Kumar Ayush

Incoming MS CS Student
Stanford University

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Education

Indian Institute of Technology, Kharagpur, India 2013 - 2017
Bachelor of Technology (Hons.) in Computer Science and Engineering
CGPA: 9.49/10.0
Thesis Advisor: Prof. Pabitra Mitra

Rajendra Vidyalaya, Jamshedpur, India 2013
Indian School Certificate (ISC) - 12th Grade - English, Science, Maths, and Comp. Sc.
Percentage score: 97.6%, **ranked 1st in school**

Publications

Kumar Ayush*, Anirudh Singhal*, Utkarsh Patel*, Balaji K. "Towards a Unified Framework for Fashion Compatibility and Outfit Recommendation". *Thirty-Fourth AAAI Conference on Artificial Intelligence.* 2020. (To be submitted) (*equal contrib.)

Kumar Ayush*, Surgan Jandial*, Ayush Chopra*, Mayur Hemani, Abhijeet Halwai, Balaji K. "SieveNet: A Unified Framework for Robust Image-Based Virtual Try-On". *IEEE Winter Conference on Applications of Computer Vision (WACV).* 2020. (pdf, Under review) (*equal contrib.)

Kumar Ayush*, Surgan Jandial*, Ayush Chopra*, Balaji K. "Powering Virtual Try-On via Auxiliary Human Segmentation Learning". *Second Workshop on Computer Vision for Fashion, Art and Design - IEEE International Conference on Computer Vision (ICCV).* 2019. (Workshop, pdf, To appear) (*equal contrib.)

Kumar Tanmay*, **Kumar Ayush***. "Augmented Reality Based Recommendations based on Perceptual Shape Style Compatibility with Objects in the Viewpoint and Color Compatibility with the Background". *Advances in Image Manipulation Workshop (AIM) - IEEE International Conference on Computer Vision (ICCV).* 2019. (Workshop, pdf, To appear) (*equal contrib.)

Kumar Ayush*, Surgan Jandial*, Ayush Chopra*, Mayur Hemani, Balaji K. "Robust Cloth Warping via Multi-Scale Patch Adversarial Loss for Virtual Try-On Framework". *10th International Workshop on Human Behaviour Understanding (HBU) - IEEE International Conference on Computer Vision (ICCV).* 2019. (Workshop, pdf, To appear) (*equal contrib.)

Kumar Ayush. "Context Aware Recommendations Embedded in Augmented Viewpoint to Retarget Consumers in v-commerce". *Third Workshop on Computer Vision for AR/VR - IEEE Conference on Computer Vision and Pattern Recognition (CVPR).* 2019. (Workshop, pdf)

Kumar Ayush*, Abhishek Sinha*. "Improving Classification Performance of Support Vector Machines via Guided Custom Kernel Search". *The Genetic and Evolutionary Computation Conference (ACM GECCO).* 2019. (Poster, pdf,) (*equal contrib.)

Ayush Chopra, Abhishek Sinha, Hiresh Gupta, Mausoon Sarkar, **Kumar Ayush**, Balaji K. "Powering Robust Fashion Retrieval with Information Rich Feature Embeddings". *Understanding Subjective Attributes of Data: Focus on Fashion and Subjective Search Workshop - IEEE Conference on Computer Vision and Pattern Recognition (CVPR).* 2019. (Workshop, Best Paper, pdf)

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

Kumar Ayush, Raja Karamakar, Varun Rawal, Pradyumna K. Bishoyi, Samiran Chattopadhyay, 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. (Oral, pdf, slides)

Gaurush Hiranandani, **Kumar Ayush**, Atanu R 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. (Poster, pdf)

Avisek Lahiri, **Kumar Ayush**, Prabir Kumar Biswas, 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 - IEEE Conference on Computer Vision and Pattern Recognition (CVPR).* 2017. (Workshop, pdf, slides,).

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. (Journal, pdf, slides).

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. (Poster, pdf, framework)

Patents

Kumar Ayush, Atishay Jain, Harnish Lakhani. "Robust Video Retrieval Using Temporal Video Content". (In filing process)

Kumar Ayush, Atishay Jain, Harnish Lakhani. "Augmented Viewpoint Driven Bundle Recommendation in Virtual Commerce". (In filing process)

Kumar Ayush*, Surgan Jandial*, Ayush Chopra*, Mayur Hemani, Balaji K. "System and Method for Robust Image-Based Virtual Try-On". (In filing process)   (*equal contrib.)

