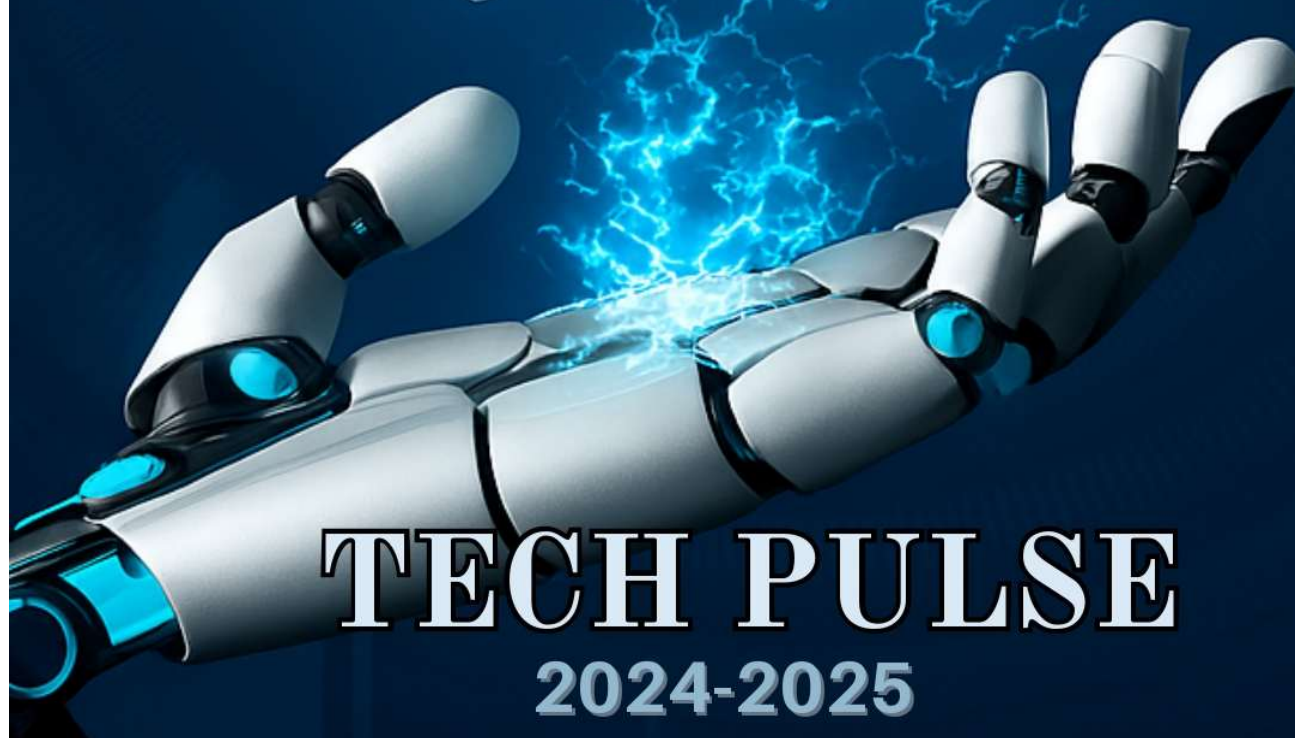


DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING



TECH PULSE

2024-2025



PRAGATI ENGINEERING COLLEGE

1-378, ADB Road, Surampalem-533437

(Approved by AICTE, Permanently Affiliated to JNTUK, KAKINADA & Accredited by NAAC with 'A' Grade)
Recognized by UGC under sections 2(f) & 12(b) of the UGC Act, 1956)



TECH PULSE

CHIEF EDITOR

Dr. D.V.Manjula

HOD-CSE

ASSOCIATE EDITOR

P Kanaka Tulasi

Asst. Professor

STUDENT COORDINATORS

MD Sadiq Ahmed

23A31A05I2

V S P Chaitanya

23A31A05J4

P Sai Ganesh

23A31A05I5

VISION

To emerge as a center of technical expertise in the field of computer science and engineering by producing globally competent professionals with technical & research capabilities, ethical values, and team spirit.

MISSION

M1: To produce qualified and competent software professionals.

M2: To induce application-oriented and research capabilities in students for the betterment of society.

M3: To inculcate ethics and human values in students so as to adapt to the dynamism in the field of computing technology.



PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO-1 :

To provide students with a strong foundation in the mathematical, scientific, and engineering fundamentals necessary to formulate, solve, and analyze engineering problems.

