Kumar Ayush

4th year undergraduate
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Education

Indian Institute of Technology Kharagpur, West Bengal, India 2013 - 2017
B.Tech(Hons.) in Computer Science and Engineering
CGPA: 9.46/10.0

Rajendra Vidyalaya, Jamshedpur, India 2013
Indian School Certificate (ISC) - 12th Grade
Percentage score: 97.6%, **ranked 1st in school**

Rajendra Vidyalaya, Jamshedpur, India 2011
Indian Certificate of Secondary Education (ICSE) - 10th Grade
Percentage score: 96.57%

Interests

My broad area of interest is machine learning and computer vision. I am currently working on generative models including Generative Adversarial Networks (GANs).

Papers

Mayank Singh, Barnopriya Barua, Priyank Palod, Sidhartha Satapathy, Samuel Bushi, **Kumar Ayush**, Krishna Sai Rohith, Tulasi Gamidi, Pawan Goyal, Animesh Mukherjee. **"OCR++: A Robust Framework For Information Extraction from Scholarly Articles."** *International Conference on Computational Linguistics (Coling).* 2016. (Accepted, poster, paper link, framework link)

Srinivas S. S. Kruthiventi, **Kumar Ayush**, R. Venkatesh Babu. **"DeepFix: A Fully Convolutional Neural Network for predicting Human Eye Fixations".** *IEEE Transactions on Image Processing.* (Under revision, paper link).

Gaurush Hiranandani, **Kumar Ayush**, Atanu Sinha, Sai Varun Reddy Maram, Chinnaobireddy Varsha, Pranav Maneriker. **"Enhanced Personalized Targeting using Augmented Reality."** *IEEE International Symposium on Mixed and Augmented Reality (ISMAR).* 2017. (In submission)

Patents

Gaurush Hiranandani, **Kumar Ayush**, Chinnaobireddy Varsha and Sai Varun Maram Reddy. **"Creating Targeted Content based on Detected Characteristics of an Augmented Reality Scene."** *US15/454,750.* (Filed)

Gaurush Hiranandani, Sai Varun Maram Reddy, **Kumar Ayush**, Chinnaobireddy Varsha and Siddhant Jain. **"Product Recommendations Based on Augmented Reality Viewpoints."** *US62/415,332.* (Filed in multiple countries)

Gaurush Hiranandani, Chinnaobireddy Varsha, Sai Varun Maram Reddy, **Kumar Ayush** and Atanu R. Sinha. **"Identifying Augmented Reality Visuals Influencing User Behavior in Virtual-Commerce Environments in Virtual-Commerce."** *US15/433,834.* (Filed)

Internships

Big Data Experience Labs, Adobe Systems, Bangalore, India Summer 2016
Augmented Reality for Enterprise
Guide: Gaurush Hiranandani

Worked on the development of an end-to-end system to create personalized catalogues for re-targeting with product recommendations embedded in the purchase viewpoint in v-Commerce environment. Designed a predictive model for identification of purchase viewpoint from a user's mobile app session. Built a system for creating personalized catalogues with relevant recommendations embedded in the viewpoint. A novel method for recommendation was designed which retrieves products based on style similarity and theme compatibility. Devised a graph based approach for automatic generation of personalized email content suitable for the catalogue. *Three patents* have been filed in the *US Patent and Trademark Office*. One of the patents was appreciated, by Adobe's Patent Review Committee, as an important technology and has been filed not only

in USA but also in India and other countries of Europe. This project was also selected to be presented at Adobe's Tech Summit 2017 in San Jose, California. This work has been submitted to *International Symposium on Mixed and Augmented Reality (ISMAR) 2017*.

Video Analytics Lab, Indian Institute of Science, Bangalore, India Summer 2015
DeepFix: A Fully Convolutional NeuralNetwork for predicting Human Eye Fixations
Advisor: Prof. R. Venkatesh Babu

Worked on the development of a fully convolutional neural network for accurate saliency prediction. DeepFix is designed to capture semantics at multiple scales while taking global context into account using network layers with very large receptive fields and also modeling location dependent patterns (e.g. centre-bias) by incorporating a novel Location Biased Convolutional layer. We evaluated the proposed method on multiple challenging datasets, and were able to outperform other recent methods by a huge margin. This work is under review in *IEEE Transactions on Image Processing*. Our model, DeepFix, won the *1st prize* in the *Saliency Prediction* task at *Large Scale Scene Understanding Challenge (LSUN) 2016*, organized by *Princeton University* in conjunction with *IEEE Conference on Computer Vision and Pattern Recognition (CVPR) 2016*.

