Dipak Kumar Yadav

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EDUCATION

B.Sc. Physics, St. Xavier's College, Maitighar, Kathmandu, Nepal 2020 – 2025
Percentage: 71% – First Division
Relevant Coursework: Quantum Mechanics; Solid State Nuclear Physics; Elementary Particle Physics; Classical Mechanics; Electrodynamics; Computational Physics; Differential Equations; Linear Algebra; Probability Inference.

High School in Science (Class 11–12), Lord Buddha Sec. School, Biratnagar, Nepal 2018 – 2020
GPA: 3.37/4.0 (Grade A)

Secondary Education (Class 10), Super Sense Sec Eng Boarding School, Dharapani, Dhanusha, Nepal 2016 – 2017
GPA: 3.65/4.0 (Grade A+)

RESEARCH EXPERIENCE

Identifying Higgs Boson Events in $\sqrt{s}$ = 13 TeV ATLAS Data Using Deep Neural Networks 2024-2025
Department of Physics, St. Xavier's College, Tribhuvan University, Nepal
Supervisor: Dr. Vinaya Kumar Jha

- Developed a deep neural network (TensorFlow/Keras) to classify Higgs boson events against Standard Model backgrounds in proton-proton collisions at $\sqrt{s}$ = 13 TeV using ATLAS Open Data.
- Selected the $H \to ZZ \to 4\ell$ decay channel; processed simulated events with ROOT and extracted kinematic/invariant-mass features for training.
- Achieved an AUC of 0.94; ROC curves and score distributions showed clear signal–background separation.
- Obtained a statistical significance of **5.372** σ, surpassing the 5σ discovery threshold, demonstrating the discriminative power of ML methods in HEP.
- Compared network-learned solutions with analytical counterparts, confirming complementarity between ML and traditional approaches.

Deep and Shallow Neural Networks in Particle Physics Experiments July – Aug 2025
IFJ PAN Particle Physics Summer Student Programme (PPSS 2025), Kraków, Poland
Supervisors: Dr. hab. Tomasz Wąchała, Dr. Karol Adamczyk

- Participated in a 4-week intensive programme (160 hours) combining lectures, ROOT training, and a group research project in machine learning for HEP .
- Investigated signal–background discrimination with shallow vs deep NNs using open data from **ATLAS (Higgs)**, **MiniBooNE (neutrinos)**, and **Belle II (continuum suppression)**:contentReference[oaicite:1]index=1.
- Results: AUC = 0.88 (ATLAS), 0.98 (MiniBooNE), 0.987 (Belle II). Discovery significance for Higgs: **5.36** σ **(deep)** vs **4.58** σ **(shallow)**.

- Utilized Cyfronet Ares supercomputer for large-scale training; GPU acceleration reduced epoch time from 150s (CPU) to 23s (GPU).
- Concluded that deep NNs excel for complex, large datasets, while shallow NNs remain competitive for smaller datasets, especially with physics-engineered features.
- Co-authored and presented project findings with Kacper Kopeć at the PPSS mini-conference; presentation available online: ppss.ifj.edu.pl/materials_2025/12_PPSS_Kopec_Yadav.pdf.

PRESENTATIONS & POSTERS

Poster Presentation: Presented undergraduate thesis research *"Identifying Higgs Boson Events in* $\sqrt{s} = 13$ *TeV ATLAS Data Using Deep Neural Networks"* at the **Pentecost Spring School on Quantum Science 2025 (PenteQost-25)**, University of Siegen, Germany June 6–10, 2025

WORKSHOPS, SUMMER SCHOOLS & COMPETITIONS

Pentecost Spring School on Quantum Science 2025 (PenteQost-25) June 6–10, 2025
University of Siegen, Germany
• Participated in an interdisciplinary spring school covering topics such as Optical Clocks & Precision Spectroscopy, Quantum Foundations, Open Quantum Systems, Quantum Information, Statistical Inference, Integrable Quantum Systems, and Quantum Computational Complexity. :contentReference[oaicite:0]index=0

IFJ PAN Particle Physics Summer Student Programme (PPSS 2025) July 7–Aug 1, 2025
Henryk Niewodniczański Institute of Nuclear Physics, Polish Academy of Sciences, Kraków, Poland
• Intensive 4-week programme (160 hours) combining lectures, ROOT training, Hypatia hands-on sessions, and a supervised research internship in machine learning for high-energy physics. :contentReference[oaicite:1]index=1

