BHAVYA BHATT

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EDUCATION

Bachelor of Technology(Computer Science and Engineering) *2016 - 2020*
Indian Institute of Technology, Mandi Overall GPA: 8.06/10 (Up to 6th Semester)
School of Computing and Electrical Engineering

CBSE(Higer Secondary) *2016*
MDS Public School, Udaipur, Rajasthan Percentage: 93.5%

CBSE(Matriculation) *2014*
St. Gregorios Sen. Sec. School, Udaipur, Rajasthan CGPA: 9.6

TECHNICAL SKILLS

Computer Languages	C, C++, Python, JAVA (for android development)
Frameworks	PyTorch (Advanced), Keras (Medium), Android Studio (JAVA)
Computer Science Interests	theoretical machine learning, probabilistic modelling statistical learning theory
Mathematics Interests	manifold analysis, tensor calculus, differential geometry stochastic processes, group theory, abstract analysis, information theory
Physics Interests	quantum field theory, quantum gravity and it's origins in quantum foundations, cosmology, statistical mechanics and applications in computational learning theory

RELEVANT COURSES

Computer Science Courses
Pattern Recognition
Deep Learning and its Applications
Advanced Data Structures and Algorithms
Advance Database Practicum
Large Application Practicum
System Practicum (Operating System and Networking)

Physics and Mathematics Courses
Special topics in Quantum Mechanics
Special topics in High-Energy Physics
Statistical Mechanics
Continuum Mechanics
Real Analysis
Linear Algebra
Probability and Stochastic Processes

EXPERIENCE

Siemens Technology & Services Pvt. Ltd. June 2019 - August 2019
Software Research Intern

- Used program analysis tools like Atlas to run control flow analysis on large code base.
- Implemented four different types **(Tensor Product Composition, HOLE, ComplEx, QuatE)** of Knowledge Graph embedding probabilistic architectures in PyTorch.
- **Proposed a model for learnable background geometry** (components of metric tensor itself are learnable parameters) along with entity and relation embedding.

Siemens Technology & Services Pvt. Ltd. December 2018 - February 2019
Software Research Intern

- Processing internal service logs for building shift-right testing application.
- Used recurrent neural networks (LSTM) to predict most probable test cases which user can execute.
- Analyse the data for anomaly detection in the logs sequence dataset by probability estimation method.

Tata Institute of Fundamental Research, Mumbai June 2018 - July 2018
Summer Research Intern

- **Proposed a new approach for path integrals of collapse models** like GRW and other "all particle dynamics theories".
- Explained the killing of macroscopic superposition mechanism can be achieved through appropriate limit on collapse model parameters and rigorously formalised these limits.

PROJECTS

Second-Order phase transitions in neural based learning models Major Technical Project

- This project is a sub part of my major technical project at IIT Mandi. This project deals with **theoretical studies of learning algorithms** for neural network models and their bifurcation limits.
- Current neural based models assumes only first-order linear dependence between the attributes of data and impose non-linearity on these first-order terms.
- The whole formalism shatters when there is significant **second-order dependence which can have critical phase transitive behaviour** in gradient field which in turn results in large variations across batches of data.
- This project tries to formalize a new framework for such second-order learning.

PyGlow: a Python package for information theory of deep learning Open Source Project

- I am the author of this package and is part of an ongoing final year major technical project in the field of **Mathematics of Deep Learning**. The Project aims at developing new theoretical ideas for answering some of the profound questions in the field of deep learning.
- These questions include the mysteries of **generalization, optimal architectures, compression phase** in context of deep neural networks.
- The project demands the need for exploring cross field topics from **information theory, statistical physics, group theory and complexity theory** and experiment with these ideas in code.
- As a result of this project, all the experimentation code is available in form of a Python library package **PyGlow: Information Theory of Deep Learning**.

EinsteinPy: a Python package for Numerical Relativity Open Source Project

- This package was founder by me and my enthusiastic batch mates who were struggling to learn **numerical relativity**.
- This library is first to provide support for numerical relativity and **relativistic astrophysics problems** in Python programming language.
- I am the physics advisor and core developer in the organisation.

Quantum Path Integrals formulation for Collapse Models Summer Research Project

- For my summer research internship at Tata Institute of Fundamental Research, Mumbai.
- The project aimed at formulating path integral approaches to some of the collapse models of quantum measurement problems.
- Proposed new approaches for the above stated problem by the proper application of jump operators in every infinitesimal time interval, gave the path integrals for the theory and calculated the propagator.

Euler Notes 2^{nd} year Topcoder Hackathon

- A web application indented for hearing impaired people.
- The app processes the real-time speech data into text and produces short summaries of the whole speech lecture with the use of machine learning (used extensions).
- It identifies main keywords and produces educational links in the same interface.

OPEN SOURCE

GitHub Handle: spino17 , Link: `https://github.com/spino17`

PyGlow - Information Theory of Deep Learning June 2019 - Present
Author and Maintainer

- The package is currently available in 0.1.7 version on PyPI and can be installed from `https://pypi.org/project/PyGlow/`.
- GitHub Repository is available at: `https://github.com/spino17/PyGlow`
- PyGlow documentation is available on: `https://pyglow.github.io/`

EinsteinPy - Numerical Relativity in Python February 2018 - Present
Coauthor

- Partly sponsored by **ESA (European Space Agency)**.
- Soon to be a sub-organization under **OpenAstronomy**.
- The package is currently available in 0.2.0 version on PyPI and can be installed from `https://pypi.org/project/einsteinpy/`
- GitHub Repository is available at: `https://github.com/einsteinpy`
- EinsteinPy documentation is available on: `https://docs.einsteinpy.org/en/latest/?badge=latest`

PUBLICATIONS

Quantum Path integral formulation for "all particle dynamics" June 2018 - August 2019
Summer Research Intern

- The work at TIFR, Mumbai resulted into a paper named "Path integrals, spontaneous localization and classical limit". Link: `https://arxiv.org/abs/1808.04178`.

ACADEMIC ACHIEVEMENTS

My project "Implementation of gravitational lensing in Schwarzschild hypersurface" under EinsteinPy was selected in first screening of Europe Space Agency - SOCIS 2019.

Secured 1st position in TopCoder Hackathon for-Eulers Notes.

Secured 1st position in paper presentation and debate event held at technical fest of STAC club - Astrax 2019.

Secured All India Rank (AIR) 2324 in JEE Advanced (IIT-JEE) examination 2016.

POSITION OF RESPONSIBILITY

Mentor
Summer of Code in Space *ESA*

· Held the position of **honorary-project mentor** in SOCIS (Summer of Code in Space) organized by ESA (European Space Agency) for The EinsteinPy Project.

Lead Summer Researcher Intern
TIFR *Mumbai*

· Lead the team of 5 summer research intern students working on "Path Integrals of Collapse Models" and successfully completed the project and published the results.

Speaker at STAC
Space Technology and Astronomy Cell *IIT Mandi*

· Held the position of event judge for club intra-college fest "Zenith".
· Held many talks on various topics from artificial intelligence, mathematics and gravitational physics.

Teaching Assistant

· For the course on Data Science Lab and Advanced Data Structures and Algorithms.

EXTRA-CIRRUCULAR

Participated in a debate event - **"Ruminating the God"** organised by College Club.

Participated in Vibgyor event organised by Art and craft club - Art Geeks, for two years (2017-2018).

Participated in flash mob event in the Tech-Cult fest of IIT Mandi, Exodia.