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

Talks and Workshops

Fall 2016	**History of Astronomy**, Krittika-Astronomy Club, IIT, Bombay. ○ An exploration of history of mathematical astronomy as it developed from Stone Age time keeping to Einstein's General Relativity
Fall 2015	**Positional Astronomy**, Krittika-Astronomy Club, IIT, Bombay. ○ Spherical trigonometry and astronomical co-ordinate systems ○ Fundamental applications such as prediction of eclipses
Fall 2015	**Scratch Day**, Web n Coding Club, IIT, Bombay. ○ Conducted a workshop on MIT Scratch to an audience of 100 students ○ Aimed to be an introduction to programming for freshmen
Spring 2016	**Photometry**, Krittika-Astronomy Club, IIT, Bombay. ○ Introduced students to essential physics and tools for photometry ○ Demonstration on light curve analysis from planethunters.org
Summer 2016	**Scientific Computing**, ITSP Bootcamp, IIT, Bombay. ○ Introduced students to elementary techniques of solving ODEs numerically ○ 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	LaTeX, OpenOffice, Linux, MS Excel, OpenCV, *Hindi*
Basic	MATLAB, Photoshop, Illustrator, C#, *Sanskrit, German*

Interests

- Music	- Travel
- Cooking	- Reading