



VELS



INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)

(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)

PALLAVARAM, THALAMBUR, PERIYAPALAYAM - CHENNAI

NATIONAL CONFERENCE

on

INNOVATIONS AND EMERGING TECHNIQUES IN COMPUTER APPLICATIONS (NCIETCA'25)

31st October 2025

CONFERENCE PROCEEDINGS

Chief Editor

Dr. C. Jothi Venkateswaran

Editors

Dr.P.Sujatha

Dr.K.Dharamarajan

Dr.S.Kamalakkannan

Sub Editors

Dr.K.Rohini

Dr.J.Jebathangam

Editorial Board

Dr.M.Sakthivanitha

Dr.V.Divya

Dr.U.Hemamalini

Dr.R.Bagavathi Lakshmi

Dr.S.Rani

Dr.N.Shyamala Devi



Organized by

Department of Computer Applications

School of Computing Sciences, VISTAS, Pallavaram, Chennai - 117

ISBN NO : 978-93-344-5403-1



Title	:	NATIONAL CONFERENCE ON INNOVATIONS AND EMERGING TECHNIQUES IN COMPUTER APPLICATIONS (NCIETCA'25)
Chief Editor	:	Dr. C. Jothi Venkateswaran
Editors	:	Dr.P.Sujatha Dr.K.Dharamarajan Dr.S.Kamalakkannan
Sub Editors	:	Dr.K.Rohini Dr.J.Jebathangam
Editorial Board	:	Dr.M.Sakthivanitha Dr.V.Divya Dr.U.Hemamalini Dr.R.Bagavathi Lakshmi Dr.S.Rani Dr.N.Shyamala Devi
Published by	:	ADSYSINFO Publications
Publisher's Address	:	ADSysinfo, Bharathi Nagar 2nd St, Bharathi Nagar, Pallavaram, Chennai, Tamil Nadu 600043
Edition Details(I.II.III)	:	I
ISBN	:	978-93-344-5403-1
Month & Years	:	October, 2025
Copyright @	:	Editor's
Pages	:	1-154

ABOUT VISTAS

VELS Institute of Science, Technology & Advanced Studies(VISTAS), established in 2008, is committed to shaping individuals into well-rounded professionals with both character and competence, dedicated to nation-building and sustainable development. Recognized as a Deemed to be University by the Ministry of Human Resource Development(MHRD), Government of India, and the University Grants Commission(UGC), VISTAS offers a diverse range of undergraduate, postgraduate, and Ph.D. programs. As a multidisciplinary university in Tamil Nadu, VISTAS provides academic programs across various fields, including Arts, Science, Engineering, Medicine, Nursing and Allied Health Sciences, Technology, Management Studies, Pharmaceutical Sciences, Physiotherapy, Maritime Studies, Education, Law, Hotel and Catering Management, Aviation, Agriculture, Music, and Fine Arts.

All programs at VISTAS are accredited by the relevant statutory regulatory bodies, including the All India Council for Technical Education(AICTE), National Medical Commission (NMC), Indian Nursing Council(INC), Pharmacy Council of India(PCI), Bar Council of India(BCI), National Council for Teacher Education (NCTE), and the Directorate General of Shipping (DGS). The institution has been awarded an "A++" grade by the National Assessment and Accreditation Council(NAAC) and has been granted 12-B status by the UGC. Also, VISTAS has been graded as a Category-I Institution by the UGC. Additionally, eleven programs have received accreditation from the National Board of Accreditation(NBA). In the NIRF University Rankings 2024, VISTAS secured a position in the 101-150 range, demonstrating its commitment to excellence in education and research.

ABOUT THE DEPARTMENT

The School of Computing Sciences at VELS Institute of Science, Technology & Advanced Studies (VISTAS) is a center of excellence committed to fostering innovation, research, and quality education in the field of computer science and information technology. With a mission to empower students with cutting-edge skills and knowledge, the School offers a diverse range of programs including BCA(General), BCA(Data Science), BCA(Cloud Technology), B.Sc.(Computer Science), B.Sc.(Information Technology), B.Sc.(AI&ML), B.Sc.(AI&DS), B.Sc.(Cyber Security), M.Sc.(Computer Science), M.Sc.(Data Science), M.Sc.(Information Technology), MCA, and Research Programs.