Video Analytics Lab, Indian Institute of Science, Bangalore, India Summer 2015
Combining Class Conditioned Representations in CNN for Salient Object Segmentation
Advisor: Prof. R. Venkatesh Babu

Worked on the development of a CNN framework followed by Dense Conditional Random Field (CRF) for Salient Object Segmentation. Proposed a deep fusion architecture which not only combines class-conditional representations but also introduces scale invariance by combining it via inception like module (inspired from GoogleNet). We evaluated our model on MSRA-1000 and CSSD datasets and were able to perform at par with state-of-the-art models.

Academic Projects

Bachelor's Thesis, Indian Institute of Technology Kharagpur, India 2016 - Present
Generative Adversarial Learning for Reducing Manual Annotation in Semantic Segmentation on Large Scale Microscopy Images
Advisor: Prof. Pabitra Mitra

CNN based semantic segmentation require extensive pixel level manual annotation which is daunting for large microscopic images. The work is aimed towards mitigating this labeling effort by leveraging the recent concept of generative adversarial network(GAN) wherein a generator maps latent noise space to realistic images while a discriminator differentiates between samples drawn from database and generator. We extend this concept to a multi task learning wherein a discriminator-classifier network differentiates between fake/real examples and also assigns correct class labels.

Bachelor's Thesis, Indian Institute of Technology Kharagpur 2016 - Present
Generative Adversarial Networks (GANs) for Action Recognition in Images
Advisor: Prof. Pabitra Mitra

Exploring whether GANs can be used in a semi-supervised setting for recognition of human-object interactions in images, which is an important subset of the larger problem of action recognition. Currently focusing on class conditional GAN architectures with plans to extend the work to videos as well.

Indian Institute of Technology Kharagpur, India Autumn 2016
Supporting Throughput Fairness in IEEE 802.11ac Dynamic Bandwidth Channel Access: A Hybrid Approach
Advisor: Prof. Sandip Chakraborty

IEEE 802.11ac supports *Dynamic Bandwidth Channel Access (DBCA)*, where a wireless station selects channel bandwidth dynamically based on the availability of the secondary channels. But the widely-used contention based medium access mechanism provides an opportunistic access of secondary channels and affects the performance of DBCA. Consequently, unfairness in channel access is increased in DBCA, which further reduces average throughput of stations. In this work, we develop a hybrid adaptive resource reservation mechanism, *Hybrid Adaptive DBCA (HA-DBCA)*, for supporting fair channel access in DBCA. In HA-DBCA, a polling based online learning mechanism is designed to avoid starvation of primary channel users.

Indian Institute of Technology Kharagpur, India Spring 2016
Researcher Recommendation System
Advisor: Prof. Pawan Goyal and Prof. Animesh Mukherjee

Developed a search and recommendation engine for Scientific Research Community, as a part of Term Project for the completion of Information Retrieval Course. Used beautiful soup and selenium in python to parse MAS to generate the data set for the project (1 lakh authors and their publications). Used clustering techniques to cluster similar authors based on their co-author graph to recommend new co-authors to an author. Used LDA to model topics from the keyword database of an author and recommended top 100 authors based on their rank (gained a 25% increase in recall). Further developed a full-fledged Scientific Search Engine.

Indian Institute of Technology Kharagpur, India Autumn 2015
OCR++: A Robust Framework For Information Extraction from Scholarly Articles
Advisor: Prof. Pawan Goyal

An open-source framework designed for a variety of information extraction tasks from scholarly articles including metadata (title, author names, affiliation and e-mail), structure (section headings and body text, table and figure headings, URLs and footnotes) and bibliography (citation instances and references). Extensive evaluations were conducted on a test dataset to compare OCR++ and state-of-the-art systems which shows significant improvement in each of the retrieval tasks along with fast implementation speed-ups and batch processing functionality. Our work has been accepted for poster presentation at the *International Conference on Computational Linguistics (Coling) 2016*. The framework is accessible online at `http://www.cnergres.iitkgp.ac.in/OCR++/home/`

Indian Institute of Technology Kharagpur, India Autumn 2015
TinyC Compiler
Advisor: Prof. Partha Pratim Das

Designed and implemented a compiler for a C-like language (a subset of C language), as a part of Term Project for the completion of Compilers Course.

