

Kumar AYUSH

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Seeking learning opportunity for May-July 2017

Awards and Achievements

- Jul 2013 **Silver Medal** at International Olympiad on Astronomy & Astrophysics, Greece
- Oct 2012 **Silver Medal** at International Astronomy Olympiad, Korea
- 2013 Recipient of **Kishore Vaigyanik Protsahan Yojana Scholarship** awarded to **Top 300** students by the Govt. of India to motivate interest in research
- 2012–2014 **Olympiad Orientation–Cum–Selection Camp – Astronomy.**
 - Awarded the Best Answer to a Challenging Data Analysis Question in 2012
 - Awarded the Best Observer in 2013
 - Awarded the Best Answer to a Challenging Theoretical Question in 2014
- 2010 Holder of **NTSE Scholarship** awarded by NCERT, Govt. of India

Research Experience & Course Projects

- Winter 2015 **Variability analysis for the globular cluster NGC 2419,**
NIUS – Astronomy, Prof. Priya Hasan, MANUU.
 - Searched and cataloged variable stars in the globular cluster
 - Read about differential CCD photometry
 - Developed Python scripts to perform standard routines from IRAF
- Winter 2013 **An X-Ray Study of Black Hole Candidate X Norma X-1,**
NIUS – Astronomy, Prof. Manojendu Choudhury, CEBS – UM.
 - Analyzed temporal data for a low mass X-ray binary from RXTE to detect quasi-periodic oscillations
 - Fitting 3-30 keV spectra with a model accounting for blackbody & non-thermal radiation, and interstellar extinction, we obtained values of system parameters like inner radius and temperature.
- Winter 2012 **Estimation of Photometric Redshifts Using ML Techniques,**
NIUS – Astronomy, Prof. Ninan Sajeeth Philip, IUCAA, Pune.
 - Estimated redshifts based on SDSS color data using a feed-forward artificial neural network with two hidden layers
 - We expanded the dataset by simulating the data for various redshifts and then compared the performance of our ANN against other ML techniques like linear regression and k-NN
- Fall 2015 **Meta-population and Coupled Logistic Maps,**
Non Linear Dynamics – Course Project, Prof. A Nandi, Prof. R Chelakkot, IITB.
 - The aim was to investigate the evolution of a network of cities and study the benefits of migration towards long term survival
 - Wrote a computational routine to predict evolution of a network with arbitrary initial conditions
 - Studied modeling of a pair of cities using coupled logistic maps and demonstrated their stabilization due to coupling
- Spring 2016 **Webcam Spectrograph using RPi,**
Waves, Oscillations and Optics – Course Project, Prof. Tapanendu Kundu, IITB.
 - Made a spectrograph out of scrap, using a CD as the diffraction grating
 - Used a Raspberry Pi with a camera module to make it portable and wireless
- Spring 2016 **3 body Simulation using FPGA,**
Digital Lab – Course Project, Prof. Pradeep Sarin, IITB.
 - Programmed an FPGA board using VHDL to perform 3 body simulation
 - Made a VGA module to display the results on a monitor

Leadership & Organizational Experience

- Summer 2015-2016 **Indian National Astronomy Olympiad Program 2015,**
Resource Person for the selection of the Indian teams to IAO and IOAA.
- Student facilitator for mentoring and evaluating students
 - Generated and evaluated questions for the selection procedure
 - IOAA Team India got best result in 9 years, topped the medal tally and won team competition
- Spring 2015 **IPhO–Rum, 46th IPhO,**
International Physics Olympiad 2015, Mumbai, India.
- Created a first of its kind browser application to be used during academic meetings with functionalities such as file management, voting & feedback
 - Worked in the academic logistics team during the Olympiad helping with a variety of proceedings
- Current **Manager,**
Web n Coding Club, IIT Bombay.
- Set up an ecosystem where people can mentor volunteers on their hobby projects
 - Reviewed and guided Institute Technical Summer Projects under the club

