

# Kumar Ayush

4th year undergraduate  
Department of Computer Science and Engineering  
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## Education

<b>Indian Institute of Technology Kharagpur, West Bengal, India</b> B.Tech(Hons.) in Computer Science and Engineering CGPA: 9.46/10.0	2013 - 2017
<b>Rajendra Vidyalaya, Jamshedpur, India</b> Indian School Certificate (ISC) - 12th Grade Percentage score: 97.6%, <b>ranked 1st in school</b>	2013
<b>Rajendra Vidyalaya, Jamshedpur, India</b> Indian Certificate of Secondary Education (ICSE) - 10th Grade Percentage score: 96.57%	2011

## Interests

My broad area of interest is deep 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 review, paper link).

## Patents

Gaurush Hiranandani\*, Sai Varun Maram Reddy, **Kumar Ayush**, Chinnaobireddy Varsha and Siddhant Jain. **“Product Recommendations Based on Augmented Reality Viewpoints.”** *US62/415332*. (Filed in multiple countries)

Gaurush Hiranandani\*, **Kumar Ayush**, Chinnaobireddy Varsha and Sai Varun Maram Reddy. **“Augmented Viewpoint Driven Generation of Diversified Personalized Targeting Content.”** (Filed)

Gaurush Hiranandani\*, Chinnaobireddy Varsha, Sai Varun Maram Reddy, **Kumar Ayush** and Atanu R. Sinha. **“System and Method to Identify Augmented Visuals Influencing Consumer Purchase in Virtual-Commerce.”** (Filed)

\*Adobe's patent filing policy requires the name of a full time employee to be placed at the beginning (for contact purpose).

## Internships

<b>Big Data Experience Labs, Adobe Systems, Bangalore, India</b> <b>Augmented Reality for Enterprise</b> Guide: Gaurush Hiranandani	Summer 2016
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Worked on the development of an end-to-end system to create personalized catalogues to retarget users with recommendations embedded in the purchase viewpoint provided by augmented reality app usage. 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 approved for filing in the *US Patent Office* and other countries as well. Currently working on a research paper for submission in *ACM SIGGRAPH 2017*. The work also featured in Adobe's technology review of augmented reality/virtual reality at a press release. One of the patents was appreciated, by Adobe's Patent Review Committee, as an important innovation and has been filed not only in USA but also in India and other countries of Europe.

**Video Analytics Lab, Indian Institute of Science, Bangalore, India**

Summer 2015

**DeepFix: A Fully Convolutional Neural Network 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 various 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).

**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**

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**

2016 - Present

**Segmentation of blood vessels in fundus images using Generative Adversarial Networks (GANs)**

Advisor: Prof. Pabitra Mitra

Focusing on designing class conditional GAN architectures for biomedical image processing, specifically segmentation of blood vessels in fundus images. GANs have been used in the domain of natural images but its applicability in medical imaging domain is yet to be explored.

**Indian Institute of Technology Kharagpur, India**

Autumn 2016

**PCF-based model for Performance Enhancement of Double Channel 802.11n WLAN**

Advisor: Prof. Sandip Chakraborty

Proposed (and analyzed) a modification to the double channel 802.11n architecture by introducing PCF-based Contention-Free Periods between the DCF-based contention cycles to allow the central Access Point (AP) to relieve the starving node. Currently working towards a submission in *ACM SIGMETRICS 2017*.

**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

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**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 guiding and mentoring a team of 20 people 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

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**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**

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**Proficient:** C, C++, Python, Java, Tensorflow, Caffe, Numpy

**Familiar:** Matlab, OpenCV, HTML, Javascript, Scikit-learn, PHP, MySQL

**Relevant Coursework**

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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**

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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.