Sachin Goyal

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Senior Undergraduate - Department of Electrical Engineering
Indian Institute of Technology - Bombay

Education

- **Bachelors of Technology in Electrical Engineering (July'15 - Present)**
  *Indian Institute of Technology, Bombay, **CGPA: 9.05/10.00***

- **High School, Central Board of Secondary Education, Class 12th, 2015**
  *MDS Senior Secondary School, Udaipur, India, **Score: 93%***

Patent

- Pranav Sankhe, Saqib Azim, **Sachin Goyal**. "*Indoor positioning system for position estimation in an indoor environment.*" India Patent Application 201821047043, filed December 2018. Patent Pending.

Publications

- **Sachin Goyal**, Can Zhao, Amod Jog, Jerry L. Prince, Aaron Carass. "*Improving Self Super Resolution in Magnetic Resonance Images*" SPIE Conference on Medical Imaging and Biomedical Applications 2018, Houston, Texas

Relevant Projects and Internships

Super Resolution of MRI Images   **Johns Hopkins University, USA**
Prof. Jerry Prince | Image Processing and Analysis Lab   *May '17 - Dec '17*
- Worked on self super resolution of MRI images (unsupervised learning) using **Fourier Accumulation** in 3D
- Implemented **Anchored Neighbourhood Regression** (ANR) to learn dictionary using rotated samples of input
- Used pixel reordering and swapping to remove image degradation from interpolation during rotation of images
- Achieved **.3dB** higher peak signal to noise ratio (**PSNR value**) over rest **state of the art** methods

Indoor Positioning System using WiFi   **Systems & Controls, IIT Bombay**
QuarterFinalist(Top 500/15k) - India Innovation Challenge, IIM Bangalore   *Jan '17 - Jan '18*
- Designed and developed a system to locate an object in indoor environment using WiFi network of **ESP8266**
- Used **LSTM** based RNN architecture to predict distance of object from router using features like RSSI & TDoA
- Trained network with database created using bot & achieved **state of the art 3.71cm** accuracy on scale of **2.16m**

Semi Supervised Active Learning   **IIT Bombay**
Prof. Amit Sethi | Research and Dev Project   *Jan '19 - Current*
- Aim to develop learning strategies to achieve good segmentation accuracy with **minimal labelled data** like in **histopathology**. Implementing **Active learning** to choose few samples that will result in effective classification.
- Working on a **adversarial distance** combined with **core set** strategy to find best unlabelled examples for labelling in next round of active learning.

Zero Shot Learning   **IIT Bombay**
Prof. Preeti Jyothi | Introduction to Machine Learning   *Jan '18 - April '18*
- Implemented a semi supervised **VGG** based model to predict labels of classes(animal images) unseen during training
- Used a **SVM** motivated **hinge loss** function to maximize the dot product between embedding space (**Word2vec**) and the feature vector (GoogleNet features) space
- Improved accuracy from **58.7**% to **65.3**% on unseen classes using **deep visual-semantic** embedding model

Beyond Planar Symmetry Detection   **IIT Bombay**
Prof. Subhasis Chaudhuri | B.Tech Project   *Jan '19 - Current*
- Developed an algorithm based on **radon transforms** to find 2D reflection **symmetry axis** in images. Convolved sinograms of patches around SIFT feature points with 1D sobel filters to detect symmetry.
- Currently exploring use of **U-Net** to successfully label human perceived **beyond planar symmetry axis**

The Music Box Short Film   **Video Link**
Prof. Parag Choudhuri | Computer Graphics   *Jul '18 - Dec '18*
- Created an animated film with a music box and two humanoids using **hierarchical modelling in OpenGL**
- Wrote **GLSL shaders** to implement **Gouraud shading** for humanoids and apply **textures** to room

Augmented Reality Game — IIT Bombay
Advanced Computer Graphics — *Jan '18 - April '18*
- Created **3D Labyrinth game** projected on and controllable through identifiable glyphs
- Wrote physics module using Bullet Physics library to detect collisions and implement gravity and an **AR module** using **ARToolkit** to calibrate camera and get relative position of identified glyphs
- Implemented a rendering module in **OpenGL** to display the game at the location of glyph

MirrorLink for Car Infotainment System — Qualcomm, Hyderabad
Multimedia Development Team — *May '18 - July '18*
- Developed framework for voice transmission from car dashboard microphone to mobile using **RTP** and **pyaudio**
- Enhanced the car's command engine to extract commands from voice & processed it for necessary android actions
- Received a **Pre Placement Offer** for exceptional performance during the tenure

