Nishant **Rai**

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EDUCATION

April 2017	B.Tech (Computer Science And Engineering)	IIT Kanpur	9.9/10.0
April 2013	Class XII (Central Board for Senior Education)	K.V. Delhi	96.20 %
April 2011	Class X (Central Board for Senior Education)	K.V. Shillong	10.0/10.0

ACADEMIC ACHIEVEMENTS

- Received **MITACS Globalink Award** for a Summer Research Internship at **U.B.C.** for the year **2016**.
- Received **Charpak Research Scholarship** for the year **2015**.
- Received the **Academic Excellence Award** for exceptional academic performance in **13-14** and **14-15** academic session.
- Secured AIR - **257** in **JEE (Advanced) 2013** and AIR - **79** in **JEE (Mains) 2013**.
- One amongst the **6 INMO Awardees** selected for **IMO training camp**, after clearing **INMO '13**.
- Awarded Gold medal for being selected for **IPhO training camp**, after clearing **INPhO '13**.
- Awarded **Ashray Hasta Award and Scholarship, 2013** for exceptional performance in **AISSCE, 2013**.
- Selected for the prestigious **KVPY** scholarship, in stream SX.
- Secured **Rank 1** in **Regional Mathematics Olympiad '12** (Delhi Region).

ACHIEVEMENTS IN PROGRAMMING

- Secured **1st** place in **Microsoft CodeHunt** amongst individuals from over the country. Selected for **finals** in **China**.
- Secured **8th** place in **ZS Associates Data Science Challenge** amongst **300+** students from over the country.
- Secured **13th** place in **IOPC** (International Online Programming Contest) amongst **900+** teams from over the world held during **Techkriti '15**.
- Secured **1st** place in the event **Chaos** (Esoteric Programming Contest) held during **Techkriti '15**
- Secured **17th** place in in **Morgan Stanley Codeathon 2014** amongst **1000+** individuals from over the country.
- Secured **26th** place in **ACM ICPC Onsite Contest** 2014 amongst **250+** teams from over the country.
- Secured **1st** place in the **Web-dev** event during **Takneek '14** (Inter-Hostel Technical Competition).
- Secured **1st** place in the programming event **Blackbox** during **Takneek '13** (Inter-Hostel Technical Competition).

PUBLICATIONS

Partial Multi-View Clustering Using Graph Regularized NMF — Accepted
Nishant Rai, Sumit Negi, Santanu Chaudhury, Om Deshmukh — Jul '16
23rd International Conference on Pattern Recognition

Evolving structure of the Maritime Trade Network — Accepted
Zuzanna Kosowska-Stamirowska, César Ducruet, Nishant Rai — May '16
Journal of Shipping and Trade

INTERNSHIPS

C.A.R.I.S. LAB — Research Internship
University of British Columbia — May '16 - Jul '16
Vancouver, Canada

Single-Arm Reach Prediction:

Mentored by **Justin Hart, Post Doc, CARIS Lab** and **Elizabeth Croft, Head, CARIS Lab** , for prediction of single-arm reaching motion by humans in order to create smooth and safe Human-Robot interactions.

- Worked on several robot platforms, including a **Barrett WAM** 7-DOF Robot and the **Willow Garage PR2** Robot.
- Trained in programming in the **ROS** (Robot Operating System) environment created by **Willow Garage**.
- Studied and analyzed the performance of multiple **Hand** and **Model** trackers and the possibility of inclusion in our pipeline.
- Developed and debugged interfaces in the experimental setup to be used in the **Human subject** Experiments.

Merging Point Clouds from Multiple Kinects:

Mentored by **Justin Hart, Post Doc, CARIS Lab** for aligning points clouds being received from multiple Kinects. Supporting project for improving the performance of other setups present in the lab.

- Literature survey on existing work for **Camera Calibration** and **Distortion reduction** in cameras.
- Performed **Chessboard Corner** detection to get target points to perform calibration. Computed the **Homography** from the detected points. Used parts of **Zhang's Camera Calibration** in order to extract the final camera parameters.
- Averaging using **Rodriguez** representation along with **Bundle Adjustment** used to improve results.
- **Transformation** between Kinects computed using the extracted camera parameters. Used to align the Point Clouds.

