Kumar **Ashutosh**

SENIOR UNDERGRADUATE

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Sum**mary**

Currently Senior Undergraduate at Indian Institute of Technology Bombay, India. Interested in Research and Development for feasible solutions to exciting real-life challenges. Explored research in Augmented Reality, Computer Vision, Machine Learning, Cognitive Engineering and Computer Graphics. An active contributor to Open Sourced Softwares. Interested in exploring the broad dimensions of Science and Technology.

Edu**cation**

Indian Institute of Technology Bombay   *Mumbai, India*
DUAL DEGREE (B.TECH AND M.TECH) IN ELECTRICAL ENGINEERING (MAJOR) AND COMPUTER SCIENCE (MINOR)   *Jul. 2016 - Exp. Jun. 2021*
- Current Cumulative Performance Index (CPI) of **8.76** on a scale of 10.

Kendriya Vidyalaya NERIST   *Arunachal Pradesh, India*
INTERMEDIATE (CLASS 12TH), CENTRAL BOARD OF SECONDARY EDUCATION   *Apr. 2015 - Mar. 2016*
- Secured 488/500 marks (**97.6%**) with 100/100 marks in Computer Science and Chemistry.

Kendriya Vidyalaya NERIST   *Arunachal Pradesh, India*
MATRICULATION (CLASS 10TH), CENTRAL BOARD OF SECONDARY EDUCATION   *Apr. 2013 - Mar. 2014*
- Secured Cumulative Grade Point Average (CGPA) of **10/10**.

Pub**lication**

- R. Bose*, **K. Ashutosh***, A. Bezerianos, N. Thakor, J. Li and A. Dragomir
  A Multilayer Network Approach for Studying Creative Ideation Markers from EEG, *11th International Conference on Brain Informatics, 7-9th December 2018, Arlington, Texas, USA*   [Link]   *equal contribution

Wor**k Experience**

Prototyping and Signal Processing for around Ear EEG system†   *Sony Corporation, Atsugi City, Japan*
RYO SASAKI, YOTA KOMORIYA   *May 2019 - Jul. 2019*
Designed novel **around ear** EEG device prototype from scratch. Developed Software for experiment stimulus and result analysis. Also, carried out **experiments** on a set of participants followed by **result analysis** as per the designated literature.   † Non-Disclosure Agreement signed

Multi-layered Analysis of Brain Networks   *National University of Singapore*
PROF. ANASTASIOS BEZERIANOS, PROF. NITISH THAKOR   *May 2018 - Jul. 2018*
Investigated novel approach of **Multi-Layered Analysis** in Brain Connectivity Patterns during Creative Ideation using EEG connectivity strengths. Obtained statistical significant differences between **Convergent Thinking** and **Divergent Thinking** at both nodal as well as global level on various graph metrics including **Degree Sum**, **PageRank Centrality** and **Betweenness Centrality**. Also obtained statistical significance on Multilayered **Supra-Adjacency Matrix**.

Extended Visualization: Focus in GLSL   *Python Software Foundation*
GOOGLE SUMMER OF CODE UNDER PROF. ELEFTHERIOS GARYFALLIDIS   *Apr. 2018 - Present*
Employed **GLSL Shaders** to build stunning visualizations of brain images and other datasets. Studied the various uses of **Fragment**, **Vertex** and **Geometry Shaders** and extended the current viz module to support Shaders that would result in a better visualization. Developed vtk.SetGeometryShaderCode examples which would be helpful to both dipy and vtk libraries.

Key **Projects**

Capture The Flag - An Augmented Reality Based Tabletop Game   *IIT Bombay*
R&D PROJECT UNDER PROF. PARAG CHAUDHURI, COMPUTER SCIENCE ENGINEERING   *Jan. 2019 - Apr. 2019*
Developed an Augmented Reality based tabletop game in **Unity Editor** (with **Vuforia AR-SDK**) having new and exciting game elements. The game is Map-based which can be dynamically designed by one player and then played by the other. The game elements adjusts with **height differences** due to objects on the board area. Also takes into account real life objects in the scene thus being **immersive**. This game provides a new dimension to existing XR games.