Scholastic Achievements

- Pursuing a Minor in **Computer Science and Engineering**
- Awarded **AP grade** (given to **2/120**) for exceptional performance in Introduction to Chemical Eng '16
- Among Top 300 in Chemistry (**INChO**) and Astronomy(**INAO**) Olympiads conducted by **HBCSE** '15
- Qualified **NTSE** (**AIR 6**/450k+ aspirants); Conferred with **KVPY** Schp (**AIR 90**/150k+) by Govt of India '14
- Awarded with prestigious **Maharana of Mewar Fateh Singh** award for best student in the city in high school
- Bagged an **All India Rank 2** out of 50k participants in National Science Olympiad (NSO) '12
- Awarded certificate of merit by CBSE for outstanding performance in class 10th

Other Projects

Digitally Programmable Analog Computer
Electronic Design Lab — *Jan '18 - April '18*
- Developed **proof-of-concept** hybrid computer simulating **hardware-in-loop** systems, solves differential equations
- Implemented an on board power management circuitry to make it a stand alone device
- Integrated dense layout of 110 programmable switches & passive blocks along with an onboard MSP microcontroller inspired by FPGA architecture. Achieved fast and accurate results compared to digital simulations

Augmented Reality(AR) with Glyphs — Project Link
Prof. Arjun Jain | Computer Vision — *Jan '18 - April '18*
- Made an **AR** tool placing objects at desired location and orientation in virtual scene with hand gestures
- Extracted top view of identified glyphs using **homography** & implemented **KLT Tracker** to stabilize results
- Applied **Perspective-n-Point** algorithm for **camera** (laptop webcam) **calibration** using a chessboard image

Image Registration Using FFT
Digital Signal Processing, Selected in Top 5/40 projects — *Jan '18 - April '18*
- Built a FFT based tool for registering & mosaicing images captured from different view points & scales
- Used **phase correlations** in log polar coordinates for rotational alignment, impulse location for translation alignment

Portfolio Optimzation
Data Analysis and Interpretation — *July '17 - Dec '17*
- Developed **Monte Carlo Simulation** based model suggesting portfolio for asset management aiming best returns
- Used 5yr historic data of **NASDAQ** & **S&P**, capital asset pricing (CAPM) for future returns, monte carlo for risks
- Chose stocks with min. risk to return ratio & **thresholded correlation** avoiding cases of all depriciating together

RISC Processor Design
Microprocessors — *Nov '17 - Dec '17*
- Designed and implemented on FPGA a **6-Stage 16-bit Pipelined** microprocessor using only 20 states
- Implemented data forwarding and branch control to prevent structural and control hazards

Bicycle Renting Portal
Data Structures and Algorithms — *Jan '17 - April '17*
- Conceptualized and developed the prototype of a **portal** to facilitate renting of bicycles
- Implemented a text based **database system** for efficient storage of data of bicycles to be rented
- Used **Merge Sort** and linear searching algorithms for efficient results based on dynamic pricing

Relevant Courses and Skills

- Computer Graphics, Advanced Computer Graphics, Computer Vision, Image Processing, Advanced Image Processing, Introduction to Machine Learning, Data Structres & Algorithms, Operating Systems, Computer Networks

- **Mathematics**: Probability, Data Analysis, Differential Equations, Linear Algebra, Complex Analysis
  - **Languages and Packages**: C++, Python, VHDL ; TensorFlow, Keras, openGL, MATLAB, SCILAB

Positions Of Responsibility

System Administrator

*Hostel 7, IIT Bombay | Awarded **Organizational Color** for exceptional performance*   *Jul '17 - Ongoing*
  - In charge of overall **digitization** of hostel, facilitating effortless accessibility of hostel facilities
  - Worked on revamping website & developing Hostel Android App, formed **chrome extension** for mess updates
  - Created a Mess Rebate portal using **PHP Mailer** to automate the Mess-refund procedure for students on leave
  - Developed parcel notification system, mess rebate, guest room booking and franchise food ordering portals
  - Administered hostel LAN and CCTV, revamped hostel computer room facilities and WiFi setup

Teaching Assistant   **IIT Bombay**

Biosciences Department   *Jan '17 - April '17*
  - Mentored **50+** 1st year UG students by conducting weekly tutorials & solving doubts to boost academic performance
  - One among the top 10 selected out of 50+ applications; initiated interactive two way learning in classroom

Other Interests and Extra-curricular activity

  - **NCC Cadet** & completed mountain adventure Course (MAC) conducted by Govt. of India in Jammu and Kashmir
  - **Chess**: Stood 2nd in State (Under 14) Chess championship and winner of district inter school chess tournament
  - Won 5 awards for **Dramatics**, 6 awards in **Literary Competitions** and 3 awards for academic excellence in school
  - Avid interest in global and **national politics**, highly interested in reading about economic policies