X.R.C.I — Research Internship
Xerox Research Center India — Dec '15
Bangalore, India

Multi View Clustering via Non Negative Matrix Factorization:

Mentored by Om Deshmukh, Senior Researcher (Area Manager, Multimedia Analytics), XRCI and Sumit Negi, Principal Researcher, XRCI , for developing and evaluating algorithms for Multi View Clustering using Non Negative Matrix factorization.

- Literature Survey on **existing work** and **Variants** of Multi View Clustering; **Partial/Constrained Multi View Clustering**.
- Studied various algorithms for optimization including **Greedy Coordinate Descent**, **Alternating Least Squares**, Method of **alternate Optimizations**, **Augmented Lagrangian** methods. **Formulated update rules** for our methods based on them.
- Proposed, implemented and evaluated several models to tackle the Partial Multi View problem. **Outperform** existing models.
- Studied the effect of **Graph Regularization** on the results and the effect of **varying Kernels** on it, on multiple **Image** and **Textual** datasets.

I.N.R.I.A. — Research Internship
The French Institute for Research in Computer Science and Automation — May '15 - Jul '15
Rocquencourt, France

Alternate Paths in Road networks:

Mentored by Laurent Viennot, Senior Researcher, INRIA and Adrian Kosowski, Researcher, INRIA , for finding routes substantially different from the shortest path based on different criteria.

- Implemented various **shortest path** algorithms and compared their efficiency on **real world road networks**.
- Proposed algorithms to compute paths according to another feasible definition.
- Created **measures** to **compare** different algorithms developed efficient algorithms for the involved computations.

Feature Based Representation of Social Networks:

Mentored by Adrian Kosowski, Researcher, INRIA , finding good local features which are suitable predictors for global features

- Studied **information spread models** and about maximizing spread, **Local Ranking** problem, **Pagerank** algorithm.
- Implemented and studied randomized **rumor spreading**, the relation between size and steps for spread of the rumor
- Studied and explored different **local features** in graphs based on **walks, subgraph densities, centrality measures** and their relation with other **global properties** along with arguments to explain the obtained results.

PROJECTS

CHALEARN: APPARENT PERSONALITY ANALYSIS THROUGH VIDEOS: — Jun '16 - Jul '16

- Project for challenge hosted for **ChaLearn Looking at People, ECCV '16 workshop**. Secured 6^{th} place amongst **85** teams.
- Challenge aimed at recognizing **personality traits** of users in **short video** sequences (15 secs).
- Our method titled **"Multi-modal Approaches for Personality Analysis through Videos"** constructs multiple models using different modalities and performs **late feature fusion** in order to predict the traits.
- Preprocessing of videos involves **Face detection** followed by **Facial Landmark** alignment.
- Experimented with **multiple** visual feature based models including **Background-Context** and **Facial feature** models.
- **Visual features** computed using **CNNs** trained on video frames. Also experimented with activations of the last layer of **VGG-Net**.
- **Audio features** used same as the one used in **INTERSPEECH 2010** Paralinguistic Challenge. Audio clips broken into **multiple segments**. Experimented with various **pooling** methods and **regressors** for the final prediction.
- Multiple methods used for **combining** the **frame-wise predictions** to extract the final results. More details available in **report** online.
- **Stacking** and **Blending** performed to fuse the Multi-Modal predictions. Results **much better** than models using a single modality.

DEEP LEARNING FOR VISUAL QUESTION ANSWERING: — Mar '16 - Apr '16

- **Course Project** for course **CS676A**: Computer Vision and Image Processing, under **Prof. Vinay Namboodiri**.
- Project aimed at constructing Neural Network-based models for **Answering Open-ended questions** about images.
- Task reduced to **multi-class classification** after selecting the top K answers from the training set, and restricting the final output.
- Image embeddings are activations of the last layer of a **Convolutional Neural Network** (pre-trained on the **ImageNet** dataset).
- Question embeddings are computed using the **Glove Word Vectors** of the constituent words and **LSTM** Networks.
- **Multiple methods** used for combining the embeddings and their effect on the performance was studied. The entire network (except the CNN for image features) is trained **End-to-End**.
- Studied about **Spatial-Attention** and **External Knowledge** Based Models for Visual Question Answering. Implemented a **Semantic-Attention** model, where the attention cues are extracted using the question.