Web & Coding Experience

- Fall 2014 **Video Attendance,**
Face Detection using Hidden Markov Models and Discrete Cosine Transforms,
Prof. D.B. Phatak, IIT, Bombay.
- Programmed detection of faces in a video capture for marking the attendance of the student
 - Learnt about hidden Markov Models and implemented a prototype using a Gaussian mixture model based on features extracted from a block based DCT
 - Each observation was a vector containing the 15 lowest frequency elements of the DCT of a block
- Fall 2014 **AviPulse,**
A non-profit initiative to build the world's first bird identification system.
- Ported a sound processing algorithm to identify the bird species from MATLAB to Python
 - Created a web tool which takes the bird voice as input and helps bird enthusiasts and conservationists identify the species
- 2014–2015 **Gruppo Leopardo Inc,**
www.gruppoleopardo.com / www.grandimagazzinibomboniere.it.
- Designed & maintained e-commerce websites for the company based in Italy
- Spring 2015 **PNR Predictor,**
An app as a part of a hackathon, code.fun.do, Microsoft.
- Built an app which predicts probability of ticket confirmation using logistic regression
 - Runner up at institute level and participated in Finalists' Forum

Hobby Projects

- Summer 2016 **ANN for Photometric Redshifts.**
- Extending [my project](#) about estimating photometric redshifts in 2012, tried different kinds of NN models using the Keras framework
 - Experimented with a novel approach by classifying the objects and fitting a different model to each class
- Summer 2016 **Functional Programming with Google Sheets.**
- Experimented with implementing features of a functional programming language in a spreadsheet programming framework and wrote Bubble sort, Dijkstra algorithm and a Laplace solver as an example
- Summer 2016 **Verify Collatz Conjecture using Multicomputing.**
- Wrote a UDP based protocol to verify Collatz conjecture on a network of computers
 - Used a server-client based architecture where the clients request the server for a range of numbers which they test locally

- Fall **Kelvin Water Drop**, Maths n' Physics Club, IIT, Bombay.
 2014
 - o Built a working model of the Kelvin Water Drop experiment
 - o Demonstrated before an audience followed by a discussion on concepts involved

Talks and Workshops

- Fall **History of Astronomy**, Krittika-Astronomy Club, IIT, Bombay.
 2016
 - o An exploration of history of mathematical astronomy as it developed from Stone Age time keeping to Einstein's General Relativity
- Fall **Positional Astronomy**, Krittika-Astronomy Club, IIT, Bombay.
 2015
 - o Spherical trigonometry and astronomical co-ordinate systems
 - o Fundamental applications such as prediction of eclipses
- Fall **Scratch Day**, Web n Coding Club, IIT, Bombay.
 2015
 - o Conducted a workshop on MIT Scratch to an audience of 100 students
 - o Aimed to be an introduction to programming for freshmen
- Spring **Photometry**, Krittika-Astronomy Club, IIT, Bombay.
 2016
 - o Introduced students to essential physics and tools for photometry
 - o Demonstration on light curve analysis from planethunters.org
- Summer **Scientific Computing**, ITSP Bootcamp, IIT, Bombay.
 2016
 - o Introduced students to elementary techniques of solving ODEs numerically
 - o Demonstrated emphasis on keystones like epsilon and aliasing

Courses Undertaken

- CSE** Networks, Data Structures and Algorithms, Computer Graphics
- Physics** Electricity and Magnetism, Classical Mechanics, Non Linear Dynamics, Special Theory of Relativity, Quantum Mechanics I & II, Waves Oscillations and Optics, Photonics, Group Theory Methods
- Maths** Calculus, Linear Algebra, Ordinary Differential Equations, Complex Analysis
- Other** Introduction to Electronics, Signals and Systems, Digital Systems, Computational Fluid Dynamics

Software and Languages

- Advanced Python, C/C++, HTML, JavaScript, PHP, *English*
- Intermediate L^AT_EX, OpenOffice, Linux, MS Excel, OpenCV, *Hindi*
- Basic MATLAB, Photoshop, Illustrator, C#, *Sanskrit, German*

Interests

- Music
- Travel
- Cooking
- Reading