ANIRUDDHA PATHAK

anipath@iastate.edu ⋄ aniruddhapathak07@gmail.com ⋄ anipath.github.io

EDUCATION

Doctor of Philosophy in Statistics Aug 2020 - Present
Iowa State University, Ames, IA; CGPA: 3.75/4

Master of Science in Statistics Aug 2018 - Jul 2020
Indian Institute of Technology, Kanpur, India; CGPA: 9.2/10

Bachelor of Science with Honors in Statistics Jul 2015 - Jun 2018
Ramakrishna Mission Residential College, Narendrapur; University of Calcutta; India.
Honors(Major) Subject Aggregate Marks : 84.25%.
Minor Subjects : Mathematics, Computer Science.

RESEARCH INTERESTS

Statistical Classification, Clustering, Kernel Density Estimation.

RESEARCH EXPERIENCE

Structure in the Least-Significant-Bit Does Not Imply Concealed Message in an Image
ISU STAT 680 Course Project Aug 2021 – Dec 2021

- **Supervisor**: Prof. Ranjan Maitra, Iowa State Univeristy.
- **Abstract**: Image steganography is the practice of hiding messages in grayscale images, often by replacing some of the least-significant-bits (LSBs) with appropriate values. Detecting and decoding these images presents a challenge to security agencies and professionals and is the domain of steganalysis. Common algorithms in steganalysis assume that unaltered LSBs are independent of each other. We develop nonparametric tests under the assumption of a second-order Markov random field on a binary rectangular grid and show that the tests have good power in detecting deviations from independence. We also demonstrate that the fundamental steganalysis assumption of the independence of unaltered LSBs is not supported in 1800 digital camera images of different scenes over 18 devices from 5 camera models. As a result, detecting concealed messages in grayscale images may be more difficult under current algorithms than previously assumed.

Parsimonious Classification using Higher Order Markov Chains
Masters Project at IIT Kanpur Jan 2020 – Jun 2020

- **Supervisor**: Prof. Subhajit Dutta, IIT Kanpur
- **Abstract**: Classification problems with categorical feature variables can be found in various fields of study like biology, computer science, finance, etc. Our goal is to discuss some parsimonious methodologies that can be used in this context. Here we discuss three different classifiers. The first one uses maximum likelihood estimates. The second one uses a mixture probability model for the conditional probabilities. And, the last one uses LASSO regularized logistic regression on counting statistics. We prove the weak consistency of the classifier based on maximum likelihood estimates. We apply these classifiers on simulated datasets to assess the performance by their misclassification rates and time efficiency.

Some Exploratory Issues in Statistical Computing
IASc - INSA – NASI Science Academies' Summer Research Fellowship Program 2019 May 2019 - Jul 2019

- **Project Guide** : Prof. Saurabh Ghosh, Human Genetics Unit, Indian Statistical Institute Kolkata
- **Abstract**: Reviewed the efficiency of likelihood-based and k-Means clustering in context of Iris dataset. Studied the application of EM algorithm for the estimation allele proportion estimation in blood type data. Applied the methodologies to analyze dataset on the effect of physical and genetic properties on Coronary Artery Disease.

OTHER TERM PROJECTS

Analysis and Forecasting of Gold Price Data
Course Project for 'Time Series Analysis' under Prof. Amit Mitra, IIT Kanpur Aug 2019 – Nov 2019

- Data Preparation including handling missing values, estimation and elimination of trend and seasonal component
- Tested of stationarity and accordingly built a suitable model through ARIMA and analysis with forecasting

A Study on Car Pricing based on Automobile Market Data
Course Project for 'Regression Analysis ' under Prof. Sharmishtha Mitra, IIT Kanpur Jan 2019 - May 2019

- Preparation of raw data by the imputation of missing values and dummification of categorical variables
- Used multiple linear regression to model the car prices on specifications
- Checking for multicollinearity and validity of the model assumptions through tests and Visualizations
- Determination of best possible subset model through variable selection method
- Using confidence intervals for predicted car prices detection of overpriced cars

Multi-Period Trading via Convex Optimization
Course Project for 'Convex Optimization' under Prof. Ketan Rajawat, IIT Kanpur Jan 2019 - May 2019

- Analysis of the performance of various convex optimization algorithms in the setup of a Multi-Period Trading.

A Statistical Study on the Development of Admission Process to an Undergraduate College
Undergraduate Project at RKMRC, Narendrapur Jan 2018 - Apr 2018

- Investigated the disparity in the current undergraduate admission process, which fails to properly evaluate students from different educational backgrounds and tried to propose a better evaluation scheme,
- Used some fundamental psychometric tools along with the statistical tools from Simulation and Regression Analysis;

TEACHING EXPERIENCE

Graduate Teaching Assistant
Iowa State University

- Lab Instructor for STAT 101 Fall 2021, STAT 326 Fall 2021.
- Grader for STAT 231 Spring 2021, STAT 587 Summer 2021, STAT 322 Spring 2022, STAT 642 Spring 2022.

RELEVANT COURSEWORK

At Iowa State University -

- **Theory** : STAT 641, 642 and 643.
- **Methods** : STAT 510, 520 and 601.
- **Other Electives** : STAT 502, STAT 546, STAT 580 and STAT 680.

At IIT Kanpur -

- **Statistics** : Probability Theory, Sampling Theory, Regression Analysis, Statistical Inference, Analysis of Variance, Time Series Analysis, Stochastic Process, Statistical Simulation and Data Analysis, Probabilistic Theory of Pattern Recognition, Multivariate Analysis, Nonparametric Inference, Bayesian Analysis, Statistical and AI Techniques in Data Mining.
- **Mathematics** : Linear Algebra, Real Analysis, Complex Analysis, Convex Optimization.
- **Computer Science** : Computer Programming and Data Structures.

SCHOLASTIC ACHIEVEMENTS

- Selected under IASc - INSA – NASI Science Academies' Summer Research Fellowship Program 2019,
- Secured All India Rank 33 in IIT Joint Admission Test for M.Sc. 2018 among 2926 candidates from all across the country,
- Recipient of INSPIRE-SHE Scholarship awarded by Department of Science and Technology, India to meritorious students pursuing an undergraduate degree in sciences at India's premier institutes;

TECHNICAL SKILLS

Programming Languages: R, C, C++ Python, HTML, JavaScript.
Other Tools: LaTeX, JMP, Minitab.

EXTRA-CURRICULAR ACTIVITIES

Worked as a Volunteer in National Service Scheme during the undergraduate days,