Md Enayat Ullah, Dual Degree Student
Department of Mathematics and Statistics, IIT Kanpur
enayat@iitk.ac.in | (+91) 8953440996 | home.iitk.ac.in/∼enayat

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Education

Indian Institute of Technology, Kanpur *(2012 - present)*
Bachelor of Science - Masters of Science (BS – MS)
Major: Mathematics and Scientific Computing
Minor: Computer Science (Artificial Intelligence), English Literature
Cumulative Performance Index: *10/10**, *8.3/10*† (∗*-PG*,†*-UG*)

All India Senior School Certificate Examination *(2011)*
SS Vidya Mandir, Madhupur; Aggregate : *90.6%*

Indian Certificate of Secondary Education Examination *(2009)*
Carmel School, Madhupur; Aggregate : *95.2%*

Research Interests

- Machine Learning, Optimization
- Statistical Learning Theory, Deep Learning

Projects and Internships

Non-Convex Opt.: Matrix Sensing & Factored Model [slides] *(Summer'15)*
Prof. Raman Arora, Johns Hopkins University, USA

- Studied Non-Convex Optimization problems and how their benign geometry allow algorithms to efficiently escape saddle points.
- Investigated the geometry of Matrix Sensing and how the saddle points encountered can be alleviated owing to local properties
- Contributed to an Open-source Non-Convex Optimization library by implementing Matrix Regression, robust PCA and Matrix Completion.

An Attempt to Escape the Deep Saddle Points [report | slides] *(Spring'16)*
Prof. Purushottam Kar, Indian Institute of Technology, Kanpur

- Studied non-convex optimization problems like tensor decomposition, phase retrieval and how the saddle point problem can be averted using first order information.
- Extended the work on generating guarantees for SGD to escape saddle points in the classical two-layer neural network setting.
- Implemented a two-layer neural network whose weights are obtained from tensor decomposition of the strict saddle objective.

Neural Machine Translation with Bilingual Embeddings [report | slides] *(Spring'16)*
Prof. Vinay Namboodiri, Indian Institute of Technology, Kanpur

- Constructed Bilingual Embeddings by learning word representations from comparable corpora using Merge and Shuffle heuristics.
- Trained a sequence to sequence learning network with soft attention based on encoder-decoder LSTMs on Europarl Machine Translation dataset.
- Tested the Neural Machine Translator plugging Bilingual Embeddings which results in slight improvement in the translational performance metric *(BLeU)*.

Label Relation Graphs to Encode Prior Knowledge [report | poster] *(Spring'16)*
Prof. Piyush Rai, Indian Institute of Technology, Kanpur

- Studied various works on incorporating structured label space information into visual recognition models.
- Formalized the relationships between response categories using Hierarchical & Exclusion edges extracted from Wordnet lexica.
- Trained a visual object recognition system using pre-trained VGG features by exact inference using Junction Tree Algorithm.

Cross-lingual Plagiarism Detection [report | poster] *(Fall'15)*
Prof. Amitabh Muherjee, Indian Institute of Technology, Kanpur

- Performed joint learning of word vectors in unified multilingual distributional space from document aligned comparable corpora.
- To estimate the robustness of the multilingual word space, two tasks: Bilingual Lexicon Extraction and Suggested Word Translation in Context are performed.
- Trained a Deep Recursive Autoencoder with dynamic pooling to generate phrase representations which are fed to an SVM for paraphrase detection.

Domain Invariant Transfer Kernel Learning [report | slides] *(Fall'15)*
Prof. Harish Karnick, Indian Institute of Technology, Kanpur

- Proposed to implement a learning model which generalizes across training and testing data with different distributions.
- Designed a family of spectral kernels by extrapolating target eigensystem on source samples to reduce the Nystrom Approximation error in the RKH Space.
- Plugged the obtained domain-invariant Kernel matrix into an SVM which outperformed the traditional SVM on benchmarked text and image datasets.

N-body Simulation in Deterministic Annealing [poster] *(Summer'15)*
Prof. Geoffrey Fox, Indiana University, Bloomington, USA

- Contributed to an open-source library on clustering and visualization of genomic sequences which uses Deterministic Annealing.
- Studied algorithms for solving N-body problems like Hierarchical Treecodes, Fast Multi-Pole methods and Barnes-Hut Simulation.
- Approximated N-body measure by implementing Treecodes and heuristically sampling from a distribution on partition scheme

Aspect based Sentiment Analysis [report | poster] *(Spring'15)*
Prof. Amitabh Mukerjee, Indian Institute of Technology, Kanpur

- Attempted Sem-Eval'15 challenge involving identification of opinion bearing entity-attribute pair E#A in a text, and adjudging it's polarity.
- Constructed features based on word-vectors, n-grams, parse trees, POS tag and out-of-domain, publicly available sentiment lexica (wordnet, sentiwordnet).
- Trained a Conditional Random Field(CRF) for sequential learning of aspect term, and a Maximum Entropy Classifier to adjudge the polarity.

