# Sirshendu Mandal

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## Education

**Indian Institute of Technology, Kanpur** July'16 - June 2021(expected)

- *B.Tech in Computer Science, double majoring in Physics* *GPA - 8.14/10*

## Technical Skills

- **Languages :** C, C++, Python, R, PHP, Bash, Javascript
- **Tools :** Linux Command Line , Git, Latex, GNU Octave
- **Libraries and utilities :** Tensorflow, Pytorch, Eigen, OpenCV
- **Operating Systems :** Ubuntu, Fedora, Windows

## Research Interests

Optimization, Reinforcement Learning, Probablistic Machine Learning, Computer Vision, Information Theory, Statistical Mechanics, Biophysics, Quantum Computing

## Internship

- **Classification and Detection of objects on DVS images :** Samsung Research Institute
  *mentored by Dr.Vijay Narayan Tiwari* *Bangalore , May'19 - July'19*

  DVS images are very different than normal RGB images as they only highlight the temporally changing pixels.Hence don't look like normal images . But since all apples(or chairs) will have a somewhat similar representation even in DVS images too , some form of clustering will exist and existing classification and detection algorithms for RGB images should work. I implemented existing models of the YOLO family , RCNN family, SSD . And since major parts of these images are blank , so classical image processing techniques were extensively used .

## Projects

- **Operational Interpretation of Renyi Entropy:** ongoing
  *under Prof. Satyadev Nandakumar, Computer Science Department, IIT Kanpur* *July'19 - Dec'19*

  Normal Shannon Entropy has this nice interpretation as the average coding length of a set of strings. But such general interpretations for the Renyi entropy are available only for some special cases (dependent on the value of $\alpha$) . It is speculated that there's some connection between fractal volumes and the case of $\alpha < 1$ . We are interested in testing this idea and also attempt to find a uniform interpretation for $0 \leq \alpha \leq \infty$.
  *link to project report*

- **Model Agnostic Meta Learning :** Machine Learning , CS 771
  *course project under Prof. Piyush Rai, Computer Science Department, IIT Kanpur* *July'18-Nov'18*

  Explored the use of few shot learning and meta learning in image classification problems( and by using an extra LSTM layer in parallel )obtained a 5 percent increase in accuracy on several datasets . *link to project report*

- **Use of random matrices in image dimension reduction:** Numerical Linear Algebra
  *course project under Prof. Sumit Ganguly , Computer Science Department, IIT Kanpur* *Jan'19 - May'19*

  The random matrices which satisfy Johnson Lindenstrauss(JL) lemma have some nice approximation properties. This project was an attempt to use those methods in image dimension reduction. I used multiple such random matrices , like SRHT , Countsketch etc. and compared their performance and applicability to the task at hand. *link to project presentation*

- **Unsupervised Image Segmentation** Visual Recognition
  *course project under Prof. Vinay P. Namboodri , Computer Science Department, IIT Kanpur* *Jan'19 - May'19*

  Classical Image segmentation task are done by supervised methods. In this project we explored unsupervised methods for the same , mainly backpropagation based methods . *link to project report and presentation*

- **SAT based classical planning for multi-agent systems**
  *under Prof. Indranil Saha , Computer Science Department, IIT Kanpur* *Jun'18-Dec'18*

  Explored the use of cardinality constraints to bound the trajectories . And tried to correlate the set of satisfiability clauses of time dependant robot configurations with the distance travelled so far . *link to project report*

## Relevant Coursework

**MTH 102*** Linear Algebra and Ordinary Differential Equations, **MTH 101*** Multivariate Calculus, **MSO 201*** Probability and Statistics , **CS 201** Discrete Mathematics, **CS 220** Computer Organisation ,**CHM 102***General and Quantum Chemistry,**ESC 101***Introduction to Computing,**CS 203** Abstract Algebra),**CS 202**(Logic),**PHY 101***(General Physics Lab), **CHM 101***(General Chemistry Lab), **PHY 102*** ( Mechanics ) , **PHY 103*** ( Electrodynamics ) ,**PHY 226B** (Relativity) , **PHY 210A**(Thermodynamics),**ECO 101***( Introduction to Economics),**CS 771** (Introduction to Machine Learning ) ,**CS 340** (Theory of Computation) ,**ESO 207**(Data Structures and Algorithms),**CS 252**(Computing Laboratory 2) ,**CS 345** ( Algorithms-II ) , **ESC 201**(Electronics),**CS 783** (Computer Vision ) ,**LIF 101***(Introduction to Biology), **CS 698C*** ( Linear Algebraic Tools for Big Data Analysis) , **CS 687**(Algorithmic Information Theory) , **PSO 201**(Introduction to Quantum Physics), **PHY 421A** (Mathematical Methods) ,**CS396*** (Undergraduate Project in Computer Science),**PHY 431A***(Quantum Mechanics), **CS 330**(Operating Systems),**PHY 401A*****(Classical Mechanics),**PHY412**** (Statistical Mechanics), **CS 422**** (Computer Architecture), **CS498****(Undergraduate Project 2 in Computer Science)

*awarded an A grade in the course ** ongoing courses this semester ***audited the course

## Awards and Achievements

- Cleared **NSEA 2015** ( National Standard Examination in Astronomy) and appeared for INAO( Indian National Olympiad in Astronomy and Astrophysics)
- **Academic Excellence Award** , IIT Kanpur (2016-17)
- Selected for **Research Internship** at **Shibaura Institute of Technology, Japan** (summer, 2019)
- Selected for **Research Internship** at **Tomsk Polytechnic University, Russia** (winter, 2019)
- **All India Rank 100** in NEST( National Entrance Screening Test-2016)(Conducted by Department of Atomic Energy , Government of India)
- **All India Rank 14** in National Science Olympiad (Science Olympiad Foundation), 2010
- **All India Rank 53** in National Science Olympiad (Science Olympiad Foundation), 2009
- Awarded **HDFC bank scholarship** for winning the HDFC bank quiz , 2010

## Extracurriculars

Student volunteer at **Prayas** ( a campus NGO aiming to provide free supplementary education for underprivileged children and students from the villages surrounding the IIT campus ) and took mathematics and science classes of students of class 8 and higher classes . Active member of the **Adventure Sports Club,IIT Kanpur** and **Bicycling Hobby Group, IIT Kanpur**. Active member of the campus **Quiz Club**. One of the founding members of IIT Kanpur chapter of **ENACTUS**.