STTP ON

MATHEMATICS DRIVEN MACHINE LEARNING

CONCEPTS, TECHNIQUES, AND APPLICATIONS

9th to 13th December 2024

ORGANIZED BY SCIENCE & HUMANITIES DEPARTMENT LDRP INSTITUTE OF TECHNOLOGY AND RESEARCH

STTP 2024

- The Short-Term Training Program (STTP) on **Mathematics-Driven Machine Learning: Concepts, Techniques, and Applications** was successfully inaugurated at the LDRP Institute of Technology and Research, a constituent college of Kadi Sarva Vishwavidyalaya. This five-day intensive program aimed to bridge the gap between mathematical foundations and practical applications in machine learning.

- The program explored key mathematical concepts which form the backbone of machine learning algorithms. Sessions included expert-led discussions, collaborative research opportunities, and practical exercises designed to empower participants with the essential tools for innovation in the field.

- Renowned faculty experts shared valuable insights on topics like linear algebra, probability theory, and statistics, vector operations, eigenvalues, matrix factorization, random variables, distributions, and Bayes' Theorem, enhancing participants' theoretical understanding and practical proficiency.

- This initiative exemplifies LDRP-ITR's commitment to fostering academic excellence and technological advancement, creating a platform for knowledge exchange and professional growth among educators, researchers, and students.

INAUGURATION

- The inauguration ceremony of the Short-Term Training Program (STTP) on **Mathematics-Driven Machine Learning: Concepts, Techniques, and Applications** commenced with a prayer, uniting all participants in a moment of serenity and gratitude.
- This was followed by the auspicious lamp lighting ceremony, a traditional symbol of wisdom, knowledge, and enlightenment. The ceremony was graced by our esteemed dignitaries, including the Chief Guest, **Dr. Vitthalbhai A. Patel**, the Principal, the Head of Department, and the Coordinators, who collectively illuminated theceremonial lamp. This act of sharing light symbolized the dissemination of inspiration and knowledge among all present.

- The harmonious background music added to the sanctity of the moment, making it a memorable start to the event. The dignitaries presence and their participation in this ritual marked the official commencement of the program, setting a positive tone for the sessions to follow.

ESTEEMED DIGNITARY

MATHEMATICS DRIVEN MACHINE LEARNING

DR. VITTHALBHAI A. PATEL

- Emeritus Professor of Mathematics at Humboldt State University, California.
- Former faculty at V.P. Science College, Sardar Patel University, and M.G. Science Institute (1957–1965).
- Joined Humboldt State University in 1969, excelling in teaching and research until retirement.
- Notable contributions to numerical analysis with publications in prestigious journals like Computers and Fluids.
- Currently settled in Shertha, Gujarat, inspiring the academic community with his legacy.

DR. GARGI RAJPARA

- I/C Director, KSV ; Principal, LDRP-Institute of Technology and Research; Phd from IIT Bombay
- 31 Years of Professional, Research and Teaching experience involved in consultancy work of micro canal network planning and design of **Narmada Sardar Sarovar Project** .
- Numerous Research Papers in various International peer journals . A Supervisor for many Dissertations project works.
- Known for leadership roles, curriculum development, and advancing engineering education.

DR. SHRIDHAR E. MENDHE

- Professor of Electronics and Communication Department, LDRP-Institute of Technology and Research, Gandhinagar.
- Specializes in RF and microwave engineering.
- Holds a PhD in ultra-wideband antenna design using metamaterials.
- Published 15+ research papers in reputed journals.
- Life member of ISTE and IETE.
- Active reviewer for prestigious journals.

DR. KUMKUM JAIN

- Head of the Science and Humanities Department, LDRP-Institute of Technology and Research, Gandhinagar.
- Expertise in Mathematics with a focus on fostering academic excellence.
- Plays a key role in promoting interdisciplinary learning.
- Significant contributions to enriching the academic and research community.

EVENT CO-ORDINATORS

PROF. VIJAY PATEL

- Assistant Professor in Mathematics at LDRP Institute of Technology & Research.
- Pursuing Ph.D. in Computational Fluid Dynamics and Hybrid Nano-Fluid (GTU).
- M.Sc. in Mathematics from The Maharaja Sayajirao University of Baroda.
- B.Sc. in Mathematics from M.G. Science Institute.
- Qualified CSIR-NET and GSET twice.
- Published research papers in renowned journals like Elsevier, Taylor and Francis, Springer Expertise in Numerical Analysis and Computational fluid Dynamics.