The Department of Computer Applications, under the esteemed School of Computing Sciences, offers BCA (General) program — a comprehensive undergraduate course that plays a pivotal role in shaping the IT professionals and leaders of the future. The program is meticulously designed to provide students with a strong foundation in computer science principles, encompassing programming languages, software development methodologies, and emerging technologies. The curriculum integrates theory with practical exposure, ensuring students gain hands-on experience through projects, internships, and technical events. With an emphasis on innovation, analytical thinking, and professional development, the department strives to nurture skilled, industry-ready graduates who are well-equipped to excel in the IT industry, entrepreneurial ventures, or advanced studies.

KEY HIGHLIGHTS:

- ✓ **Industry-Relevant Curriculum**
- ✓ **Experienced Faculty**
- ✓ **Hands-on Learning Approach**
- ✓ **Research & Innovation Focus**
- ✓ **State-of-the-Art Infrastructure**
- ✓ **Industry Connect & Internships**
- ✓ **Career Guidance & Placement Support**
- ✓ **Value-Added Courses & Certifications**

ABOUT THE CONFERENCE

The National Conference on Innovation and Emerging Techniques in Computer Applications (NCIETCA 2025) aims to bring together academicians, researchers, industry professionals, and students from across the country to exchange knowledge, ideas, and innovations in the field of computer applications.

This conference serves as a vibrant platform for presenting and discussing the latest advancements, challenges, and opportunities in computing and emerging technologies. It seeks to promote collaboration and innovation in leveraging modern computing techniques to address real-world problems and societal needs.

By fostering interaction between academia and industry, NCIETCA 2025 offers participants a valuable opportunity to explore cutting-edge research areas, share best practices, and gain practical insights into the evolving landscape of computing.

The NCIETCA 2025 is organized by the Department of Computer Applications which provides a dynamic forum for researchers, practitioners, and students to present and discuss recent developments in computer applications — with a special focus on emerging domains such as Artificial Intelligence and Machine Learning(AI/ML), Internet of Things(IoT), Cloud Computing, Big Data Analytics, and Cyber Security.

ADVISORY COMMITTEE

1. Dr. Prasun Chakrabarti

Pro Vice Chancellor(Research &Academics)

Sir Padampat Singhania University, Udaipur.

2. Dr. R.K.Bathla

Professor,

Computer Science Desh Bhagat University, Punjab.

3. Dr. B.Bharathi

Dean Academics,

Sathyabhama University, Chennai.

4. Dr. A.Muthukumaravel

Professor & Dean,

Bharath University, Chennai.

5. Dr. Punitha

Associate Professor,

Queen Mary's College, Chennai.

6. Dr. Varalakshmi

Dean Academics

SDNB Vaishnav College for Women, Chennai.

7. Dr. Sugnaya

Assistant Professor & Head,

DG Vaishnav College, Chennai.

CHIEF PATRON

Dr. ISHARI K.GANESH
Founder - Chancellor, VISTAS

PATRONS

Dr. A.JOTHI MURUGAN
Pro Chancellor (P&D)
VISTAS

Dr. ARTHI GANESH
Pro Chancellor(Admn.)
VISTAS

Dr. PREETHAA GANESH
Vice-President
VELS Group of Institutions

CO-PATRONS

Dr. M.BHASKARAN
Vice-Chancellor(FAC)
VISTAS

Dr. M.CHANDRASEKARAN
Registrar i/c
VISTAS

CONVENORS

Dr. P. SUJATHA
Professor & Head
Department of Computer Applications

Dr. P.MAGESH KUMAR
Director
School of Computing Sciences

Dr. C.JOTHI VENKATESWARAN
Dean
School of Computing Sciences

CO-CONVENORS

Dr. K.DHARMARAJAN
Professor & Associate Director
(Digital infrastructure)

DR. S.KAMALAKKANNAN
Professor & Programme Coordinator

COORDINATORS

Dr. K.Rohini, Professor
Dr. J.Jebathangam, Professor
Dr. S.Jeyalakshmi, Professor
Dr. V.Raghavendran, Asst. Professor

Dr. U.Hemamalini, Asst. Professor
Dr. V.Divya, Asst. Professor
Dr. A.Bharathi, Asst. Professor
Dr. N.Shyamala Devi, Asst. Professor

