

Ayush Kumar

<https://github.com/ayushGHub>

+1-631-636-6779

✉ ayush_kumar@meei.harvard.edu

📄 <https://scholar.harvard.edu/ayushkumar>

Research Interest

I do Human-Centered Artificial Intelligence. I combine ideas from **Visual Analytics**, **Vision Science**, **Computer Vision**, and **Machine Learning** to unveil and exploit hidden information for scientific discovery and technological advancement in vision science.

Education

2015 – 2020 **Ph.D.**, *Department of Computer Science, Stony Brook University, New York, USA* .
Advisor: Prof. Klaus Mueller

2014 – 2020 **MS**, *Department of Computer Science, Stony Brook University, New York, USA*.
CGPA 3.82/4.0

2010 – 2014 **B.Tech**, *Department of Electronics and Communication, The LNM IIT, Jaipur, India*.
CGPA 7.5/10.0

Professional Experience

Oct 2020 - Present - **SERI, Harvard Medical School**, Eye and Head Movement detection of visually impaired people walking in an unrestricted environment..

Summer 2019 **AT&T Labs, NJ**, Designed Visual Analytic tool for CDR features analysis and network outage prediction.

Technologies used: Apache Spark (pySpark), D3.js, Python, Keras, Tensorflow

Sept 2017 - **Brookhaven National Laboratory, NY**, Designed 3-Dimensional visual analytic tool for multi-dimensional scientific data.

Aug 2018
Technologies used: Three.js, D3.js, C++, WebGL, GLSL

June 2016 - **Visualization Research Center, Univ. of Stuttgart, Germany**, Visualization driven grouping of Eye Movement Patterns.

Aug 2017
Technologies used: D3.js, R, Python

Feb 2014 - **Philips Research Lab, India**, Involved in designing an efficient algorithm to detect abnormal regions in colposcopy images.

May 2014
Technologies used: MATLAB, C++, OpenCV

Summer 2013 **Center for Biomedical Image Analysis (CBIA), Czech Republic**, Implemented an application allowing a user to easily browse, visualize and handle 2D and 3D time lapse sequences.

Technologies used: C++, OpenCV, wxWidgets

Awards And Recognitions

2018 ICTCCP Research Excellence Award

2018 "Honorable Mention" at Data Open-Code Edition (Datathon) organized by Citadel LLC

- 2016 & 2017 PhD Fellowship of SFB-TRR 161 (DFG) for a Project on Adaptive Self-Consistent Visualization
- 2015-2018 ICTCCP Scholarship for Ph.D.
- 2014 Graduate Scholarship Award during Master's.

Current Projects

- Jan 2018 - **RadVolViz: Data-driven Transfer Function based Volumetric Visualization.**
Present – Designed a multi-dimensional transfer function editor for the interactive visualization of multivariate volume data.
- Aug 2016 - **Visual Analytic Tools for Analysis of Eye Movement Data.**
Present – **EyeSAC:** Designed tool which synchronizes eye tracking data from multiple sources, cleans and annotates for further analysis.
– **EyeFIX:** Visualizes eye movement data to unveil both spatial as well as temporal behavior for better understanding.
– Visualized eye movement patterns for detecting outliers.
- 2019 - **Visual Attention & Event Detection using deep neural network in Eye Tracking.**
Present – Using neural networks to detect the events in eye movement data.
– Visual attention prediction using eye movement data.
- May 2017 - **Task Classification Model for Eye Tracked Visual Exploration.**
Present – Designed a visual analytic tool for grouping eye-tracked users using their eye movement patterns
– Classifying the task corresponding to respective eye movement patterns using deep neural network.
– Visualizing neural network features to find out strong relation between task and eye movement patterns.

Selected Publications

- JEMR 2018 **Visual Multi-Metric Grouping of Eye-Tracking Data.**
Authors : **Ayush Kumar**, Rodolf Netzel, Michael Burch, Daniel Weiskopf and Klaus Mueller.
Journal of Eye Movement Research, 10 (5), 11.
- ETRA 2020 **Challenges in Interpretability of Neural Networks for Eye Movement Data.**
Authors : **Ayush Kumar**, Prantik Howlader, Daniel Weiskopf, and Klaus Mueller.
ACM Proceedings of the 12th ACM Symposium on Eye Tracking Research & Applications(ETRA), Stuttgart.
- ETRA 2020 **Demo of the EyeSAC System for Visual Synchronization, Cleaning, and Annotation of Eye Movement Data.**
Authors : **Ayush Kumar**, Debesh Mohanty, ... Daniel Weiskopf, and Klaus Mueller.
ACM Proceedings of the 12th ACM Symposium on Eye Tracking Research & Applications(ETRA), Stuttgart. (Demo Track)
- Submitted, **RadVolViz: An Information Display-Inspired Transfer Function Editor for Multi-variate Volume Visualization.**
IEEE
TVCG'20 Authors : **Ayush Kumar**, Huolin Xin, Hanfei Yan, Xiaojing Huang, Wei Xu, and Klaus Mueller.
- ETRA 2019 **Task classification model for visual fixation, exploration, and search.**
Authors : **Ayush Kumar**, Anjul Tyagi, Michael Burch, Daniel Weiskopf, Klaus Mueller.
ACM Proceedings of the 11th ACM Symposium on Eye Tracking Research & Applications(ETRA), Denver.
- ETRA 2019 **Visually Comparing Eye Movements over Space and Time.**
Authors : **Ayush Kumar**, Michael Burch and Klaus Mueller.
ACM Proceedings of the 11th ACM Symposium on Eye Tracking Research & Applications(ETRA), Denver.

