

# Utkarsh Ojha

## Research interests

**Computer vision, Deep learning, Adversarial attacks.**

## Education

- 2014–2018 **NIT Allahabad.**  
(expected) B.Tech - Computer Science and Engineering  
CGPA - 8.85
- 2014 **K.V. SAC Vastrapur.**  
AISSCE - CBSE (XII) : 94.8
- 2012 **K.V. SAC Vastrapur.**  
AISSCE - CBSE (X) : 10.0 CGPA

## Research Experience

- May 2017 – **Indian Institute of Science, Bangalore, Prof. Venkatesh Babu.**  
present Worked on modeling universal adversarial perturbations for target classifiers
- Developed a generative model that learns the manifold of structured noise, which when added to an image can fool current state-of-the-art classifiers easily.
  - The approach extends upon existing works on universal adversarial perturbations by going beyond a single perturbation to the manifold of the perturbations.
  - Our work beats current state-of-the-art in terms of fooling rates for the specific CNN as well as its transferability to other CNNs
- Worked on reducing artifacts in images using Generative adversarial networks
- Developed a hierarchical generative adversarial network that progressively learns to reduce the compression artifacts (ex. JPEG compression) in images.
  - The model inspired from SRGAN paper uses a perceptibility loss function that enforces visually good looking images, going beyond PSNR values.
  - Dataset used for this experiment is BSDS500 and LIVE1
- May – July 2016 **Indian Space Research Organization, Ahmedabad, Debajyoti Dhar, Prof. Ranvijay.**  
Worked with the team of *Optical data processing department* to make denoising of images computationally efficient, using a machine learning approach
- Developed deep architectures that learn to reconstruct the images from its noisy version, trained on the images captured by CARTOSAT-2
  - The objective was to make the reconstruction results similar to the results of existing state-of-the-art techniques (Non-local means, BM3D etc), but in much less computation time.
  - Our model works decently in terms of PSNR value of the reconstructed images (close to images reconstructed by Non-local means), and produces these results within 45 seconds (per image).
- August 2016 – **Computer vision and Image processing lab | NIT Allahabad, Prof. Dushyant Singh.**  
present Worked/Working on various extracurricular and final year projects related to computer vision and machine learning including understanding the dynamics of objects in images (currently working), understanding a stream of images via stream of sentences, object recognition in images etc.

## Projects

### **Modeling universal adversarial perturbations.**

A generative model that learns a manifold of universal adversarial perturbations which deceive specific CNN into misclassifying perturbed images with high fooling rate. Work is still in progress and we expect it to be submitted to CVPR 2018, and also expect to compete in NIPS 2017 challenge on adversarial attacks and defenses. An extension of this work is to study how dangerous these adversarial examples can be for self-driving cars i.e. how the response (fooling rates) of state-of-the-art classifiers change when viewing these adversarial images at differing angles and scales.

### **ARGAN: Artifact reduction using Generative adversarial networks.**

A hierarchical generative adversarial network approach to remove JPEG compression artifacts from images; incorporating a perceptibility enhancing term that is expected to reconstruct images that humans find visually more realistic

### **Travelogue: Understanding a stream of images via natural descriptions.**

Developed a multimodal deep learning architecture consisting of ConvNets and bidirectional recurrent neural networks for generating a sequence of natural language descriptions for a sequence of images captured when visiting a place

### **FRIENDS Season 11.**

Developed a RNN+LSTM architecture to predict what would have happened if FRIENDS had continued beyond season 10. Training data was the complete subtitles from season 1-10 in text format, on which the LSTM architecture was trained. The model produced some quite funny and realistic conversations.

### **Scene understanding (currently going on).**

We are developing a system that detects and tracks objects in real time, understands the scene by classifying it and predicting its attributes, and is able to predict the distance of prominent objects from the view point.

### **Denoising high resolution images using deep learning approach.**

This work was conducted in the *Optical data processing department*, ISRO Ahmedabad during summer 2016. Used stacked autoencoders to learn the mapping from a captured noisy image to its reconstructed form. The objective was to make the reconstructed images similar to the images reconstructed by existing state-of-the-art techniques (Non-local means, BM3D), and more importantly do the denoising operation faster and efficiently than existing techniques. Resulting paper has been accepted at ICMLA 2016.

### **Artificial intelligence for Reversi game.**

The project was about developing an artificial system that could take intelligent moves based on the current scenario of the board, in an attempt to maximize the future rewards. We used a combination of Minimax algorithm and dynamic programming approaches to develop the AI.

### **Code compression techniques for low powered embedded systems.**

This was a course project for *Embedded Systems*. In this work, we provide a detailed review of some of the recent techniques that have been used for code compression, which can lead to reduced memory access, and eventually can lead to lower power consumption. At the end, we propose our own idea of combining the idea of bit masking with a machine learning approach that can further help in reducing the number of bits required to represent some data.

### **Designing an automatic gate using data driven approach.**

This was a course project for *Microprocessor and its applications* and outlines the development of an automatic gate with the help of a microprocessor using a machine learning approach and how this approach can be used to overcome the shortcomings of traditional triggering methods, and improve the efficiency in detecting when to open or close gates automatically.

## Papers

Konda Reddy Mopuri\*, Utkarsh Ojha\*, Utsav Garg, Venkatesh Babu. "NAG- Network for adversary generation". In proceedings of CVPR 2018 (under review).

Utkarsh Ojha, Ankur Garg. "Denoising high resolution multispectral images using deep learning". In proceedings of ICMLA 2016.

## Coursework

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Machine learning (Nando de Freitas)\*\*, Introduction to computer vision (Udacity - Georgia Tech)\*\*, CS231n: Convolutional Neural Networks for visual recognition (Stanford University)\*, Machine Learning (Coursera - Stanford)\*, Database management system, Scientific computing, Computer Networks, Operating systems, Cryptography, Automata theory, Graph theory and combinatorics, Data structures, Foundation of logical thought (Discrete mathematics).

\*\*Currently going on, \*Audited

## Technical proficiency

### Operating systems.

Linux and Windows

### Programming.

Python, Tensorflow, Theano (basic), C, C++ (basic), Java (basic), L<sup>A</sup>T<sub>E</sub>X

## Achievements

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  - o Attended International Conference on Machine learning and Applications held in Anaheim, California to present my paper on *Denoising high resolution images using deep learning approach*
  - o Certificate of excellence from Indian Space Research Organisation (ISRO) for successful completion of the research project.
  - o 3rd position for developing an artificial intelligence for Reversi game in CodeWarriors event held in the technical festival of NIT Allahabad.
  - o Awarded a scholarship of Rs. 5000 for academic excellence in class 12th (2nd rank with 94.8 percentage) from Kendriya Vidyalaya Sangathan, New Delhi.
  - o Awarded scholarship of Rs. 5000 for academic excellence in class 10th (10 CGPA) from Kendriya Vidyalaya Sangathan, New Delhi.
  - o Gold medalist: International Mathematics Olympiad, National Science Olympiad
  - o Selected for finals of Indian National Mathematical Olympiad

## Extra curricular

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  - o Institute badminton team captain - Represented the institute and won at different levels of tournaments
  - o Selected for Kendriya Vidyalaya National level sports meet for badminton