RISC Processor Design

Course Project under Prof. Virendra Singh, Electrical Engineering

IIT Bombay

Jul. 2018 - Nov. 2018

Designed a **16 bit Multi-Cycled** Reduced Instruction Set Computer (RISC) microprocessor having **arithmetic operations**, **branch** and **jump instructions**. Also designed **Pipelined** version of the same Instruction Set Architecture (ISA). Simulated the design in VHDL and verified the working with Register Transfer Logic (RTL) followed by flashing the code on a **Field Programmable Gate Array (FPGA)**.

Discriminative Localization in Medical Images

R&D Project under Prof. Amit Sethi, Electrical Engineering

IIT Bombay

Jan. 2018 - Apr. 2018

Developed an algorithm to visualize the parts of image influencing a decision in a **CNN architecture**. Deployed the algorithm to **Breast Cancer Dataset** and obtained the activation regions in Benign, In-Situ, Normal and Invasive tissues and analyzed the various regions of interest. Generated Heatmaps of localization in tissues and investigated **hidden features** across four classes. Performed the localization task both on patches as well as on whole tissue images.

Virtual Keyboard using Hand Gestures

Self Project

April 2019

Designed a Virtual Keyboard using **Leap Motion Controller** in **Unity Editor**. Mapped the alphanumeric keys on fingers and used Leap Motion Controller to predict alphanumeric character based on the hand position. Tried with two different keyboard designs. Also implemented other important keys including Caps Lock, Backspace, Enter and Spacebar.

Augmented Reality Based Chess Game

Self Project (As a Mentor)

June 2019 - Present

Developing an Android **Augmented Reality based Chess Game** Application. Also mentoring a freshman as part of **Open Source** Initiative of Web n Coding Club, IIT Bombay. Designing the 3D models of Game Elements in **Blender** - a 3D modelling tool. Using **Vuforia AR-SDK** in **Unity Editor** for the gameplay to achieve the animation and gameplay.

GeoLocationAR - AR Based Location Assistant

Self Project (As a Mentor)

July 2019 - Present

Planning and developing an AR based **Location Assistant Application**. Location and orientation is tracked using **Global Positioning System** (GPS) and **Intertial sensors** (Gyroscope, Linear Accelerometer). Both **World Stabilized** and **Screen Stabilized** 3D objects are augmented for information about the location. Also mentoring a freshman as part of **Open Source** initiative of Web n Coding Club, IIT Bombay.

Course Projects

Designing Room Animations using OpenGL

Prof. Parag Chaudhuri, CS-475 Computer Graphics

IIT Bombay

Autumn 2018

Designed two characters and coded the complete **Rendering Pipeline** from Scratch in OpenGL and C++. Constructed a room and other room objects and added rendering and animation. Also handled **controllable lighting conditions** and character movement. Used various **Cubic Spline Interpolation technique** for smooth animations. Also added camera movement by taking care of the **view frustum** and **occlusion**.

Implementation of Depth from Shading and Depth from Stereo

Prof. Subhasis Chaudhuri, EE-702 Computer Vision

IIT Bombay

Spring 2019

Implemented both **Depth from Shading** and **Depth from Stereo** from scratch in MATLAB. Shape from Shading was done with both **Gnomonic Projection** and **Stereographic Projection**. The Algorithm was verified with matte images of real life objects. Shape from Stereo uses **template matching** technique with variable window size. Also the **Right-Left consistency check** was performed on the disparity map.

Discrete Analog to Digital Converter

Prof. Pramod Murali, EE-344 Electronic Design Lab

IIT Bombay

Spring 2019

Designed **Second Order Delta Sigma Modulator** to convert an **Analog Audio signal** to high resolution **discrete bit stream**. Transmitted the bit stream via **Tiva board** and demodulated the signal, followed by **Low-Pass filtering**, to obtain the digital version of the reconstructed signal. MATLAB was used to calculate the **design parameters** and Spice was used for **circuit simulation**. The circuit was designed in **Eagle** and printed on a **Printed Circuit Board** (PCB).

Projects prior to **May 2018** can be seen [here].