DR. MANOJ PATEL

- Assistant Professor in Mathematics at LDRP Institute of Technology & Research.
- Ph.D. in Computational Fluid Dynamics, Gujarat Technological University.
- M.Sc. in Pure Mathematics (Sardar Patel University), B.Ed. in Maths-Science (HNGU), and B.Sc. in Mathematics (M.G. Science Institute).
- Published various research papers in renowned journals like Elsevier, Taylor and Francis, Springer Expertise in Finite Volume Method, Numerical Analysis, and Mathematical Modelling

DAY-1

MATHEMATICS DRIVEN MACHINE LEARNING
9TH DECEMBER,2024

SESSION - 1

Dr. Manoj Sahni

Pandit Deendayal Energy University, Gandhinagar

- Professor, Department of Mathematics, PDEU, Gandhinagar, with over 19 years of teaching and research experience.
- Holds M.Sc., M.Phil. (IIT Roorkee), and Ph.D., with expertise in Mathematical Modeling and Computational Techniques.
- Published 100+ research papers and authored eight edited books with reputed publishers like Springer and Elsevier.
- Member of professional societies like AMS, SIAM, and IEEE; organized four International MMCITRE Conferences.
- Guided three Ph.D. students, with ongoing GUJCOST-sponsored projects under his supervision.

TOPIC:

Solving Linear Systems, Non-linear Equations, and Numerical Methods.

- Focused on foundational numerical techniques in mathematical computation.
- Emphasized the importance of solving linear and non-linear equations.
- Discussed practical applications of numerical methods in engineering and data science.
- Provided insights into algorithmic efficiency and accuracy.
- Shared examples to bridge theoretical concepts with real-world implementations.
- Encouraged participants to explore advanced numerical approaches.

SESSION - 2

Dr. Pratik Barot

Government Engineering College, Gandhinagar

- Asst. Professor, Department of Mathematics, Government Engineering College, Gandhinagar, with over 19 years of teaching and research experience.
- Educational qualifications: ME/MTech from L.D. College of Engineering, BE/BTech from Sankalchand Patel College of Engineering.
- Expertise in teaching core computer science subjects like data mining, database management systems, and operating systems.
- Placement Coordinator at Government Engineering College, Gandhinagar.
- Participated in training programs on intellectual property rights, privacy, and security engineering at IIT Kharagpur, NIT Goa, and NITTTR Bhopal.

TOPIC: Explore the Mathematics of SVM and Kernel Tricks.

- Introduced Support Vector Machines (SVM) and their mathematical underpinnings.
- Focused on kernel functions and their role in transforming data for better separability.
- Demonstrated the relevance of SVMs in classification and regression tasks.
- Discussed optimization techniques within the SVM framework.
- Provided practical examples to connect theory with implementation.
- Highlighted advancements in kernel-based learning methods.

DAY-2

MATHEMATICS DRIVEN MACHINE LEARNING
10TH DECEMBER,2024

SESSION - 1

Dr. Hiten Kanani
Government Science College, Gariyadhar

- Asst. Professor ,Government Science College, Gariyadhar
- Ph.D. in Mathematics from Sardar Patel University, specializing in Banach algebras.
- Recipient of prestigious awards like the National Board of Higher Mathematics Scholarship and UGC Junior Research Fellowship.
- Published research in journals such as Proceedings of the American Mathematical Society.
- Extensive teaching experience, mentoring B.Sc. students and preparing them for IIT-JAM.
- Creator of the YouTube channel Mathematics with Hiten Kanani for knowledge sharing.

TOPIC: Vector Space, Eigenvalues & Eigenvectors, Singular Value Decomposition (SVD).

- Covered the concept of vector spaces and their role in machine learning.
- Explained eigenvalues and eigenvectors with applications in data reduction.
- Discussed Singular Value Decomposition (SVD) as a key tool in dimensionality reduction.
- Showed real-world applications of these concepts in ML algorithms.
- Simplified mathematical concepts for better participant understanding.
- Provided practical demonstrations of computational methods.
- Encouraged exploration of linear algebra in modern data science.

SESSION - 2

Dr. Parita Shah

Vidush Somany Institute of Technology and Research, Gandhinagar

- Asst. Professor Vidush Somany Institute of Technology and Research, Gandhinagar
- Over 10 years of academic and teaching experience.
- Ph.D. from Parul University with a strong academic foundation from esteemed Gujarat institutions.
- Specializes in sentiment analysis, particularly in the Gujarati language, with several publications in renowned journals.
- Recipient of financial grants for research projects and holds a patent for a virtual reality headset.
- Actively engaged in academic counseling, research, and innovative teaching methods.
- Focused on fostering student engagement and achieving program outcomes through effective learning strategies.

TOPIC: Applications of Linear Algebra in Machine Learning.

- Highlighted the role of linear algebra in core ML algorithms.
- Discussed matrix operations and their computational applications.
- Showed practical use-cases like recommendation systems and image processing.
- Simplified complex concepts for participant engagement.
- Focused on bridging theory with implementation.
- Shared insights into optimizing machine learning models.
- Encouraged participants to apply linear algebra in their projects.