ORGANIZING COMMITTEE

1	Dr.Sangeetha Radhakrishnan, Assistant Professor
2	Dr. S. Rani, Assistant Professor
3	Dr.M.Sakthivanitha, Assistant Professor
4	Dr.R.Bagavathi Lakshmi, Associate Professor
5	Dr.L.Ramesh, Assistant Professor
6	Mrs.D.Narayani, Assistant Professor
7	Mrs.S.Prathi, Assistant Professor
8	Mrs. S.M.Fathima Rumaiza, Assistant Professor
9	Dr.M.Elavarasi, Assistant Professor
10	Dr.T.Thirumalaikumari, Assistant Professor
11	Dr. M.Krithika, Assistant Professor
12	Dr.P.N Shiammala, Assistant Professor
13	Ms. Pulla Sujarani, Assistant Professor
14	Mrs.F. Leema Raina, Assistant Professor
15	Mrs. R.Anitha, Assistant Professor
16	Mrs.M.Vedhapriya, Assistant Professor



Dr. Ishari K. Ganesh

Founder – Chancellor, VISTAS.

I am delighted to convey my warm greetings to all participants of the National Conference on Innovation and Emerging Techniques in Computer Applications(NCIETCA 2025), organized by the Department of Computer Applications, VISTAS.

In this age of rapid technological advancement, innovation in computer applications has become the cornerstone of progress across all sectors. The integration of emerging technologies such as Artificial Intelligence, Machine Learning, Data Analytics, Cloud Computing, and the Internet of Things is transforming the way we live, learn, and work. It is therefore essential for academia to continually engage in dialogue, research, and collaboration to remain at the forefront of these transformative developments.

I am pleased that NCIETCA 2025 serves as a dynamic platform for students, researchers, academicians, and industry professionals to exchange ideas, share research outcomes, and explore the latest trends in computer applications. Such initiatives not only strengthen the academic and research ecosystem of our institution but also make a significant contribution to the technological growth of the nation.

I appreciate the dedicated efforts of the Department of Computer Applications in organizing this conference and in nurturing a spirit of innovation, inquiry, and excellence among young minds. I am confident that the deliberations and discussions during this conference will inspire new perspectives and advance knowledge in this vital field.

I wish **NCIETCA 2025** great success and applaud the collective efforts of the organizers, participants, and contributors who have worked diligently to bring this conference to fruition.

Chancellor



Dr. Preethaa Ganesh

Vice President, Vels Group of Institutions

I take this opportunity to express my sincere greetings to the organizers and participants of the National Conference on Innovation and Emerging Techniques in Computer Applications (NCIETCA 2025), hosted by the Department of Computer Applications, VISTAS.

In the present era of digital transformation, innovation and technology play a vital role in shaping our society and economy. The rapid evolution of computing technologies such as Artificial Intelligence, Data Science, Cloud Computing, and the Internet of Things presents immense opportunities to address real-world challenges and improve human life.

Conferences like NCIETCA 2025 serve as a valuable platform for students, researchers, and professionals to share insights, present research outcomes, and exchange creative ideas that can drive technological progress and innovation in these emerging domains.

I sincerely applaud the efforts of the Department of Computer Applications for organizing this national-level event that fosters research, collaboration, and knowledge exchange among the academic and industrial communities. Such initiatives are instrumental in empowering young minds to think critically, explore new frontiers, and contribute meaningfully to the nation's technological advancement.

I extend my heartfelt wishes for the grand success of NCIETCA 2025. May this conference inspire every participant to pursue excellence and continue contributing to the ever-evolving world of computer applications.

Vice President



Dr. A. Jothi Murugan

Pro-Chancellor (Planning & Development), VISTAS

It gives me great pleasure to extend my warm greetings to all the delegates, participants, and organizers of the National Conference on Innovation and Emerging Techniques in Computer Applications (NCIETCA 2025), organized by the Department of Computer Applications, VISTAS.

In today's fast-evolving digital world, innovation in computer applications has become an essential driver of progress and development. The emergence of cutting-edge technologies such as Artificial Intelligence, Machine Learning, Block chain, Cloud Computing, and the Internet of Things is redefining industries, education, and everyday life. This conference provides an ideal platform for academicians, researchers, and students to exchange knowledge, present their research, and explore new technological frontiers.