Kumar Ayush*, Surgan Jandial*, Ayush Chopra*, Mayur Hemani, Balaji K. "Robust Cloth Warping via Multi-Scale Patch Adversarial Loss for Virtual Try-On Framework". (In filing process)   (*equal contrib.)

Kumar Ayush, Atishay Jain. "Center-Biased Machine Learning Techniques to Determine Saliency in Digital Images". *US 16/507,300.* (Filed)

Kumar Ayush, Abhishek Sinha, Ayush Chopra, Hiresh Gupta, Mausoom Sarkar, Balaji K. "Improving Performance of Neural Networks Using Leaned Specialized Tranformation Functions". *US 16/534,856.* (Filed)

Kumar Ayush. "Compatibility Based Identification of Incompatible Products in Digital Representations of Real-World Environments". *US 16/281, 806.* (Filed)

Kumar Ayush, Harsh Vardhan Chopra. "Automatic Generation of Context-Aware Composite Images". *US 16/275,261.* (Filed)

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. "Generating and Providing Augmented Reality Representations of Recommended Products Based on Style Similarity in Relation to Real-World Surroundings". *US 16/004,787.* (Filed)

Gaurush Hiranandani, **Kumar Ayush**, Sai Varun Maram Reddy, Chinnaobireddy Varsha, Siddhant Jain. "Creating Personalized Catalogues with Recommendations Embedded in Augmented Viewpoint to Retarget Consumers". *US 62/415,332.* (Filed)

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

Gaurush Hiranandani, Sai Varun Maram Reddy, **Kumar Ayush**, Chinnaobireddy Varsha, Siddhant Jain. "Product Recommendations Based on Augmented Reality Viewpoints". *US 15/492,971, DE 102017007998.6, AU 2017216603, GB 1714133.4, CN 201710780770.6.* (Published)

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

Work Experience

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

- Mentored two internship projects - (a) Image-based virtual try-on for fashion garments (two accepted papers in ICCV Workshops, one paper under review in WACV 2020), (b) Fashion Compatibility and Outfit Recommendation using Graph Neural Networks (submitting to AAAI 2020). Achieved state-of-the-art performance on both projects.
- Augmenting real-world training datasets with realistic renderings and segmentation masks of virtual scenes for Adobe Deep Product Search (for furniture domain). Used Unreal Engine for the same.
- Worked on enhancing digital experience in AR-based retail apps. (Two workshop papers in CVPR and ICCV. Two patents in filing process).

Senior Member of Technical Staff (Photoshop Elements and Adobe Stock)   Jan 2018 - Aug 2018
- Developed a Neural Network based technology for Modeling the Sellability of Adobe Stock Images.
- Worked on Creative Cloud Bots for Slack and Microsoft Teams.
- Implemented a VQA model for solving mathematical equations from images. *Published in IEEE ICIP 2018.*
- Proposed and worked on improving product recommendations in AR-based retail apps using state-of-the-art computer vision and machine learning techniques. *Filed 3 international patents.*
- Proposed and developed a method for background scene recommendation for 3D objects in Adobe Dimension CC using scene compatibility, theme compatibility, and automated image matching. *A patent is filed.*

Member of Technical Staff (Photoshop Elements and Adobe Stock)   Jun 2017 - Dec 2017
- 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 Google Slides as part of the Adobe Stock Hackathon. Used NLP techniques to automatically construct queries from an author's content to be used for retrieving relevant assets from Adobe Stock.

Internship Experience

Big Data Experience Lab, Adobe Research, Bangalore, India
Enhanced Digital Marketing using Augmented Reality   Summer 2016
Advisors: Gaurush Hiranandani and Dr. Atanu R Sinha

> Analyzed consumer interactions on AR-based retail apps to identify the preferred purchase viewpoint. Created personalized catalogues with recommendations, based on style similarity and theme compatibility, embedded in the viewpoint visual. Devised a graph-based approach for automatic generation of personalized email content for the catalogue. *Three international patents published. Work published in IEEE ISMAR 2017.*

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

> Implemented a neural network for saliency prediction. Utilized the potential of inception modules, filters with holes, and location-biased convolutional filters. *Work published in IEEE Transactions on Image Processing. Winner of Saliency Prediction task at LSUN 2016, organized by Princeton University.*

Research Projects

Adobe India - Indian Institute of Technology, Kharagpur, India
Neural Network Model Selection using Singular Learning Theory ⍾   *Ongoing*
Advisor: Prof. Pabitra Mitra

> Investigating Watanabe-Akaike Information Criterion (WAIC) as a candidate for evaluating Bayesian Neural Networks. Implemented and inferred Bayesian Neural Networks for MNIST in PyMC3 and tensorflow-probability through techniques sourced from both Markov Chain Monte Carlo and Variational Inference.