Youth in High-Dimensions: Recent Progress in Machine Learning and High-Dimensional Statistics July 3–10, 2025
International Centre for Theoretical Physics (ICTP), Trieste, Italy (online)
• Attended lectures on recent advances in machine learning, high-dimensional inference, and philosophical perspectives on generative AI. :contentReference[oaicite:2]index=2

PLANCKS 2024 Finals (International Association of Physics Students) May 23–27, 2024
Trinity College Dublin, Ireland
• Represented Nepal in the international theoretical physics competition; competed in advanced problems across quantum mechanics, relativity, classical mechanics, and statistical physics. :contentReference[oaicite:3]index=3

Summer School in Theoretical (Astro)Physics (SSTP-2024) 2024
IUCAA & St. Xavier's College, Ahmedabad, India
• Studied relativity and applied machine learning techniques to analyze gravitational-wave data from GWOSC.

BCVSPIN-2024: Masterclass in Particle Physics (ML Workshop) Dec 4–6, 2024
Central Department of Physics, Tribhuvan University, Nepal
• Introduced to particle physics & HEP experiments; hands-on ML with ATLAS data; group presentation on Higgs signal–background classification.

Introduction to Quantum Computing (Workshop) Apr 2023

St. Xavier's Physics Council, Kathmandu, Nepal
• Fundamentals of quantum computing with Qiskit; introduction to ML algorithms in quantum frameworks.

Quantum ESPRESSO Basics (Workshop & Hands-on) 2023
Department of Physics, St. Xavier's College, Kathmandu, Nepal
• Completed 15 hours / 1-credit workshop on ab-initio simulations with Quantum ESPRESSO.

COURSES & CERTIFICATIONS

Diploma in Quantum Computing and Programming — QWorld & Qiskit 2024
Instructor: Dr. Jibran Rashid | Diploma No. Qbronze115-60

Particle Physics: An Introduction — University of Geneva, Coursera 2024

Machine Learning Introduction for Everyone — IBM, Coursera 2024

Programming for Everybody (Getting Started with Python) & **Python Data Structures** — University of Michigan, Coursera 2023

TEACHING & WORK EXPERIENCE

Teacher (Science & Mathematics), Mrigashira World School, Nepal 2023 – 2024

- Taught Science and Mathematics at the high school level; designed lesson plans and facilitated interactive learning.
- Fostered critical thinking, conceptual understanding, and student engagement through classroom discussions and practical examples.

Private Tutor (Physics & Mathematics), Independent 2020 – 2023

- Provided personalized one-on-one tutoring to high school students, assisting with complex topics in Physics and Mathematics.
- Focused on developing problem-solving strategies, critical reasoning skills, and exam preparation techniques.

LEADERSHIP, EXTRACURRICULAR ACTIVITIES & OUTREACH

Executive Representative (2022–2023) & Treasurer (2023–2024), St. Xavier's Physics Council Nepal (SXPC-Nepal)
St. Xavier's College, Kathmandu, Nepal

- Organized, volunteered, and coordinated academic and outreach events including *Yuri's Night*, *Pi Day*, Quantum Computing workshops, and invited physics talks.
- Facilitated student engagement in physics-related activities, fostering a collaborative academic environment.
- Developed leadership, teamwork, and event management skills through active participation and executive responsibilities.

HONORS, AWARDS & GRANTS

Winner, "10 Years of PLANCKS" Challenge 2024
Received a commemorative CUP as prize during the PLANCKS Finals, Dublin, Ireland.

Travel Reimbursement Award 2025
Awarded **€700** reimbursement for travel expenses to attend the Pentecost Spring School on Quantum Science (PenteQost-25), University of Siegen, Germany.

Undergraduate Merit Scholarship 2020 – 2023
Three-year academic scholarship awarded by St. Xavier's College, Kathmandu, Nepal.

Research Travel Grant 2025
Awarded a grant of **NPR 30,000** from St. Xavier's College to support participation in the IFJ PAN Summer Student Programme (PPSS 2025) in Kraków, Poland.

Most Aesthetic Student Award 2025
Recognized during graduation ceremony at St. Xavier's College for outstanding presentation and engagement.

SKILLS

Programming & Scripting: Python, C, C++, HTML, MATLAB
Data Analysis & HEP Tools: ROOT, Hypatia, TensorFlow, Keras, scikit-learn
Systems & Development: Linux, Git/GitHub, Docker, SLURM
Scientific Writing: LaTeX