Harish Rajagopal

Fourth Year Undergraduate
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Educational Qualifications

Degree	Year	Institution/Board	CGPA/%
B. Tech	2016 – Present	IIT Kanpur	9.7/10.0
Sr. Secondary	2016	Maharashtra HSC	90.46%
Secondary	2014	Maharashtra SSC	93.6%

Academic Achievements

- Secured 8 **A⋆** grades for exceptional performance across 7 semesters.
- Awarded **Academic Achievement Awards** for outstanding performance in 1st and 2nd years.
- Secured All India Rank of **185** in **JEE (Advanced) 2016** given by about 200 thousand students.
- Secured All India Rank of **205** in **JEE (Mains) 2016** given by about 1.4 million students.

Internships

- **Research Intern, NYU Tandon** May '19 – July '19
  Prof. Paweł Korus, Prof. Nasir Memon
  - Researched robust image hashes that are immune to typical image transformations, while being sensitive to malicious image edits such as face swaps, deep fakes, object addition/deletion.
  - Constructed models that take an image and output a binary hash that would give lower *Hamming distances* for hashes of similar images while giving more considerable distances for dissimilar images.
  - Developed a *framework* for testing against transformations like compression, contrast changes, blurring, warping.
  - Trained various novel network architectures on the *triplet loss* along with *mining* of examples for improved training.
  - Tested the networks against *adversarial attacks* such as *FGSM*, *Projected Gradient Descent*, *Boundary Attack*.
- **Research Intern (Remote), NYU Tandon** May '18 – July '18
  Prof. Yao Wang https://github.com/rharish101/Plasticity-Networks
  - Researched *differentiable plasticity* for *domain transfer* in images using Convolutional Neural Networks.
  - Tested three architectures on the *Street View House Numbers (SVHN)* dataset: standard ResNet, ResNet with plasticity on the fully-connected layer and ResNet with plasticity on all layers, using 20 and 56 layer variants.
  - Improved *efficiency* in the temporal update rule for the *Hebbian weights* by using *transpose convolution*.
  - Achieved notable improvement in classification accuracy for the 20 layer models using full plasticity, when adapting models trained on the SVHN dataset for the MNIST dataset.
- **Intern, Machine Learning Team, New York Office of IIT Kanpur** May '17 – July '18
  Prof. Manindra Agrawal
  - Developed an *online* text clustering model using a fully-online modification of the *DBSCAN* algorithm.
  - Implemented an *online* document vectorisation model based on the *Distributed Memory paragraph vectors* model.
  - Developed a *Word2Vec* model to identify duplicate documents using *Word Mover's Distance* on word vectors.
  - Trained a Convolutional Neural Network with sliding windows for English Optical Character Recognition (OCR).

Projects

- **Improving GANs through Test-Time Constraints** Jan '19 – Present
  Prof. Vinay Namboodiri, Prof. Chetan Arora https://cse.iitk.ac.in/users/rharish/ugp2
  - Pre-trained *Generative Adversarial Networks* (GANs) are fine-tuned using *interactive user input*, inspired by the iGAN paper and the paper Exploiting Test Time Evidence to Improve Predictions of Deep Neural Networks.
  - The user provides sketches of edges on a single output of the generator and a *difference-of-Gaussians* based loss is backpropagated through the generator to fine-tune the generator's weights.

  - A regularisation term in the loss prevents the weights from deviating away from the weights learned initially.

- **Multi-Agent GANs for Image Super-Resolution** Aug '18 – Dec '18
  Prof. Vinay Namboodiri https://cse.iitk.ac.in/users/rharish/ugp1
  - A *Multi-agent generalisation* of *SRGAN* inspired by *MADGANs* for image super-resolution in *TensorFlow*.
  - Four generators (with shared lower layers) get the four corner sections of the input (with a slight overlap), and their outputs are joined (negating the overlap) to get the final high-resolution image.
  - Each generator pairs with a discriminator, while a global discriminator acts on the final output.

- **Higher-Order Optimisation in Deep Learning** Sept '18 – Nov '18
  Prof. Piyush Rai, CS771A Course Project https://github.com/rharish101/CS771-Project
  - A survey on the use of *quasi-Newton methods* in deep learning as part of a course.
  - Surveyed *Hessian-Free optimisation*, *AdaQN*, and *Sum of Functions Optimiser (SFO)*.
  - Benchmarked Hessian-Free optimisation on an MLP against the *Adam* and SGD optimisers in *TensorFlow*.

- 7^{th} **Inter-IIT Tech Meet (Silver Medal)** Dec '18
  IIT Kanpur Contingent https://github.com/rharish101/eye-in-the-sky
  - The Eye in the Sky: Semantic segmentation of satellite images using a dataset of only 14 images.
  - Won 2^{nd} *place* using the *P-Net* architecture, trained on an augmented dataset generated by slicing each image into multiple images and using rotations.
  - Tuned model hyperparameters using the *Tree of Parzen Estimators* method from the *Hyperopt* library.

- **Compiler for Golang in Python** Jan '19 – Apr '19
  Prof. Amey Karkare, CS335A Course Project https://github.com/rharish101/CS335A
  - A compiler for translating Golang to MIPS written in Python as part of a course.
  - Implemented basic C-like features like data types, variables, expressions, control statements (if-else, switch, loops), arrays, functions, pointers, structs, library imports, and I/O.
  - Implemented advanced features like composite literals, struct embeddings, typedefs/aliases, operator overloading, multiple value returns, multiple parallel assignments, short declarations, and short-circuit evaluation.

- **No-Frills Cab Locator – Android App** Sept '18 – Nov '18
  Prof. Nisheeth Srivastava, CS252A Course Project https://nfcl.pythonanywhere.com

- 6^{th} **Inter-IIT Tech Meet** Dec '17 – Jan '18
  IIT Kanpur Contingent https://cse.iitk.ac.in/users/rharish/sixth-tech-meet

- **Reinforcement Learning in Atari Games** Jan '17 – July '17
  Association of Computing Activities, IIT Kanpur https://github.com/rharish101/ACA-Project

- **Depression Therapy Chatbot** May '17 – July '17
  Programming Club, IIT Kanpur https://github.com/rharish101/PClub-Project

- **Visual Attention in Image Captioning (Mentored)** May '18 – July '18
  Programming Club, IIT Kanpur https://github.com/DEVANSH99/Image_cptning2018

Technical Skills

- **Programming Languages:** Python, Bash, C, C++, LaTeX, PHP, HTML+CSS, MySQL, Typescript
- **Software and Utilities:** TensorFlow, PyTorch, Keras, Numpy, Git, OpenCV, Hyperopt, Gensim, Ionic, AutoCAD

Relevant Courses

Visual Recognition	Special Topics in NLP (∗, †)	Probabilistic Machine Learning (∗, ‡)
Convex Optimization (∗)	Introduction to Bayesian Analysis (∗)	Introduction to Machine Learning
Econometrics	Computational Cognitive Science	Probability and Statistics

∗: In progress †: Audit ‡: As part of a reading group

Positions of Responsibility

- **Tutor**, Computer Science and Engineering Department, IIT Kanpur Dec '19 – Present
- **Secretary**, Programming Club, IIT Kanpur Aug '17 – Apr '18
- **Academic Mentor**, Counselling Service, IIT Kanpur Mar '17 – Feb '18