I am delighted to see the Department of Computer Applications take the initiative to organize this national-level event, fostering an environment that encourages creativity, critical thinking, and research excellence. By bringing together scholars and practitioners from diverse backgrounds, NCIETCA 2025 not only strengthens the academic and research ecosystem of VISTAS but also contributes to the advancement of technology at a national level.

I congratulate the organizing committee for their dedication and admirable efforts in conducting this conference. I am confident that the deliberations and discussions held during this event will inspire innovative ideas and collaborative opportunities among all participants.

I wish NCIETCA 2025 grand success and hope it continues to serve as a beacon of innovation and academic excellence.

Pro- Chancellor (P&D)



Dr. M. Bhaskaran

Vice-Chancellor (FAC), VISTAS

I extend my warm greetings to all the participants of the National Conference on Innovation and Emerging Techniques in Computer Applications (NCIETCA 2025), organized by the Department of Computer Applications, VELS Institute of Science, Technology & Advanced Studies (VISTAS).

In today's rapidly evolving digital era, innovation and technology stand as the driving forces of transformation across every facet of human life. The unprecedented pace at which computing technologies are advancing presents both opportunities and challenges to researchers, educators, and industry professionals.

Conferences such as NCIETCA 2025 play a vital role in promoting the exchange of knowledge, ideas, and experiences that inspire meaningful innovation and sustainable development. This event provides an excellent platform for scholars, students, and practitioners to explore emerging areas including Artificial Intelligence, Data Science, Cyber Security, Cloud Computing, and Internet of Things. The deliberations and discussions held during the conference will undoubtedly foster creativity, generate new knowledge, and encourage young minds to think beyond traditional boundaries.

I sincerely congratulate the Department of Computer Applications for organizing this national-level conference and for its unwavering commitment to academic excellence, research promotion, and innovation within VISTAS. I also extend my best wishes to all the participants, presenters, and distinguished speakers for an insightful and memorable conference experience.

May NCIETCA 2025 serve as a beacon of innovation, collaboration, and progress, inspiring continued advancement in the field of computer applications and emerging technologies.

Vice Chancellor



Dr. M. Chandrasekaran

Registrar, VISTAS

It gives me immense pleasure to extend my warm greetings to the organizers, participants, and delegates of the National Conference on Innovation and Emerging Technologies in Computer Applications (NCIETCA 2025), organized by the Department of Computer Applications.

In today's rapidly evolving digital landscape, innovation and technological advancement play a crucial role in shaping the future of education, research, and industry. This conference provides an excellent platform for academicians, researchers, and students to exchange ideas, share research findings, and explore emerging trends in computer applications and related fields.

I applaud the Department of Computer Applications for taking the initiative to organize this event, which fosters collaboration between academia and industry, encouraging participants to think creatively and develop sustainable technological solutions.

I extend my best wishes for the grand success of NCIETCA 2025 and hope that the deliberations during the conference will inspire new insights and innovations that contribute meaningfully to the advancement of technology and society.

Registrar



Dr. P. Magesh Kumar

Director, School of Computing Sciences

I am pleased to extend my warm greetings to all the participants of the National Conference on Innovation and Emerging Technologies in Computer Applications (NCIETCA), organized by the Department of Computer Applications, School of Computing Sciences.

In today's rapidly evolving digital landscape, innovation and emerging technologies play a pivotal role in transforming ideas into impactful solutions. This conference serves as an excellent platform for academicians, researchers, and students to share knowledge, exchange perspectives, and explore the latest trends in computer science and its applications.

I appreciate the sincere efforts of the organizing committee for bringing together a diverse group of thinkers and innovators. Such initiatives not only foster academic collaboration but also nurture creativity and problem-solving skills among young minds—preparing them to meet future technological challenges with confidence and competence.

I extend my best wishes to the Department of Computer Applications for the successful conduct of this conference. May NCIETCA continue to inspire innovation, encourage research and contribute meaningfully to the advancement of computing sciences.

Director
School of Computing Sciences



Dr. C. Jothi Venkatewaran

Dean, School of Computing Sciences

It is a matter of great pride for me to address all the participants, speakers, and delegates of the National Conference on Innovation and Emerging Techniques in Computer Applications (NCIETCA 2025), organized by the Department of Computer Applications, VISTAS.

In this era of rapid technological advancement, innovation and research play a crucial role in shaping the future of computer applications. Conferences like NCIETCA 2025 provide an excellent platform for academicians, researchers, students, and industry professionals to exchange ideas, share research outcomes, and explore the latest trends in the computing domain. Such collaborative efforts are essential to address the challenges and opportunities posed by emerging technologies.