- ETRA 2019 **Clustered Eye Movement Similarity Matrices.**
Authors : **Ayush Kumar**, Neil Timmermans, Michael Burch and Klaus Mueller.
ACM Proceedings of the 4th Workshop on Eye Tracking and Visualization (held jointly with ETRA), Denver.
- VIS 2018 **Eye Tracking for Exploring Visual Communication Differences.**
Authors : **Ayush Kumar**, Michael Burch, ... and Klaus Mueller.
Workshop on Visualization for Communication (co-located with VIS), Berlin, Germany.
- ETRA 2018 **Visual Analysis of Eye Gazes to Assist Strategic Planning in Computer Games.**
Authors : **Ayush Kumar**, Michael Burch and Klaus Mueller.
ACM Proceedings of the 3rd Workshop on Eye Tracking and Visualization (held jointly with ETRA), Warsaw, Poland.

Professional Service

Organizing Committee

- 2021 ETRA (Associate Chair, Short Paper)
- 2019 ETRA (SV Chair), ETVIS (Media Chair)
- 2018 ETVIS (Media Chair)

Program Committees

- 2020 ETRA, EMDPA, PLEY
- 2019 ETRA, ETVIS, VINCI
- 2018 VISSOFT, ETVIS
- 2017 MSIP
- 2016 ETVIS

Journal/External Reviewer

- 2019 VIS, ETRA, JEMR
- 2018 ETRA, COGAIN
- 2017 JEMR

Public/Research Talks

- 06/2020 **TUTORIAL** at ETRA 2020, Stuttgart, Germany: Interpretable Machine Learning (Cancelled due to COVID 19)
- 06/2019 Task classification model for visual fixation, exploration, and search at ETRA, Denver, CO.
- 06/2019 Visually Comparing Eye Movements over Space and Time at ETRA, Denver, CO.
- 06/2019 Visualization and Visual Analytics : Eye Tracking Techniques and Application at IIT Patna, India.
- 10/2018 Eye Tracking for Exploring Visual Communication Differences at VisComm, Berlin, Germany.
- 10/2018 PetalVis - Floral Visualization for Communicating Set Operations at VisComm, Berlin, Germany.
- 06/2018 Visual Analysis of Eye Gazes to Assist Strategic Planning in Computer Games at ETRA, Warsaw, Poland.
- 10/2016 Multi-Similarity Matrices of Eye Movement Data at ETVIS, Baltimore, MD.
- 03/2016 Eye Tracking Visualization and Analytics at Thapar University, India.
- 03/2016 Eye Tracking Visualization and Analytics at DRDO, India.

Mentoring and Teaching Assistance

Mentoring **SBU**: Debesh Mohanty (MS), Chandrika Kapre (MS), Ashish Kumar (MS), Aakanksha Prasad (MS), Arnav Prasad (MS), Chumki Acharya (MS), Vanessa Singh (MS), Aveena Kottwani (MS), Keshav Rajupet Premkumar (MS), Siddhanth Parikh (MS), Monica Kanasani (MS), Melita Saldanha (MS), Neha Shetty (MS), Shreya Singh (MS)

Spr 2019 &20 **Stony Brook University**, Teaching Assistant

Assisted Prof. Klaus Mueller in teaching CSE 564 Visualization (~ 145 graduate students). Handled all course logistics including lab supervision, D3.js tutorial, final project advising.

Fall 2018 **Stony Brook University**, Teaching Assistant

Assisted Prof. Klaus Mueller in teaching CSE 593 Visualization (10 Ph.D. + ~ 50 UG students). Handled all course logistics including lab supervision, D3.js tutorial, final project advising and grading.

Fall 2014 **Stony Brook University/ SUNY Korea**, Teaching Assistant

Assisted Prof. Ilchul Yoon in teaching CSE 215 Introduction to Computer Science (UG students). Handled course logistics including weekly recitation, and grading.