Improving Classification Performance of SVMs via Guided Custom Kernel Search ⍾   *Ongoing*
Advisor: Prof. Pabitra Mitra

> Improving SVM classification via automatic task-specific custom kernel function search using reinforcement learning and genetic algorithms. Verifying the effectiveness of the searches by conducting an empirical evaluation with the best discovered kernel function on MNIST, FashionMNIST and selected UCI datasets.

Bachelor's Thesis, Indian Institute of Technology, Kharagpur, India
Generative Adversarial Learning for Reducing Manual Annotation in Semantic Segmentation on Large Scale Microscopy Images ⍾   Spring 2017
Advisor: Prof. Pabitra Mitra

> Leveraged GAN for semi-supervised learning on large scale fundus imaging modality for automated blood vessel segmentation. Achieved comparable performance (sometimes even better) with recent CNN based segmentation techniques while using upto 9X less training data. *Work published in Computer Vision for Microscopy Image Analysis (CVMI) Workshop - CVPR 2017.*

Video Retrieval using Natural Language Query   Spring 2017
Advisor: Prof. Pabitra Mitra

Implemented an encoder-decoder model using LSTM to encode the frames of a video and generate a description. Embedded the descriptions and the input query using a pre-trained skipthoughts model to facilitate query-based search. Used Microsoft Video Description Corpus dataset for training and testing.

Indian Institute of Technology, Kharagpur, India

Supporting Throughput Fairness in IEEE 802.11ac Dynamic Bandwidth Channel Access: A Hybrid Approach Autumn 2016
Advisor: Prof. Sandip Chakraborty

Performed a literary survey pertaining to unfairness in IEEE 802.11ac Dynamic Bandwidth Channel Access and proposed a hybrid adaptive resource reservation mechanism for supporting fair channel access in DBCA. A polling based online learning mechanism is designed to avoid starvation of primary channel users. Achieved significantly better performance compared to DBCA. *Work published in IEEE LCN 2017 (Oral Paper).*

Branched Convolutional Neural Network for Salient Object Segmentation and Automatic Custom Shaped Mask Placement in an Image Spring 2016
Advisor: Prof. Pabitra Mitra

Implemented a branched CNN architecture using inception modules to extract features from intermediate layers. Passed the concatenated output from inception modules to a segmentation block. Used fully connected Conditional Random Field to obtain the final segmentation mask. Achieved comparable performance on MSRA-1K and CSSD datasets with state-of-the-art models. Implemented a method to automatically find custom non-rectangular regions of interest (ROIs) in a user supplied image using Particle Swarm Optimization.

Search and Recommendation System for Scientific Research Community Spring 2016
Advisors: Prof. Pawan Goyal and Prof. Animesh Mukherjee

Parsed Microsoft Academic Scholar to generate the dataset. Used clustering techniques to cluster similar authors based on their co-author graph. 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). Developed a full-fledged Scientific Search Engine.

OCR++: A Robust Framework For Information Extraction from Scholarly Articles Autumn 2015
Advisor: Prof. Pawan Goyal and Prof. Animesh Mukherjee [Project]

Worked with a team on the development of a framework designed for a variety of information extraction tasks from scholarly articles using CRF models and generic patterns. Conducted extensive evaluations to compare OCR++ and state-of-the-art systems, showing significant improvement in each of the retrieval tasks along with fast implementation speed-ups and batch processing functionality. *Work published in Coling 2016.*

Other Key Projects

EthPhoto, OpenSoft (inter-hostel tech competition), IIT Kharagpur Spring 2017

Co-led the hostel team, developing a decentralized location & tag based photo-sharing app using Ethereum blockchain technology and IPFS storage. *Received Third Prize.*

Course Management System, Database Management Systems Term Project ⌂ Spring 2016

Created a web-based application aimed at self-paced learning featuring online course design, text and video based course content, course calendar publishing, automated tests, chat forums and e-mail communcation.

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

Developed an application for detecting graphs from scanned documents and producing the corresponding data tables.

TinyC Compiler, Compilers Term Project ⌂ Autumn 2015

Designed and implemented a compiler for a C-like language (a subset of C language) using flex, yacc, and gnu assembler.

Software Component Cataloguing Software, Software Engineering Term Project Spring 2015

A fully functional system, implemented as a JAVA Applet and GUI realized in JAVA Swing, which maintains a catalogue of various available Software Components to allow their potential code reuse.