Other Projects

Image Deblurring using Convolutional Neural Networks, Machine Learning Term Project Autumn 2016

Implemented a deep convolutional neural network structure for image deconvolution. A series of convolution steps were used for approximating deconvolution. The system uses two modules corresponding to deconvolution and artifact removal.

Course Management System, Databases & Management Systems Term Project Spring 2016

Developed an end to end web application for students, teachers, faculty and parent role access. Used php, html5, css3, bootstrap and mysql to implement the application. Implemented features like mail, file transfer, chat forum, calendar, notifications and quizzes using mysql as database.

PlotEx, Open Soft (inter-hostel tech competition), IIT Kharagpur Spring 2016

Detecting graphs from scanned documents and producing the corresponding data tables for the graphs. Used OpenCV, open source libraries like tesseract to detect text from image and plotted data table from the information obtained. Was mainly involved in mentoring a team of sophomores for the event.

Software Component Cataloguing Software, Software Engineering Term Project Spring 2015

A fully functional system, implemented as a JAVA Applet and GUI realised in JAVA Swing. The project involved designing and developing a complete GUI Software which maintains a catalogue of various available Software Components, and showcases all the details and information about each component, to allow their potential code reuse. Provided full documentation of the software including UML diagrams.

Academic Honors and Awards

Gandhian Young Technological Innovation (GYTI) Award 2017
Awarded for our work on OCR++ by SRISTI (Society for Research and Initiatives for Sustainable Technologies and Institutions). These awards are given every year during the Festival of Innovation (FOIN) at Rashtrapati Bhawan (Office of the President of India) in the month of March.

IBM Day - System Demonstration Contest - Third Prize 2016
Awarded for our work on OCR++ by a panel of delegates from IBM India, from a pool of 20 submissions.

Large Scale Scene Understanding Challenge (LSUN) - Saliency Prediction Winner 2016
Our saliency model, DeepFix, won the 1st prize in LSUN which was organized by Princeton University (in conjunction with IEEE Conference CVPR 2016).
Team VAL - `http://lsun.cs.princeton.edu/2016/`

Best Term Project - Speech & Natural Language Processing 2015
Our work, OCR++, was felicitated as the best project from a pool of 30 projects by the course coordinator and Flipkart (an Indian e-commerce company). The award also included a grant of 1000$.

Indian Academy of Sciences - Summer Research Fellowship 2015
for funding a summer internship at Indian Institute of Science, Bangalore, India.
Awarded jointly by Indian Academy of Sciences, Indian National Science Academy, and
The National Academy of Sciences, India.

Kamalavati Syngal and Goralal Syngal Memorial Scholarship 2014
for academic excellence at IIT Kharagpur.

Jagadish Bose National Science Talent Search (JBNSTS) Scholar 2013
Awarded to 34 candidates in the state of West Bengal.

Kishore Vaigyanik Protsahan Yojana (KVPY) Scholarship 2013
by Dept. of Science and Technology, Govt. of India for exceptional aptitude in basic sciences.

Abhay Seva Sansthan Gold Medal 2013
Awarded for scoring 100% in Computer Science in ISC (12th grade) examination.

S.P.Sinha Scholarship 2011
Awarded full scholarship for 11th & 12th grade for outstanding performance in ICSE (10th grade) examination.

Technical Skills

Proficient: C, C++, Python, Java, Tensorflow, Caffe, Numpy
Familiar: Matlab, OpenCV, HTML, Javascript, Scikit-learn, PHP, MySQL

Relevant Coursework

Probability & Statistics	Matrix Algebra	Information Retrieval
Speech & Natural Language Processing	Algorithms I & II	Discrete Structures
Formal Languages & Automata Theory	Machine Learning	Image Processing
Performance Modeling of Computer Networks	Artificial Intelligence	Theory of Computation
Adv. Image Processing & Comp. Vision*	Deep Learning*	Principles of Programming Languages*

*Ongoing courses

Extra Curricular Activities

Student Academic Mentor under the Student Welfare Group (SWG) of IIT Kharagpur. 2015 - 2017
Mentoring a group of 5 freshmen to ease their transition into college life.

Member of the OpenSoft (inter-hostel tech competition) team of 2016
Meghnad Saha Hall of Residence, IIT Kharagpur.

National Sports Organization (NSO) 2013 - 2015
Involved in Athletics as a part of NSO, IIT Kharagpur for two years.

Won Medals in 100m & 200m sprints, and long-jump during school period.