obtained were: neutral (87.50%), angry (96.36%), sad (99.00%), happy (25.71%). We won 2nd Best Research Project Award. Paper accepted in poster presentation at Grace Hopper Celebration 2011 held at Portland, Oregon US.

Data Mining and Bio-informatics (SURGE Summer Internship, May 2010 - Current) (MySQL, Java, Python, Graphviz)

Mentors: Dr. Harish Karnick(HOD), Dr. Arnab Bhattacharya, CSE IITK and Dr. Amitabha Bandyopadhyay, BSBE IITK

- Designed and implemented an algorithm that built tissue specific metabolic networks, gene-regulatory network, **biobionics** of research papers and find the relation between various genes from them
- Analysis and prediction of transcription factor binding sites on DNA sequences using **p-match algorithm**
- Predicting enhancer sites on DNA sequences and validating them with co-regulated genes
- Planning to submit a **research paper** to a premier international conference on Data Mining

I designed and implemented an algorithm that built tissue specific metabolic networks and gene-regulatory networks for chicken. My work also dealt with biobionics of research papers and finding the relation between various genes from them. I have extended the work and currently working on the analysis and prediction of transcription factor binding sites on DNA sequences

using p-match algorithm. It aims to predict enhancer sites on DNA sequences. I have proposed and implemented a new algorithm to validate the results of enhancer sites with co-regulated genes. We are planning to submit a research paper to a premier international conference on Data Mining.

Build Robot Create Science (BRiCS) Training Program (June 2010 – July 2010)

- Mentor in Summer Training Program <http://www.bricsworld.com/> .
- Guided college students and engineers from all over India in Embedded Systems, Robotics, Automation, Communication and Software Development.
- Responsible for smooth conduction of lectures and workshops in Training Programs
- BRiCS(Build Robots Create Science) is a commercial establishment of IIT Kanpur alumni which teaches students robotics and embedded systems.
- I worked there as a mentor to help the students of various colleges with the practical implementation of Line-Follower Robots, GSM communication, printing on LED matrices, Digital clocks on LCD, UART communications etc
- Technologies used: Eclipse Software for programming microcontroller (coding was done in C)

Image Processing: Indian Currency Detector (Dec 2009) (OpenCV, C)

Mentor: Dr. Phalguni Gupta, CSE IITK

- Designed and implemented an **efficient algorithm** to detect features in Indian notes using concepts of match template with ROI and phase correlation
- Features like size of the note, intensity of color, noise in note and various other **security features** obtained by RBI were considered
- Achieved **70% accuracy** in detecting notes

I designed and implemented an efficient algorithm to detect features in Indian notes using concepts of match template with ROI and phase correlation. Features like size of the note, intensity of color, noise in note and various other security features obtained by RBI were considered. We achieved 70% accuracy in detecting notes

Mtech Thesis

Multimedia Analysis TO BE UPDATED

Mentor: Prof. Harish Karnick, CSE IITK and Dr. Bhiksha Raj, Assistant Professor, Carnegie Mellon University

- Aims to learn distance functions for clustering multimedia data.

Conference/Workshop Attended

- Paper on “Emotion detection from Speech” accepted in general poster session in **Grace Hopper Celebration 2011**, held at Portland, Oregon (US). Acceptance rate of 15%
- Attended talk at **ISEC 2012**, 5th Indian Software Engineering Conference on Methods for Loop Invariant Generation: The Fixpoint Brush in The Art of Invariant Generation by Dr. Sumit Gulwani, Senior Researcher, Microsoft Research (Redmond Lab)

Paper Presentations

- Presented the paper **Locally Linear Support Vector Machines** by Ladicky and Torr, ICML 2011 as part of Data Mining course
 - Got **Best Paper Presentation** among 25 other presentations
- Presented the paper **On k-Nearest Neighbor Searching in Non-Ordered Discrete Data Spaces** as part of Indexing and Searching Techniques course.
- Critically reviewed a paper on **Automatic compilation of MATLAB programs for synergistic execution on heterogeneous processors** by Ashwin Prasad, Jayvant Anantpur and R. Govindarajan PLDI 2011: 152-163

Relevant Courses

- | | | |
|-----------------------------------|-----------------------------------|--------------------------------------|
| • Data Mining | • Machine Learning | • Indexing and Searching Techniques |
| • Cryptography | • Algorithms II | • Advanced Compilers Optimizations |
| • Operating System | • Discrete mathematics | • Multiagent Systems |
| • Compiler Design | • Theory of computation | • Artificial Intelligence |
| • Principles of Database Systems | • Programming tools & techniques | • Fundamental of computing(Java) |
| • Computer networks | • Data structures & algorithms | • Introduction to Mathematical Logic |
| • Principles of programming lang. | • Intro. to computer organization | |

Mathematics courses: Multivariable Calculus, Complex Analysis & Linear Algebra, Fourier Analysis & Differential Equations, Probability and Statistics

Economics courses: Microeconomics, Macroeconomics, Indian Problems and Policies, Money and Banking