Awards and Achievements

Best Paper - FFSS-USAD @ CVPR 2019 2019
Our work on fashion retrieval received best paper award at IEEE CVPR Workshop FFSS-USAD.

Early Promotion - Adobe 2018
Promoted to Senior Member of Technical Staff within 6 months of joining Adobe (Usual promotion
period: 1-1.5 years). Only one amongst all fresh graduate hires.

Best Project - Web Technologies Technical Bootcamp - Adobe 2017
Awarded amongst fresh graduate hires for an Online Examination System made using AngularJS.
Adjudged on parameters like best practices, coding standards, code modularity, MVC architecture, etc.

Best Bachelor's Thesis Award - IIT Kharagpur 2017
Awarded in a batch of 105 students in the Dept. of Computer Science & Engg., IIT Kharagpur.

OpenSoft Inter-hostel Tech Competition (Captain) - Third Prize - IIT Kharagpur 2017
Co-led the hostel team, developing a decentralized photo-sharing application (EthPhoto) using Ethereum
blockchain technology and IPFS storage.

Gandhian Young Technological Innovation (GYTI) Award 2017
Awarded for OCR++ by SRISTI at Rashtrapati Bhawan (Office of the President of India).

IBM Day @ IIT Kharagpur - System Demonstration Contest - Third Prize 2016
Awarded for OCR++ by IBM Research India from a pool of 20 submissions.

Saliency Prediction Winner - Large Scale Scene Understanding Challenge (LSUN) 2016
Our saliency model, DeepFix, won the 1st prize in LSUN, organized by Princeton University in
conjunction with CVPR 2016.

Honda Young Engineer & Scientist's (Y-E-S) Fellowship Finalist 2016
Amongst 20 finalists from all over India.

Best Term Project - Speech & Natural Language Processing Course 2015
Awarded for OCR++ from a pool of 30 projects by the course instructor and Flipkart
(an Indian e-commerce company). The award also included a grant of 1000$.

Indian Academy of Sciences - Summer Research Fellowship 2015
Awarded for research internship at Indian Institute of Science, Bangalore.

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

Jagadish Bose National Science Talent Search (JBNSTS) Scholarship 2013
Awarded to 34 candidates from around 1000 applicants in the state of West Bengal for exceptional aptitude
in basic sciences and research.

Kishore Vaigyanik Protsahan Yojana (KVPY) Scholarship 2013
Awarded to 1056 students from around 100,000 applicants by Dept. of Science and Technology, Govt. of
India for exceptional aptitude in basic sciences.

All-India-Rank 805 - IIT JEE (Joint Entrance Examination) - Advanced 2013
Secured an All-India-Rank of 805 in JEE Advanced 2013 amongst 150,000 candidates.

All-India-Rank 779 - IIT JEE (Joint Entrance Examination) - Mains 2013
Secured an All-India-Rank of 779 in JEE Mains 2013 amongst 20,00,000 candidates.

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

S. P. Sinha Scholarship 2011
Awarded full scholarship for 11th & 12th grade due to outstanding performance (96.57%) in ICSE
(10th grade) board examination.

Talks

Context Aware Personalized Product Recommendations in Virtual Commerce [Slides - 1, 2]   Feb 2018
Adobe Inc., Noida, India

Saliency Prediction and its applications in Vision and Design   August 2019
Adobe Inc., Noida, India

Technical Skills

Languages: Python, C++, Javascript
Libraries: Tensorflow, PyTorch, NumPy, OpenCV, scikit-learn
Others: Unity3D, Unreal Engine, LaTeX

Extra Curricular Activities and Professional Service

Internship Mentor at Adobe (2019): Mentored 4 undergraduate interns on two projects based on virtual try-on and outfit compatibility.

Technovation Mentor for Youth Coding Initiative (2018): Mentored 5 high-school girls to build a business plan and mobile app to address a community problem.

Reviewer (2019) for Robotics and Autonomous Systems (Journal - Elsevier), and Computer Vision and Image Understanding (Journal - Elsevier).

Volunteer Teacher at eVidyaloka (2018): Teaching Maths and Science to underprivileged children in remote areas of Jharkhand via Skype.

Teaching Assistant (2018) for the Machine Learning course for employees at Adobe Inc., Noida.

Student Academic Mentor, Student Welfare Group, IIT Kharagpur (2015 - 2017): Looked after the orientation and guidance of 5 new students and undertook the initiative to motivate them for performing academically as well as in extra-curricular activities.

Captain (2017) of the OpenSoft (inter-hostel tech competition) team of Meghnad Saha Hall of Residence, IIT Kharagpur.

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