DAY-3

MATHEMATICS DRIVEN MACHINE LEARNING
11TH DECEMBER,2024

SESSION - 1

Dr. Krunal Kachhia

Charotar University of Science & Technology , Changa

- Head of the Department of Mathematical Sciences, P. D. Patel Institute of Applied Sciences, Charotar University of Science & Technology, Changa
- 13+ years of academic experience with research expertise in Fractional Calculus and Chaos Theory.
- Published 27 research papers in reputed national and international journals.
- Supervised one Ph.D. student, currently guiding three Ph.D. scholars and mentoring five M.Sc. students.
- Recipient of awards like CHARUSAT-GSA Best Thesis Award (2016), GSA Best Research Paper Award (2020), A.M. Mathai Research Excellence Award 2024, and Young Scholar Award (2024).
- Reviewer for esteemed international journals and organizer of various academic events.

TOPIC:

Implementing and Analyzing Gradient Descent Algorithms in Machine Learning.

- Explained the fundamentals of gradient descent in optimization.
- Focused on how gradient descent is used in training ML models.
- Discussed convergence, learning rates, and challenges.
- Highlighted practical examples for implementing algorithms.
- Shared insights on improving gradient descent efficiency.
- Discussed its role in neural networks and deep learning.
- Provided guidance for tackling implementation challenges.

SESSION - 2

Dr. Mrugendrasinh Rahevar
Charotar University of Science & Technology , Changa

- Assistant Professor at U & P U Patel Department of Computer Engineering, Charotar University of Science & Technology, Changa.
- Completed B.E. in Computer Engineering from Gujarat University in 2006.
- Earned M.E. in Computer Science and Engineering from Gujarat Technological University in 2014.
- Research areas: **Computer Vision and Deep Learning.**
- Actively contributing to advancements in cutting-edge technologies.

TOPIC: Gradient Descent and its Variants in Machine Learning.

- Explored advanced versions of gradient descent, such as stochastic and mini-batch methods.
- Focused on their efficiency in large-scale data processing.
- Discussed optimization techniques for faster convergence.
- Provided practical examples of applications in modern ML tasks.
- Shared the pros and cons of various gradient descent techniques.
- Simplified complex algorithms for better understanding.
- Encouraged participants to experiment with different approaches.

DAY-4

MATHEMATICS DRIVEN MACHINE LEARNING
12TH DECEMBER,2024

SESSION - 1

Dr. Brajesh Kumar Jha
Pandit Deendayal Energy University, Gandhinagar

- Associate Professor, Department of Mathematics, PDEU, Gandhinagar.
- Over 12 years of teaching and research experience.
- Holds an M.Sc. in Mathematics and a Ph.D. from SVNIT, Surat.
- Research focuses on mathematical neuroscience, fractional equations, and AI/ML in biology.
- Published 60+ research papers and edited notable books and conference proceedings.
- Guided 3 Ph.D. and 1 M.Sc. student; currently guiding 5 Ph.D. and 1 M.Sc. student.
- Presented papers at international conferences in Singapore, UAE, Sri Lanka, and Portugal.

TOPIC:

Probability Distributions, Bayes' Theorem, Expected Value, Variance, Hypothesis Testing.

- Introduced the role of probability in machine learning.
- Discussed key concepts like distributions, expected values, and variance.
- Highlighted the importance of Bayes' Theorem in probabilistic models.
- Explained hypothesis testing with examples.
- Provided insights into real-world applications of probability.
- Bridged theoretical knowledge with machine learning implementations.
- Simplified statistical concepts for participants.

SESSION 2

Dr. Safvan Vahora

Government Engineering College, Modasa

- Asst. Professor , Government Engineering College, Modasa.
- Research areas: Computer Vision, Machine Learning, Deep Learning, Medical Imaging, and Image Processing.
- Delivered over 13 invited talks at workshops and training programs.
- Published over 20 research articles in reputed journals/conferences.
- Holder of three Indian patents.
- Served as reviewer, editorial board member, and program committee member for international journals and conferences.

TOPIC: Application of Probability and Statistics in Machine Learning.

- Focused on practical applications of statistical methods in ML.
- Discussed random variables, distributions, and inference.
- Highlighted use-cases in prediction and decision-making.
- Showed examples of probabilistic models in real-world tasks.
- Simplified complex statistical tools for participants.
- Connected probability concepts to data-driven decision processes.
- Encouraged participants to utilize statistics effectively in ML.

