# Utkarsh Pratiush

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## EDUCATION

- **University of Tennessee** — TN, USA
  *Doctoral degree in Material Science;* — *Aug 2023 - going on*
  Thesis supervisor - Dr. Sergei Kalinin. Link:↗

- **Indian Institute of Science** — Bangalore, India
  *Masters in Material Science; GPA: 9.2/10 (7.35/8.0) Note: GPA after BS-MS(together) 8.05/10 (6.42/8)* — *Aug 2019 - July 2020*
  Thesis supervisor - Dr. Praveen C Ramamurty. Link:↗

- **Indian Institute of Science** — Bangalore, India
  *Bachelors in Material Science; GPA: 7.8/10 (6.2/8.0)* — *Aug 2015 - July 2019*
  Thesis supervisor - Dr. Manish Jain and Dr. Rajeev Ranjan. Link:↗

## PROFESSIONAL POSITIONS

- **Indian Institute of Technology** — Delhi, India
  *Research Associate, **M3RG Lab*** — *Jan 2023 - Jul 2023*
  Supervisors: Dr. NM Anoop Krishnan and Dr. Sayan Ranu

- **Indian Institute of Science** — Bangalore, India
  *Research Associate;* **Deep Representation learning lab**; *Dept of Electrical Communication Engineering* — *Aug 2022 - Dec 2022*
  Supervisor - Prof. Prathosh AP and Prof Vishweshwa Guttal

- **Mindtree Limited. Link:↗** — Bangalore, India
  *Research Engineer;* **Machine learning** — *Aug 2020 - July 2022*

- **Vijna Labs. Link:↗** — Bangalore, India
  *Research Intern;* **Deep learning for computer vision** — *July 2019 - Dec 2020*

- **Japan Advanced Institute of Technology** — Ishikawa, Japan
  *Research Intern;* **Drug discovery** — *June 2017 - Aug 2017*

## PATENT

Kalinin, S.; Liu, Y.; Biswas, A.; Duscher, G.; **Pratiush, U.**; Roccapriore, K.; Ziatdinov, M.; Vasudevan, R.; mani, V.; Ahmadi, M. *Human-in-the-loop machine learning for automated experiment in computation, synthesis, microscopy, and characterization.* (Patent Application Filed.)

## PUBLICATIONS

- T.S. Sunil Kumar Naik, S. Saravanan, K.N. Sri Saravana, **U Pratiush**, Praveen C. Ramamurthy,
  "A non-enzymatic urea sensor based on the nickel sulfide / graphene oxide modified glassy carbon electrode,"
  *Materials Chemistry and Physics.*
  [Link to Article]
  **50 citations** as of 10th Oct 2023.

- Machine Learning meets Statistical Physics: a Web3 perspective
  Matteo Manzi, **Utkarsh Pratiush**, Enzo Caceres
  [Link to Article]

- EGraFFBench: Evaluation of Equivariant Graph Neural Network Force Fields for Atomistic Simulations
  V Bihani, **U Pratiush**, Sajid Mannan, Tao Du, Zhimin Chen, Santiago Miret, Matthieu Micoulaut, Morten M Smedskjaer, Sayan Ranu, NM Krishnan
  [Link to Article] *arXiv preprint arXiv:2310.02428*

- Discovering mesoscopic descriptions of collective movement with neural stochastic modelling
  **U Pratiush**, A Nabeel, V Guttal, P AP
  [Link to Article] *arXiv preprint arXiv:2303.09906*

- Human-in-the-loop: The future of Machine Learning in Automated Electron Microscopy
  Sergei V Kalinin, Yongtao Liu, Arpan Biswas, Gerd Duscher, **U Pratiush**, Kevin Roccapriore, Maxim Ziatdinov, Rama Vasudevan
  [Link to Article] *arXiv preprint arXiv:2310.05018*

## Skills Summary

- **Languages**: Python, Shell scripting, C++, Julia(light), Javascript, CSS, HTML.

- **Tools**: GIT, PyTorch, Tensorflow, relevant python packages(Numpy, Pandas, Flask, Scipy, Scikit-learn), Docker.

## Relevant research experience

- **MULTIPHYSICS MULTISCALE MECHANICS RESEARCH GROUP- Lab website link⧉ Jan '2023 - Aug '2023**:
  - ⇒ Atomistic modelling using **Equivariant Graph Neural Networks**.(Code link: ⧉ ).
  - ⇒ We evaluate them on several complex tasks such as evaluation of the structure and dynamics on forward simulations at different temperatures, compositions, and crystal structures. We evaluate the quality of simulations by new metrics on structure, and dynamics.

- **Mathematical modelling in ecology, Theoretical Ecology and Evolution Laboratory, IISc- Lab website link⧉ Aug '2022 - Dec '2023**:
  - ⇒ Studying the behaviour of collective behaviour of fishes using a **stochastic differential equation**.(Code link: ⧉ ).
  - ⇒ Used **neural networks**, to fit drift and diffusion function of the sde .
  - ⇒ The implemented code has potential to study dependence of other factors, like position of fishes in determining the sde thus helping in studying boundary effects(one of the applications).