The Department of Computer Applications has consistently demonstrated a strong commitment to fostering research and innovation in areas such as Artificial Intelligence, Machine Learning, Data Science, Cyber security, Cloud Computing, and Internet of Things.

As part of this significant event, I have the honour of presenting the Conference Proceedings Book during the inaugural session. This publication encapsulates the research contributions and innovative ideas of scholars and professionals from across the nation. It stands as a testament to the collaborative spirit and intellectual vigor that drive this conference.

I congratulate the organizing committee and faculty members for their dedicated efforts in making NCIETCA 2025 a reality. I am confident that the discussions during this conference will inspire new perspectives and meaningful innovations.

Dean

School of Computing Sciences

ABSTRACTS			
S. NO.	PAPER ID	PAPER TITLE & AUTHOR(S)	PAGE NO.
1.	NCIETCA 001	Video Forgery Detection Using Hybrid Feature Extraction And Classification - Clara Shanthi D, Preethi D	1
2.	NCIETCA 002	Cloud Computing A Comprehensive Study on Cloud Computing and Its Emerging Trends - Saniya. Balan	2
3.	NCIETCA 003	Data Based Network SecurityA Modern Approach To Protecting Digital Communication - Seethalekshmi J	3
4.	NCIETCA 004	The Decentralized Dawn: Federated Learning, Data Sovereignty, and the Trajectory of Modern Information Technology - Sayed Muhammed Fazil P.P, Dr. Bharathi. A	4
5.	NCIETCA 005	Cyber Security A Modern Shield For Digital Transformation - Jibin B	5
6.	NCIETCA 006	Early Diagnosis and Treatment of Ped iatric Bipolar and Unipolar Disorders Using Machine Learning - Dr. Bharathi A, Safeena C	6
7.	NCIETCA 007	Enhanced AgriMAS: A Multi-Agent Framework for Sustainable Waste Reduction in Precision Agriculture - Naveen M V, Dr. Ramesh T R	7
8.	NCIETCA 008	A Survey On Electricity Consumption Prediction Using Machine Learning Algorithms - P. Rekha, Dr. K. Shyamala	8
9.	NCIETCA 009	Digital Transformation And Emerging Technologies - Ms.Jayasri, Ms.Leena, Ms.Sharmila	9
10.	NCIETCA 010	Ethical Hacking in the Era of Artificial Intelligence: Redefining Cyber Defence - Mrs. P. Renuka, Roshini Priya J, Kanimozhi S	10
11.	NCIETCA 011	Leveraging Artificial Intelligence for Data-Driven Decision-Making in Business Organizations - Mr.Rajesh Ravindran, Dr.R.Vettriselman	11
12.	NCIETCA 012	Machine Learning Models for the Prediction of Battery Cathode Voltage: Comparative Study & Performance Analysis - Shamili G, V. Sudha	12
13.	NCIETCA 013	Integrating ChatGPT in Academic Learning: Enhancing Programming Education and Sentiment Analysis Through Conversational AI - Dr.M.Ganesh Raja, Dr. K. Suganthavalli, Dr. R. Rengasamy	13
14.	NCIETCA 014	A Comparative Study of Sentiment Analysis Techniques for Drug Revie Data - Ashwini P	14
15.	NCIETCA 015	AI & Machine Learning on Android: Bringing Intelligence to the Edge - Dr Annies Mary Jeyaseeli J	15
16.	NCIETCA 016	Smart Hybrid Materials and Sustainable Structural Design: A Cross-Disciplinary Approach to Future Infrastructure - Jebakumar Immanuel D, Jeromy R	16
17.	NCIETCA 017	Food Label Ingredient Risk Analyzer - S. Madhumitha, Shivani. S, Mrs. Soundarya , D.S Rajan M.E	17