Awards and Recognitions

- Received *Rashtrapati Puraskar* (**President's Award**) in 2015 for excellence in interdisciplinary activities, including social service and interpersonal skills, by **The Hon'ble President of India**.
- Witnessed **Republic Day Parade - 2017** from the **PM Box** as a guest of **Hon'ble Prime Minister of India**, for academic excellence in High School.
- Qualified **Indian National Mathematics Olympiad (INMO)** and participated in International Mathematics Olympiad Training camp.

- Awarded **Dera Natung Scholarship - 2016** for securing top state rank in Intermediate AISSCEE class 12th examination.
- Received **Kishore Vaigyanik Protsahan Yojana Scholarship - 2016** award to pursue research in **basic sciences**.
- Recipient of **National Talent Search Scholarship - 2012** meant to identify and nurture talent in High School.

Technical Skills

- **Programming Languages:** Python, C++, C, VHDL, GLSL, SQL, HTML, CSS
- **Libraries:** Keras, Tensorflow, PyTorch, scikit-learn, numpy, scipy, vtk, OpenCV, Pandas, GNU Radio
- **Tools:** Git, MATLAB, Android Studio, Spice, AutoCAD, LaTeX, Illustrator, SolidWorks

Key Courses Undertaken

Electrical Engineering	Signals and Systems, Microprocessors, Analog and Digital Systems, Communication Systems, Digital Circuits and their lab courses.
Mathematics and Statistics	Linear Algebra, Data Analysis and Interpretation, Differential Equations, Complex Analysis, Probability and Random Processes
Computer Science	Computer Graphics, Computer Vision, Data Structures and Algorithms, Introduction to Machine Learning, , Automata Theory, Computer Networks

Responsibilities

Department Academic Mentor Program Coordinator

DEPARTMENT ACADEMIC MENTORSHIP PROGRAM, ELECTRICAL ENGINEERING   *Apr. 2018 - Present*

Leading a team of 24 Department Academic Mentors, assigned to guide academically under-performing students and help them with academics and non-academics need. Also coordinating with Faculty Members of the Electrical Engineering Department for organizing Research Expositions, among other events. Maintaining EE D-AMP Blog [link], which contains information about relevant courses.

Department Academic Mentor

DEPARTMENT ACADEMIC MENTORSHIP PROGRAM, ELECTRICAL ENGINEERING   *Apr. 2018 - Present*

Part of a 22 member team selected from the department students which guides academically under-performing students and help them with the academic as well as non-academic commitments. Assisting 12 Sophomores to tackle academic queries and issues they face during the semester, including the registration process, and motivate them to perform well academically.

Convener

WEB AND CODING CLUB, IIT BOMBAY   *Apr. 2017 - Mar. 2018*

Organized and hosted events pertaining to Coding and Web Development and demonstrated various programming essentials, including Git, GitHub and Android Development. Also assisted them with issues they faced during this learning. Mentored students working on various hobby projects including Attendance App and SIFT App (Scale Invariant Feature Transform).

Extra Curricular Activities

- Secured 1st position in **Stratazenith**, a Game Theory Quiz conducted by IGTS during Techfest'17.
- Delivered invited talk in the **Two Day Workshop on Teaching Methodology of Mathematics** as an expert.
- Served as overall **School Captain**, Kendriya Vidyalaya NERIST, during the academic year 2015-16.
- **Aeromodelling**: Made a remote controlled plane guided by the Aeromodelling Club.
- Successfully completed a two-semester course in **Kho-Kho** conducted by National Sports Organization(NSO).
- Part of **Kho-Kho** camp to select players to represent IIT Bombay at *Spardha*'16, the sports fest of IIT BHU.
- Represented state in **Kho-Kho** at the **42nd KVS National Sports Meet 2012**, Chandigarh, India.

References

Prof. Parag Chaudhuri	**Prof. Eleftherios Garyfallidis**
Department of Computer Science and Engineering	School of Informatics, Computing, and Engineering
Indian Institute of Technology Bombay	Indiana University Bloomington
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Prof. Nitish Thakor	**Prof. Amit Sethi**
Director, SINAPSE	Department of Electrical Engineering
(Singapore Institute for Neurotechnology)	Indian Institute of Technology Bombay
National University of Singapore	Mumbai-400076, India
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