DAY-5

MATHEMATICS DRIVEN MACHINE LEARNING
13TH DECEMBER,2024

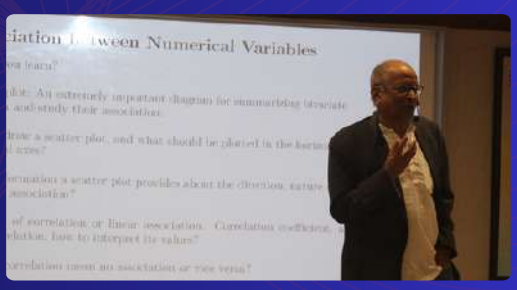
SESSION 1

Dr. Tathagata Bandyopadhyay
Director DAIICT, Gandhinagar

- Director, Dhirubhai Ambani Institute of Information and Communication Technology (DA-IICT), Gandhinagar
- Academic credentials: PhD, MSc, and BSc in Statistics from the University of Calcutta.
- Former Dean (Faculty) and Professor at IIM Ahmedabad.
- Distinguished Professor at DA-IICT since December 2021.
- Editor of the Calcutta Statistical Association Bulletin since 2009.
- Editorial contributions: Sankhya, Journal of the Indian Society of Agricultural Statistics, and Journal of Agricultural, Biological, and Environmental Statistics.
- Authored 70+ research articles in national and international journals.
- Supervised numerous PhD students and served on PhD Dissertation Committees at the University of Calcutta and IIM Ahmedabad.

TOPIC: Statistics in Machine Learning.

- Discussed the critical role of statistics in analyzing ML outcomes.
- Covered techniques like regression, correlation, and hypothesis testing.
- Emphasized the importance of statistical modeling in decision-making.
- Shared practical examples for better understanding.
- Highlighted advancements in statistical approaches to ML.
- Provided tools for applying statistics in various ML algorithms.
- Engaged participants with interactive discussions on statistical modeling.



SESSION 2

Dr. Ojas Satbhai

Pandit Deendayal Energy University, Gandhinagar

- Scientist and academician specializing in multiscale, multi-physics modeling with 4.5+ years of post-PhD experience.
- Completed M.Tech and Ph.D. from IIT Kharagpur; postdoctoral research at IIT Bombay.
- Expertise in computational heat-transfer, fluid flow, and solidification modeling using high-performance computing.
- Recipient of TARE award by SERB, with numerous publications in advanced manufacturing and energy systems.
- Convener of the 1st International Symposium on Battery Technology (Jan 2024), collaborating with Indian and Canadian universities.

TOPIC: Data-Driven Approach for Modeling of Thermal and Manufacturing Systems.

- Highlighted the use of data-driven techniques in modeling complex systems.
- Focused on applications in thermal processes and manufacturing.
- Discussed multi-physics and multi-scale modeling methods.
- Shared insights on computational tools and high-performance computing.
- Highlighted the optimization of manufacturing processes through simulations.
- Provided case studies for practical applications.
- Encouraged participants to adopt data-driven approaches in engineering tasks.

CLOSING CEREMONY

MATHEMATICS DRIVEN MACHINE LEARNING
13TH DECEMBER,2024

- The closing ceremony marked the conclusion of an enriching journey of learning and exploration.
- The event began with a warm welcome by the host, who expressed gratitude to the Honorable Principal, **Dr. Gargi Rajpara**, esteemed faculty, participants, and students for their unwavering support.

- Dr. Gargi Rajpara's career, spanning over 35 years, includes pivotal contributions to the Narmada Sardar Sarovar Project and numerous international research publications.
- Dr. Kumkum Jain presented a bouquet to Dr.Gargi Rajpara to honor her presence.
- Dr. Gargi Rajpara delivered an inspiring speech on the role of mathematics in advancing machine learning and AI.
- Student Coordinator **Hemant Pande** delivered a session report, summarizing the program's sessions, activities, and achievements.
- Selected participants shared feedback, emphasizing the program's academic and professional impact.
- Certificates were distributed to the HOD, Faculty Coordinators, Participants, Student Coordinators, Organizing Committee Members, and Volunteers.
- The event concluded with a vote of thanks by Prof. Vijay Patel and the National Anthem, marking the program as a resounding success.

OUTCOME

- Participants explored key concepts like linear algebra, probability, statistics, SVM, and kernel methods essential for machine learning.
- Hands-on sessions demonstrated practical applications in data science, optimization, and statistical modeling.
- Bridged the gap between mathematical concepts and real-world ML implementations, promoting interdisciplinary expertise.
- Enhanced participants' abilities to design, implement, and optimize ML algorithms using advanced numerical techniques and computational tools.
- Experts from academia and industry provided insights into cutting-edge research and innovation, enriching participants' understanding.
- Encouraged networking and collaboration among students, researchers, and educators for future projects.
- Certificates were awarded to all participants and contributors, acknowledging their active participation.
- Feedback highlighted the program's value in advancing academic and professional capabilities.
- Demonstrated LDRP Institute's dedication to academic excellence and fostering innovation in machine learning and technology.

Event Glimpses


SMT. KANTABEN JAYANTIBHAI PATEL U. S. A.)
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