Forest Cover-type Classification Problem [report] *(Spring'14)*
Prof. Amit Mitra, Indian Institute of Technology, Kanpur

- Attempted the Kaggle challenge of classifying forest cover type by building classification models based on the dataset.
- Employed various classification techniques such as Neural Networks, SVM, Logistic Regression, Naive-Bayes classifier, CART and Random Forests.
- Classification by Random Forests on a 10-fold cross validation training set was the most accurate with an accuracy of 87%.

Random Graph models of Social Networks [slides] *(Spring'15)*
Prof. A K Lal, Indian Institute of Technology, Kanpur

- Studied Random Graphs and their properties, degree distributions, scale-free graphs and small-world networks.
- Studied about phase transitions and random graph models such as Erdos-Renyi model, Configuration model and preferential attachment model.

Phonotactic Constraints in McGurk Fusion [report | poster] *(Fall'14)*
Prof. Amitabh Mukerjee, Indian Institute of Technology, Kanpur

- On cognitive audio-visual speech perception establishing the role of Phonotactic constraints towards producing a bias in McGurk Effect.
- Conducted experiments to conclude that Phonotactic constraints can diminish McGurk fusion rate when phonetic licensing biases against the fusion expected.

Causal Relationships Between Econometric Parameters [report] *(Fall'14)*
Prof. Amit Mitra, Indian Institute of Technology, Kanpur

- Used Time Series Econometric modelling to analyze the data of the policy macroeconomic variables using Augmented Dicky-Fuller and Granger Causality test.
- Established that both FDI inflows and Exports have a direct causal linkage with the GDP of India but there is no reciprocal causality between them.

Software Development Intern, Aurus Network Infotech Pvt. Ltd. *(Summer'14)*

- Worked with a team of developers towards building a novel e-commerce educational platform, based on the PHP framework Yii.
- Developed the Relevance Algorithm module to sort courses based on an aggregated scoring system parametrized on sale, recency and rating-reviews.
- Implemented SMS-based phone-number verification using SMS service APIs.

Philosophical Problems from the Standpoint of AI [report] *(Spring'15)*
Prof. A.V. Ravishankar Sharma, Indian Institute of Technology, Kanpur

- Compiled a brief summary of the paper "Some philosophical problems from the standpoint of artificial intelligence" by John McCarthy and Patrick J. Hayes
- Attempted to put forth a concise version of this 50 page paper while keeping the main ideas intact.

Scholastic Achievements

- Selected for Summer Research programme, offered by Johns Hopkins University.
- PG Department Rank - 1, and among the Top 8 in UG.
- Awarded an **A* grade**, for exceptional performance in Natural Language Processing.
- Awarded the 2nd best project in Natural Language Processing course for Cross Lingual Plagiarism Detection.
- Ranked in **Top 0.5%** (amongst 0.5 million students) in IIT-JEE 2012.
- Ranked in **Top 0.3%** (amongst 1.1 million students) in AIEEE 2012.
- Recipient of **Inspire** Scholarship awarded by Department of Science and Technology, Government of India.
- Secured **99.2 percentile** in National Cyber Olympiad 2009.
- Awarded the 3rd best project for manufacturing a working model of an engineering design(rope-making machine) amongst over 400 students in the course.

Relevant Coursework

Machine Leaning:

- Artificial Intelligence Programming
- Learning with Kernels
- Probabilistic Machine Learning
- Online Learning and Optimization
- Natural Language Processing
- Optimization Techniques
- Stat Techniques in AI & Data Mining
- Time Series Analysis

Mathematics:

- Linear & Abstract Algebra
- Probability and Statistics
- Topics in Topology
- Applied Stochastic Process
- Real & Complex Analysis
- Graph Theory
- Partial Differential Equations
- Several Variable Calculus

Other Relevant Courses:

- Introduction to Programming
- Introduction to Electronics
- Introduction to Cognitive Science
- Data Structures and Algorithms
- Theory of Computation

Online Courses:

- Machine Learning (Andrew Ng)
- NLP (Dan Jurafsky)
- Deep Learning (Nando de Freitas)
- Cryptography (Dan Boneh)
- Data Scientists Toolbox (Jeff Leek)

Technical Skills

Programming: C, C++, Python, R, Octave
Web Development: HTML, PHP, JavaScript, Yii, Node.js
Other Tools: Bash, Matlab, Git, LaTeX, Android SDK, Adobe Photoshop
Operating Systems: Windows, Linux(Ubuntu), Mac OS

Extra-Curricular Activities

- An active member of Quiz Club, participated in various Intra and Inter-college Quizzes.
- An Active Member of Special Interest Group on Machine Learning(SIGML).
- Worked with Pulkit Aggarwal in Winter Hackathon'14 to develop Infexious, spatially local Social Networks, working on Android devices employing bluethooh-LE.
- First Runner-up in Internet of Things competition for building a smart-mirror, at the 4th Inter-IIT Technical meet.
- Among the top 10 best coded applications in the country for Hitch-a-ride, a taxi-pooling Windows phone app in Microsoft Code.fun.do
- Co-ordinator, Crypto (Techkriti): Formulated questions for the online cryptographic treasure hunt, which witnessed participation from more than 1000 people.
- Secured 1st position in App development competition(Takneek) with SOS, an Android application which facilitates Disaster Relief efforts to aid Uttrakhand flood victims.

References

Available on request.