REAL-TIME VEHICLE AND LICENSE PLATE RECOGNITION: — Feb '16 - Apr '16

- **Course Project** for course **CS771A**: Machine Learning: Tools and Techniques, under **Prof. Harish Karnick**.
- Project aimed at **Real-time vehicle Recognition** along with **Extracting Registration Numbers** from the **License Plates** of four-wheelers in real world **surveillance** videos.
- Proposed method involves processing the video frames to extract **candidate regions** containing vehicles. **Tracking** performed using **inter-frame information** and **SIFT-based interest point matching**.
- Performed classification on the proposed regions using **SVMs, Random Forests, CNNs** and **Ensembles** (Boosted through **AdaBoost**).
- Studied the effect of the different features (Such as **HOG, SIFT** and **CNN** based features) on the performance.
- License plate **localized** after processing the candidate region. **OpenALPR** used to further narrow and extract the Vehicle number.

ADA COMPILER: Jan '16 - Apr '16

- **Course Project** for the completion of the course **CS335A**: Compiler Design, under **Prof. Subhajit Roy**.
- Project involved creating an **End-to-End Compiler** for a subset of the programming language **ADA** in the **x86** architecture.
- Implemented a **Lexical Analyzer** and **Assembly-Code Generator** in python, constructed grammar rules for parsing our identified language and created the **TAC** (Three Address Code) for intermediate code. Used **Yacc** and **Lex** for the same.
- Implemented basic types, operations for **Strings**, **Library support**, **Short circuiting**, conditionals, **Loops** with strict **type-checking** and error handling. Implemented **functions** (Allowed **overloading**) with multiple return values and scopes.

ADAPTIVE STRATEGIES FOR INFINITE PRISONER'S DILEMMA: Jan '16 - Apr '16

- **Case Study** for the completion of the course **ECO502A**: Applied Game Theory, under **Prof. Vimal Kumar**.
- Studied existing literature on the work related to **Prisoner's Dilemma** and the analysis of the Infinite Case.
- Implemented and studied the performance of both Single-Objective and Multi-Objective **Evolutionary Algorithms** to compute good strategies for the same. Confirm results proposed by **Axelrod** by conducting tournaments amongst multiple strategies.
- Proposed new **adaptive** strategies based on **Reinforcement Learning** and study its performance by conducting various experiments.
- Studied about methods such as **Q-Learning, Deep Reinforcement Learning** and its possible applications in learning new strategies.

WORD EMBEDDINGS WITH MULTIPLE WORD PROTOTYPES: Aug '15 - Nov '15

- **Course Project** for course **CS671A**: Introduction to Natural Language Processing, under **Prof. Amitabha Mukherjee**.
- Project aimed at constructing of **Multiple Sense Embeddings** for different words using purely **unsupervised approaches**.
- Proposed algorithms involved **Online clustering**, analysis of Word-Word **co-occurrence matrix** and **Non-parametric clustering** using penalties based on **Negative Sampling**.
- **Outperform existing methods** in **Local Similarity** Metric and **comparable** in terms of other metrics, result in more semantically coherent senses than the state of the art methods.

NACHOS OPERATING SYSTEM: July '15 - Nov '15

- **Course Project** for course **CS330A**: Operating Systems, under **Prof. Mainak Chaudhuri**.
- **Extended** the **NachOS** operating system to perform basic operating system functions including **Fork, Join, Sleep** and **Exec**.
- Implemented and evaluated performance of various algorithms for scheduling processes.
- Developed and added support for **Demand Paging, Shared Memory, Condition Variables** and **Semaphores**.

MULTI MODAL EMOTION RECOGNITION: May '14 - Jun '14

- Project aimed at performing **Emotion Detection** using three features i.e. **textual, speech** and **visual**.
- Recognition of facial expressions using **Eigenfaces**. Further narrowed down the features by detecting important parts such as Eyes, Nose, etc using **Haar Cascade** Classifiers.
- Used **acoustic features** of audio such as **Mel Frequency Cepstral Coefficients (MFCC)** to extract sentiment out of speech.
- Merged the results of the three classifiers to identify emotions more accurately.
- Learnt about **Facial Action Codings, Active Shape/Appearance Models** and other prevalent methods for emotion classification.

GEOMETRIC DATA STRUCTURES: Sep '14 - Nov '14

- Project for **Advanced Track** in course **CS210**: Data Structures and Algorithms, under **Prof. Surendar Baswana**.
- Project involved **re-invention, implementation** and **analysis** of **geometric** data structures to efficiently answer given queries.
- Developed efficient algorithms for maintaining **Dynamic Convex Hulls** and **Range Search Queries**.
- **Queries handled: Point in Polygon, Polygon-Line intersection, Simplex problem, Orthogonal Range Search, Half Plane problem**.