- **Natural Language processing for low resource language, IISc**      **August '2022 - current**:
  - ⇒ Implemented the induction of grammatical information tags and knowledge distillation in translation model. (Code link: ⧉ ).
  - ⇒ The trained language model(**Neural Network based - BART**) showed 20 percent increase in Bleu score.

- **Electronic properties of Lanthana using First Principles, IISc, Quantum Theory Lab - Bachelors thesis link:⧉ . July '2018 - April '2019**:
  - ⇒ Used DFT to study band structure and defect level in Lanthana, a potential replacement for Silicon dioxide.
  - ⇒ Conducted simulation in quantum espresso (open source package). Furthermore we did electrostatic correction in the formation energy of the charged defects.

- **Computer vision, Course project(extended), Autonomous navigation at Robert Bosch center for cyber physical systems, IISC**      **August 2019 - December 2019**:
  - ⇒ Worked with Prof. Raghu KrishnaPuram(link:⧉ ) to estimate obstacle dimensions and depth using a object detection **deep learning model**, YOLOv3.
  - ⇒ The accuracy percentage to detect objects was doubled.

- **Multivariate data analysis for pattern recognition using sensor response, Organic electronics group, Dept of Materials engineering at IISc - Master thesis link:⧉**      **July '2019 - July '2020**:
  - ⇒ Worked with Prof. PC Ramamurthy using dimensionality reduction to detect patterns in sensor data to **characterize ions**.
  - ⇒ Developed and deployed the code on server using flask, javascript, html and css.Web app link:⧉

- **Physics informed neural network (Self motivated)**:
  - ⇒ Wrote pinn code in pytorch for a) wave equation b) Lotka volterra eqn.(Code link: ⧉ )
  - ⇒ As part of it got hands on exposure to NVIDIA Modulus (link :⧉ ) by solving basic dynamical system (PINN's package)

## Relevant Industry experience

- **Computer vison, Vijna Labs.**      **July 2019 - December 2019**:
  - ⇒ Read and gathered ideas by reading research papers to design my CNN architecture
  - ⇒ My classifier showed a 2-fold accuracy improvement.

- **Natural Language processing, Mindtree Limited**      **Oct '2020 - Dec '2020**:
  - ⇒ Implemented a research paper (Paper link:⧉ ) using **PyTorch**.
  - ⇒ The trained language model(**Neural Network based- BERT**) became better at downstream task with an increase in F1 score from 0.69 to 0.79 on a product classification task.

- **Time series forecasting using deep learning, Mindtree Limited**    **March '2021 to March '2022**:

  - ⇒ Explored transformers(Neural Network) based time-series model (Link: ⬀ ).
  - ⇒ Thought about various features like holiday, weather and region based special occasions to encode in model for better forecasting.
  - ⇒ Finally improved bias by 7 percent and accuracy by 8 percent.

- **Neural ODE, Mindtree Limited**    **March 2021 - May 2021**:

  - ⇒ Used Neural ODE's for time series forecasting.
  - ⇒ Did hands on in julia as well as python(torchdyn package).

- **Variational Autoencoder, Mindtree Limited**    **Oct' 2020 - Nov' 2020**:

  - ⇒ Read papers in the area of VAE. Did implementation in **Pytorch** on mnist data.
  - ⇒ Prepared a presentation on it for our team.

## Relevant courses

- **Maths**: Real analysis, Probability and statistics, Linear algebra

- **Computer science**: Data structure and algorithm, Machine learning, Data analytics, Deep learning, Advanced Deep representation learning, Autonomous navigation

- **Relevant science courses**: Scientific computing, Statistical mechanics, Quantum chemistry, Biomaterials, Condensed matter physics, Modelling and simulation in material science

## Honors and Awards

- Secured above 99.5 percentile in **IIT** entrance exam 2015.

- Recipient of JASSO scholarship for carrying out a summer research project at Japan Advanced Institute of Science and Technology (JAIST), Japan

- Recipient of research scholarship for carrying out undergraduate research at IISc.

- Got **promoted** in Jan'2022 for achieving excellent performance rating at Mindtree.

## List of references

- Dr. Sergei Kalinin, UT Knoxville. Email - sergei2@utk.edu Link:⬀

- Dr. Praveen C Ramamurthy, Indian institute of Science. Email - praveen@iisc.ac.in Link:⬀

- Dr. Prathosh AP, Indian institute of Science. Email - prathosh@iisc.ac.in Link:⬀

- Dr. Vishweshwa Guttal, Indian institute of Science. Email - guttal@iisc.ac.in Link:⬀

- Amit Modak (General manager - AI), Mindtree limited (corporate). Email - Amit.Modak@mindtree.com Link:⬀