114.	NCIETCA 114	Healthcare And Medical Image Translation Using Deep Learning - Aleena. M.A, Dr. Sangeetha Radhakrishnan	114
115.	NCIETCA 115	Hologram - A Generative AI NPC 3D Character With Emotional Intelligence - Bojan.S, Santhosh.S, Ms.Divya Bairavi	115
116.	NCIETCA 116	Real - Time Facial Emotion Regulation - Sarath kumar M, Naren S, Dr.A. Manikandan	116
117.	NCIETCA 117	Fake News Detection Using Natural Language Processing - Anaas Rawoof, Haamidsha, Mohamed Sadhath, Anitha V.P	117
118.	NCIETCA 118	Machine Learning for Wastewater Treatment Optimization - Susha K B	118
119.	NCIETCA 119	Domain-Specific Text Preprocessing and Stemming Framework for Customer Queries - C.Kiruthiga, Dr. K. Dharmarajan	119
120.	NCIETCA 120	The Impact of Artificial Intelligence on Cybersecurity - Siji Jose C, Dr. H Jayamangala	120
121.	NCIETCA 121	Silent Speech to Text: Lip Reading-Based Transcription Using Computer Vision - M.Rekha, Shaik Sheeren Taj, Thrisha V, Vijhaya Shree A	121
122.	NCIETCA 122	Applications of artificial intelligence in anesthesiology - Dr Subhajini, Dr Kodanda Ram N S	122
123.	NCIETCA 123	Machine Learning Models for Disease Prediction: Algorithms, Datasets, Evaluation Metrics, Challenges, and Future Directions - Dr. Ginavane A	123
124.	NCIETCA 124	Deep Learning Techniques in Image Processing: Systematic Review - Mr. Andrews Bernard K, Dr.M.Chandramouleeswaran	124
125.	NCIETCA 125	Skin Disease Detector - Dr.M.Nisha, B. Ghanath, G. Chaithanya	125
126.	NCIETCA 126	Improving Cybersecurity using Enhanced Shuffle-Padding Stegno-Lattice Encryption scheme for Mobile Data Communication - Sreena G Nair, Dr. K. Rohini	126
127.	NCIETCA 127	TRUST : Tri Secure Reliable Unified Smart Technology - Dr. R. Varalakshmi, Teena J, Vidhya Shree B	127
128.	NCIETCA 128	Comparative Analysis of Deep Learning models for Heart Disease Prediction - C. Satya Surya Prudhvi, Dr. Saranya S	128
129.	NCIETCA 129	Blockchain Technology In Digital Forensics: Securing Iot Data Integrity And Authenticity - Ms.Priyanka M.C	129
130.	NCIETCA 130	Macula OCT Disease Images Classification Using Deep Learning Techniques - Dr. M.Dharani, Ms. K. Durgadevi	130
131.	NCIETCA 131	Enhancing Earthquake Prediction Accuracy Through Machine Learning with Flask Integration - Dr. R. Lalitha, P J Rajam	131
132.	NCIETCA 132	Innovations in UNIX-Based Simulation Systems: Architecture, Algorithms, and Emerging Applications - Dr. G.Prathima, Ms. Durga Siddharth Ms. S.Bhuvaneswari	132
133.	NCIETCA 133	Structure-Based Discovery of Marine-Derived Inhibitors Targeting the KRAS G12C Mutation in Colorectal Cancer - Kumar Viknesh, Chandrabose Selvaraj	133
134.	NCIETCA 134	Hostel managing system - Dr. V. Raghavendran, Dr. R. Bagavathi Lakshmi	134

Machine Learning for Wastewater Treatment Optimization

Susha K B

Research Scholar

School of Computing Science, School of Computing Science

sushakb@gmail.com

VISTAS Chennai, India

Dr. H Jayamangala

VISTAS Chennai, India

jayamangala.scs@velsuniv.ac.in

Abstract

Wastewater treatment is a critical process for environmental sustainability and public health protection. However, traditional treatment systems face challenges such as high operational costs, energy consumption, and variable influent characteristics. Machine Learning (ML) provides a data-driven approach to address these challenges by predicting system behavior, optimizing process parameters, and enabling smart decision-making. This paper explores the role of machine learning in optimizing wastewater treatment operations. Various ML algorithms such as Artificial Neural Networks (ANN), Support Vector Machines (SVM), Random Forest (RF), and Long Short-Term Memory (LSTM) networks are discussed for predicting and controlling key treatment parameters like Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and Total Suspended Solids (TSS). The study also highlights real-world applications, challenges, and future research directions involving the integration of ML with IoT and digital twin technologies for sustainable wastewater management.

Keywords— *Machine Learning, Wastewater Treatment, Optimization, Artificial Neural Networks, IoT, Digital Twin.*