Technical Skills	
Programming Languages	C, C++, Java, Python, Prolog, Oz, Assembly Language
Web Developments	PHP, HTML, JavaScript, MySQL, CSS
Tools	LaTeX, Lex, Yacc, Make, Shell, Eclipse, Matlab, GNU Octave, Autocad
Platforms	Windows, Linux

Key Academic Projects

Indexing and Searching TO BE UPDATED

Multiagent Systems TO BE UPDATED

Advanced Compilers Optimizations TO BE UPDATED

Machine Learning: Question Classification (Aug 2011 – Nov 2011) (Winnow, Perceptron, NB, MaxEnt, SVMs)

Mentor: Prof. Kritika Venkataramani, CSE IITK

- Classification of questions based on five categories : Abbreviation, Entity, Description, Human, Location and Numeric
- Worked on features like bag-of-words, higher order language features like POS tags, chunk tags and Named-entity Relations.
- Worked on the database and tools available at The Cognitive Computation Group at UIUC
- Analysed and compared the results of 5 classifiers for analysis: Winnow, Perceptron, Nave Bayes (NB), Maximum Entropy (Maxent) and Support Vector Machines (SVM) with SVMs giving the best result of 87.2%

Machine Learning: Emotion Recognition from Audio and Video (Aug 2011 – Nov 2011) (SVMs, AdaBoost, Matlab, Python)

Mentor: Prof. Arnab Bhattacharya, CSE IITK

- Analysis of video sequences which combines facial expressions observed visually with acoustic features to automatically recognize five universal emotion classes: Anger, Disgust, Happiness, Sadness and Surprise
- The emotions are instantaneously classified using a Support Vector Machine
- Combined the two modalities at feature and score level to compare the respective joint emotion recognition rates

Cryptanalysis of Popular Cryptosystems (Aug 2011– Nov 2011) (coding in C, Mathematica)

Mentor: Prof. Manindra Agrawal, CSE IITK

- Performed Cryptanalysis of ciphers including permutation & substitution cipher, Variant of DES, AES and RSA
- Cracked 4 round DES using differential cryptanalysis, reduce round AES by Square Attack and 1024 bit RSA with low exponent using LLL attack

Compiler for C++ (Feb 2011 – April 2011)

Mentor: Amey Karkare, CSE IITK

- Designed a **partially fledged compiler** for source language C++, target language as Mips and implementation in python
- Implemented features like basic types, arrays, pointers, functions (recursive, function overloading), literals and control structures. Generated 3-address code
- Project was nominated for the **Best Project Award** among 16 other projects

Automated Attendance Management System (2011 – April 2011) (MySQL ,Xampp)

Mentor: Dr. Sumit Ganguly, CSE IITK

- Designed and implemented an automated attendance management system optimized for 3CNF
- Implemented **convenient viewing** of attendance and timetable, viewing students above threshold attendance, giving attendance, ensuring security (**no proxy** attendance) and rescheduling classes by the instructor, maintaining sessions

Navigational bot to detect movable objects in a 2D grid (Mar 2011) (coding in Python)

Mentor: Dr. Harish Karnick, CSE IITK

- Designed and implemented software for navigational robot that would move in **unknown grid** and identify and report location of all the objects present in it, subject to condition that objects can move
- Implemented min-max algorithm and alpha-beta pruning algorithm on game which is variant of Tic-Tac-Toe.
- Implemented search algorithms including Iterative Deepening DFS, A* and IDA* on game of 8 puzzle

Simulation and analysis of various features of OS (Aug 2010 – Nov 2010) (coding in Java)

Mentor: Dr. Sumit Ganguly, CSE IITK

- Simulated and analyzed different **system calls** and scheduling algorithms using operating system simulator-NACHOS
- Implemented and analyzed performance of different **mutual exclusion algorithms**
- Simulated and evaluated page replacement algorithms for memory management and a fully associative TLB

Search Engine (Feb 2009 - March 2009) (Apache Lucene, coding in Java)

Mentor: Dr. Amitabh Mukherjee, CSE IITK

- Documents were indexed using techniques of **stemming, filtering** and **text normalization**. Query entered by the user was also tokenized in a similar way
- The results were presented to the user in a tabular manner with the option to view any particular document
- Obtained search results with **high precision** and good relevance on a dataset of 50 documents

Chat facility (Aug 2010- Nov 2010) (coding in C)

Mentor: Dr. Dheeraj Sanghai, CSE IITK

- Implemented a chat facility which enables two clients chat over network, such that server **keeps a log** of everything including who chats with whom at what time. It would also let the user know whether a friend is online or not
- Designed campus network