SENTIMENT ANALYSIS OF SOCIAL MEDIA: Aug' 14

- Application developed during **Web-Dev, Takneek '14** and secured **First** position.
- Interface to analyze the past and present **social sentiment of brands** and **their products**.
- Identifies the **"good" and "bad" features** of the product to act upon them.

OTHER MINOR PROJECTS:

- Developed a bot to play **Othello**, based on **Minimax** algorithm. **Alpha-beta Pruning** performed to speed up computations. Secured **19th** place amongst **2000+** participants from over the world.
- Designed a bot to play **Battleship**. A **probabilistic model** of the ships and board used to decide the next move.
- Created models for **Predicting Search trends**, **Topic Assignment** based on keywords, **Spam Detection** and **Multi-Label Question** classification (Tested on questions taken from **Quora**).
- **News Report Classification** completed during **Jan '14 - Apr '14** under **Association of Computing Activities**.
- Designed a **Captcha Decoder**, able to work with occlusions. **Clustering** and **Segmentation** based methods used for extracting **candidate regions** containing characters. Further passed through a classifier for confirmation.
- Completed project to discover patterns and trends about the **New York Subway**, under the **Udacity** course: **Intro to Data Science**.

TECHNICAL SKILLS

Programming Languages (Proficient):	C, C++, Python, MatLab, GNU Octave, Assembly (Verilog)
Programming Languages (Familiar):	Java, CSS, JavaScript, PHP, MySQL
Software and Utilities:	Git, GNUPlot, LaTeX AUTOCAD Inventor

INTERESTS

Algorithms and Data Structures
Competitive Programming
Machine Learning
Artificial Intelligence
Computer Vision
Natural Language Processing

POSITIONS OF RESPONSIBILITY

Jan '15 - Apr '16 | **Member, Core Team Academics, Counseling Service**
Responsible for managing remedial lectures, mentor allotment and other academics related issues.
Managing a team of 100+ Academic Mentors to help and guide academically troubled students.
Assisting peer students in departmental courses by conducting classes as well as personal tutoring.

Aug '14 - Mar '15 | **Senior Executive, Public Relations, Techkriti '15, IIT Kanpur**
Responsible for inviting eminent personalities for talks, shows and looking after their publicity and hospitality
Responsible for smooth conduction of 5 talks and 2 shows in the festival along with other teammates.
Managed a team of 15 members to organise TechPlanet which witnessed footfall of over 3000 people

Apr '14 - Apr '15 | **Secretary, Programming Club**
Jun '14 - Apr '15 | **Academic Mentor (MTH101/102), Counselling Service**
Jun '14 - Apr '15 | **Student Guide, Counselling Service**
Previous | **Secretary, Hospitality Cell, Udghosh '14**
Volunteer, Hospitality Cell, Udghosh '13

RELEVANT COURSES

ESC101 : Fundamentals of Computing
CS201 : Discrete Mathematics
Udacity: Intro to Data Science
CS203 : Abstract Algebra
CS345 : Algorithms - II
CS252 : Computing Laboratory - II
CS676 : Computer Vision and Image Processing
MTH101 : Analytical Calculus
CS210 : Data Structures and Algorithms
CS251 : Computing Laboratory
CS220 : Computer Organization
CS330 : Operating Systems
CS671 : Natural Language Processing
CS335 : Compiler Design
MTH102 : Linear Algebra and DE
Coursera: Algorithms
CS202 : Mathematical Logic
MSO201 : Probability and Statistics
CS340 : Theory of Computation
CS771 : Machine Learning: Tools and Techniques
* - ONGOING

EXTRA-CURRICULAR ACTIVITIES

Secured **1st** place in **Reviews** - Lifestyle event in **Spectrum '14** (Inter-Hostel Competition).
Secured **1st** place in **Tennis (Singles)** in **Freshers' Inferno '13** (Inter-Hostel Sports Competition).
Selected for **CBSE Tennis Regionals** (Guwahati Region), 2009.
Selected for participation in **U-17 Inter School Table-Tennis Tournament**, Shillong in 2010.
Secured **1st** place in **U-17 Tennis Open** held at Basava International School, New Delhi in 2011.