Kumar Ayush

Senior Member of Technical Staff
Adobe Systems India Pvt. Ltd.
Noida, Uttar Pradesh

kumar.ayush@iitkgp.ac.in
k.ayush147@gmail.com
https://kayush95.github.io
+91-8292878978

Education

Indian Institute of Technology Kharagpur, West Bengal, India 2013 - 2017
B.Tech(Hons.) in Computer Science and Engineering
CGPA: 9.49/10.0

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/deep learning and its applications in Computer Vision, Natural Language Processing and their intersection.

Papers

Kumar Ayush*, Abhishek Sinha*. **"Towards Mathematical Reasoning: A Multimodal Deep Learning Approach".** *25th IEEE International Conference on Image Processing (ICIP).* 2018. (Accepted, poster)

Kumar Ayush, Raja Karamakar, Varun Rawal, Pradyumna K. Bishoyi, Samiran Chattopadhya, Sandip Chakraborty. **"Supporting Throughput Fairness in IEEE 802.11ac Dynamic Bandwidth Channel Access: A Hybrid Approach".** *42nd IEEE Conference on Local Computer Networks (LCN).* 2017. (Accepted, regular paper, paper link)

Gaurush Hiranandani, **Kumar Ayush**, Atanu Sinha, Sai Varun Reddy Maram, Chinnaobireddy Varsha, Pranav Maneriker. **"Enhanced Personalized Targeting using Augmented Reality."** *16th IEEE International Symposium on Mixed and Augmented Reality (ISMAR).* 2017. (Accepted, poster, paper link)

Avisek Lahiri, **Kumar Ayush**, Prabir Kumar, Pabitra Mitra. **"Generative Adversarial Learning for Reducing Manual Annotation in Semantic Segmentation on Large Scale Microscopy Images: Automated Vessel Segmentation in Retinal Fundus Image as Test Case".** *Computer Vision for Microscopy Image Analysis (CVMI) Workshop - CVPR.* 2017. (Accepted, paper 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.* 2017. (Accepted, paper link).

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."** *26th International Conference on Computational Linguistics (Coling).* 2016. (Accepted, poster, paper link, framework link)

Patents

Kumar Ayush, Gaurush Hiranandani. **"Generating and Providing Augmented Reality Representations of Recommended Products Based on Style Compatibility in Relation to Real-World Surroundings."**. *US 15/972,815.* (Filed)

Kumar Ayush, Gaurush Hiranandani. **"Context Aware Recommendations Embedded in Augmented Viewpoint to Retarget Consumers in v-commerce."**. *US 16/004,787.* (Filed)

Kumar Ayush, Harsh Vardhan Chopra. **"Context Aware Background Scene and 3D Object Compatibility for Creation of Photorealistic 3D Images."**. (Approved by Adobe Patent Review Committee. To be filed.)

Kumar Ayush, Chinnaobireddy Varsha, Sai Varun Maram Reddy, Gaurush Hiranandani. **"Creating Targeted Content based on Detected Characteristics of an Augmented Reality Scene."** *US 15/454,750.* (Filed)

Sai Varun Maram Reddy, **Kumar Ayush**, Chinnaobireddy Varsha, Gaurush Hiranandani, Siddhant Jain. **"Prod-**

uct Recommendations Based on Augmented Reality Viewpoints." *US 62/415,332, DE 102017007998.6, AU 2017216603, GB 1714133.4, CN 201710780770.6.* (Filed)

Chinnaobireddy Varsha, Sai Varun Maram Reddy, **Kumar Ayush**, Gaurush Hiranandani, Atanu R. Sinha. **"Identifying Augmented Reality Visuals Influencing User Behavior in Virtual-Commerce Environments."** *US 15/433,834.* (Filed)

Patents Under Review

Kumar Ayush. **"Augmented Viewpoint Driven Bundle Recommendation in Virtual Commerce."**

Kumar Ayush. **"Odd one Out: Compatibility Energy driven Identification of Odd Products in Augmented Viewpoint."**

Work Experience

Adobe Systems, Noida, India Sep 2018 - Present
Senior Member of Technical Staff (Media and Data Science Research)

- Working on Singular Learning Theory and its applications in Neural Network Model Selection.
- Working on multiple product focused research ideas towards creation of Intellectual Property for Adobe.

Adobe Systems, Noida, India Jan 2018 - Aug 2018
Senior Member of Technical Staff (Photoshop Elements and Adobe Stock)

- Developed a Neural Network based technology for Modelling the Sellability of Adobe Stock Images.
- Worked on Creative Cloud Bot for Slack and Microsoft Teams.
- Working on multiple product focused research ideas towards creation of Intellectual Property for Adobe.
- Worked on a VQA model for solving mathematical equations (single variable and double variable) from images.

Adobe Systems, Noida, India Jun 2017 - Dec 2017
Member of Technical Staff (Photoshop Elements and Adobe Stock)

- Created a service using a Deep Learning Based Object Detection Method to provide Object Proposals for automatic mask selection in Nimbus (Adobe's cloud-based Lightroom-style photo editor).
- Primary developer for Adobe Stock Add-on for Wordpress. Worked on Creative Cloud Bot for Slack.
- Created an Intelligent Stock Plugin for Content Authoring Systems as part of the Adobe Stock Hackathon in November 2017. The work focuses on automatically constructing queries from an authors content to be used to retrieve relevant content/assets from Adobe Stock. Google Slides was used as the Content Authoring System for realization of the idea.
- Worked on multiple product focused research ideas towards creation of Intellectual Property for Adobe.
- Winner of Web Technologies Technical Bootcamp amongst new college graduates joining Adobe.

Internship Experience

Big Data Experience Lab, Adobe Research, Bangalore, India Summer 2016
Augmented Reality for Marketing
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 in Germany, Australia, UK and China as well. This work has also been accepted as a poster publication in *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. 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*. This work has also been accepted for publication in *IEEE Transactions on Image Processing* journal.

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 Spring 2017
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. This work has been accepted in *CVMI Workshop - CVPR 2017*.

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. This work has been accepted for publication in *IEEE Conference on Local Computer Networks (LCN) 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 as a poster publication in *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 a web based application for online course design, course calendar publishing, students registrations for self-paced learning, content administration, assignments, and assessments. Implemented using PHP, HTML5, CSS3, Bootstrap and MySQL. Features like mail, file transfer, chat forum, calendar, notifications and quizzes have also been implemented 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

Best Mini Project - Web Technologies Technical Bootcamp at Adobe 2017
Received the Best Project Award amongst the new college graduates joining Adobe. The mini project was an Online Examination System made using AngularJS 1.x, HTML and CSS. Evaluation was based on a number of parameters like best practices, coding standards, code modularity, implementation of MVC architecture, etc.

Best Bachelor's Thesis Award 2017
Received the Best Undergraduate Thesis Award in the graduating batch of the Department of Computer Science & Engineering.

Gandhian Young Technological Innovation (GYTI) Award 2017
Awarded for our work, 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, 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, Tensorflow, Numpy
Familiar: Matlab, Java, OpenCV, HTML, Javascript, Scikit-learn, Caffe, 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

Extra Curricular Activities

Reviewer for Robotics and Autonomous Systems - Journal - Elsevier 2018

Reviewer for Computer Vision and Image Understanding - Journal - Elsevier 2018

Teaching Assistant for Machine Learning course for employees at Adobe Systems. 2017 - Present

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.