Positions of Responsibility

- **Cordinator, Public Relations, Techkriti'11**, the annual inter-collegiate technical festival of IIT Kanpur
 - Led a three-tier team of 30 members consisting of Executives and Secretaries
 - Responsible for organizing of **workshops** and lectures by Nobel laureates and renowned scientists
 - Organized **events** like laser show, magic show and robotics exhibition
- **Executive, Public Relations, Techkriti'10**, the annual inter-collegiate technical festival of IIT Kanpur
 - Responsible for organizing of **workshops** and lectures by Nobel laureates and renowned scientists
 - Organized **events** like laser show, magic show and robotics exhibition
- **Event Coordinator, Women's Basketball Udghosh'10**, the Annual Sports Festival of IITK
 - Responsible for smooth scheduling of matches for 12 teams.
 - Organized pool matches, quarter finals, semifinals and final matches
- **Secretary, Robotics Club, IIT Kanpur** for academic year 2009-'10
 - **Guided students** in robotics events in Techkriti, annual inter-collegiate technical festival of IITK and Takneek, the Intra-college Technical Festival of IITK
 - Responsible for scheduling and smooth conduction of robotics **lectures and workshops**
 - Organized competitions under Takneek and Techkriti, and projects for students during Summer Camp organized by Science and Technology Council
- **Internship Secretary, Students Placement Office, IIT Kanpur** for academic year 2009-'10
 - Responsible for contacting companies to come and hire undergraduate students for summer internships
 - Ensured that all the proceedings flow as per the rules of SPO.
- **Executive, Media and Publicity Cell, Antaragni'09**, the annual inter-collegiate cultural festival of IIT Kanpur
 - Led a three-tier team of 36 members consisting of secretaries and volunteers
 - Introduced a help desk under the control of media and publicity cell for the first time in Antaragni which was responsible for clearing any queries related to events scheduling and results
 - Responsible that every event is covered by the media people and appropriate information is provided to them
 - Responsible for printing of Pre-fest and Post-fest newsletter for Antaragni. Looked after the content and other details as well
- **Organised Choreo, Freshers Party'09**
 - Responsible for organizing Choreo in Fresher's Party for the junior Y9 batch
 - Taught dance and dramatics skills needed to a team of 40 freshmen
- **Team Leader, Alumni Contact Program, IIT Kanpur** for academic year 2008-'09
 - Led a team of six members
 - Get Alumni connections globally and also inform them about current happenings
 - Promote the Alumni towards contributing to the Institute by making donations through Annual Gift Programme
 - The donations made by alumni are used to promote research and development at IITKanpur by supporting students financially
- **Head Girl, Christu Jyoti Convent School, Baghpur** for academic session 2004-2005
 - Responsible for smooth conduction of events in Annual Function, Sports Day, Teachers Day and other celebrations at school
 - Motivated and guided students in active participation of various inter-House events which consists of scientific, cultural and sports events
 - Awarded best student for my contributions to the school in terms of managerial and proficiency skills

Extra Curricular Activities/Interests

- Build Robot Create Science (BRICS)
 - Mentor in Summer Training Program <http://www.bricsworld.com/> for summers 2010.
 - Guided college students and engineers from all over India in Embedded Systems, Robotics, Automation, Communication and Software Development.
 - Responsible for smooth conduction of lectures and workshops in Training Programs.
- Institute Basketball Team, Games and Sports Council, IIT Kanpur
 - Team member, Girls Basketball Team since 2008.
 - Won Bronze Medal in Inter-IIT Sports Meet'09 and Bronze Medal in Women's Basketball Udghosh'10.
 - Awarded 1st place in Basketball in Annual Sports Championship'09.
 - Attended Summer Camp'09 for Basketball organized by Games and Sports Council, IITK.
 - Event Coordinator, Women's Basketball Udghosh'10, the Annual Sports Festival of IITK.
- Robotics Club, IIT Kanpur
 - Secretary for academic year 2009-2010.
 - Responsible for scheduling and smooth conduction of robotics lectures and workshops.
 - Made an autonomous line following robot in Summer Camp organized by Science and Technology Council, IITK in summers'09.
 - Guided students in robotics events in Techkriti, the annual inter-collegiate technical festival of IITK and Takneek, the Intra-college Technical Festival of IITK.
 - Organized competitions under Takneek and Techkriti, and projects for students over the summer camp organized by Science and Technology Council.
 - Participated in Takneek'08 and grabbed consolation prize in coding autonomous robots.
- K'OS Dance Club, IIT Kanpur
 - Active member of Dance Club IITK.
 - Participated in Dance Drama and Group Dance in Galaxy, an intra-hostel cultural festival.
 - Performed in Choreo in Fresher's Party'08, talent show for incoming batch (first year students).
 - Compered in Dance Extravaganza'09, annual Dance Club festival.
- Social Services
 - Was involved with Caring Souls Foundation and awarded Certificate of Special Effort in Mass Awareness Campaign against AIDS and Cancer to alleviate the sufferings of the Needy Cancer Patients.
 - Volunteered for the 18th National Eye Donation Fortnight, organized by Ministry of Health and Family welfare, Govt. of India and participated in Poster Painting and Slogan Writing Competition.
- Public Relations, Techkriti, IIT Kanpur
 - Coordinator and Executive in Techkriti'11 and Techkriti'10 respectively.
 - Responsible for organizing of workshops and lectures by Nobel laureates and renowned scientists.
 - Organized events like laser show, magic show and robotics exhibition.