PEO-2:

To develop an ability to analyze, design, and develop novel engineering solutions.

PEO-3:

To make the students responsible with ethics, best practices, values, and social concerns to meet requirements of responsible team player in the society.

Dr. D.V.Manjula
Professor & HoD of CSE,
Pragati Engineering College
✉ hod_cse@pragati.ac.in



MESSAGE FROM HEAD OF THE DEPARTMENT

- My vision is to enhance the constructive thinking, analytical skills, and entrepreneurial mindset of every CSE student. Our department is committed to providing a strong foundation in engineering education, equipping students for successful careers in industry, academia, and research. We aim to empower students to contribute to economic growth and create employment opportunities through innovation.
- With over a decade of experience in teaching and research, I strive to integrate practical insights into the learning environment. Alongside our dedicated faculty, I aim to build a comprehensive system that nurtures young minds, preparing them to meet future technological challenges and develop solutions for the betterment of society and the nation.

“Quantum Computing”: Redefining the Limits of Technology

Dr D V Manjula
HOD, CSE Department

What Is Quantum Computing

Quantum computing, once a theoretical concept in physics, is now evolving into a disruptive technological force with the potential to revolutionize numerous industries. Unlike classical computers, which use bits as the smallest unit of data, quantum computers operate on *qubits*, quantum bits that can exist in multiple states simultaneously. This core feature, known as *superposition*, allows quantum computers to process complex problems much faster than their classical counterparts.

Why It Matters

Speed: Algorithms like Shor's make tasks like prime factorization exponentially faster.

Simulation: Accurately model molecules for drug discovery or materials design.

Optimization: Transform logistics, finance, and AI through advanced problem-solving.

Current Challenges

- Decoherence: Qubits are extremely sensitive to noise and temperature.
- Error Correction: Requires thousands of physical qubits per reliable logical qubit.
- Scalability: Engineering systems to run stably is a major hurdle.

Industry Momentum

- Big Tech: IBM, Google, Intel — pushing boundaries of hardware.
- Startups: Rigetti, IonQ — exploring trapped ions, superconducting circuits.
- Milestone: Google claims quantum supremacy in 2019.

Global Investment

Governments, too, are recognizing the strategic importance of quantum technology. Nations like China, the United States, and members of the EU are pouring billions into quantum research initiatives, seeing it as a cornerstone for future technological dominance and national security.

The Future Ahead

Looking ahead, quantum computing is poised to transform fields ranging from artificial intelligence to climate modeling. While we may be years away from full-scale, fault-tolerant quantum systems, the foundation is being laid now. As the hardware matures and new algorithms are developed, quantum computing promises not just faster machines — but an entirely new way of understanding and interacting with the world.

The Right to Be Forgotten in AI: Myth or Reality

Mr. Manas Kumar Yogi
Assistant Professor, CSE Department

Machine unlearning - the ability to remove specific data points or influences from trained AI models - has emerged as a critical privacy challenge. Here's how to handle this in next-gen privacy frameworks:

Core Challenges of Machine Unlearning

- **Data Persistence:** Trained models may retain information even after "unlearning".
 - **Dependencies:** Removing one data point affects model behavior on related data
 - **Verification:** Difficulty in proving complete data removal
 - **Efficiency:** Current unlearning methods are computationally expensive
- Next-generation Solutions

Technical Approaches

- **Differential Privacy Integration:** Build models with inherent privacy guarantees
- **Modular Architecture:** Design models with removable components for specific data
- **Influence Functions:** Develop better methods to track and remove data influences
- **Federated Learning:** Keep sensitive data decentralized when possible

Policy and Governance

- **Right to Be Forgotten 2.0:** Update regulations to address AI-specific challenges
- **Unlearning Certification:** Create standards for verifying effective data removal
- **Data Provenance Tracking:** Maintain detailed records of training data sources
- **Liability Frameworks:** Clarify responsibilities when unlearning fails

Hybrid Solutions

- **On-demand Re-training:** Maintain mechanisms for rapid model retraining without specific data
- **Data Segmentation:** Organize training data to enable selective removal
- **Approximate Unlearning:** Develop acceptable standards for "good enough" removal

Implementation Roadmap

- **Research Phase:** Fund academic/industry research into efficient unlearning algorithms
- **Standardization:** Develop industry-wide benchmarks for unlearning effectiveness
- **Regulatory Alignment:** Work with policymakers to create practical compliance frameworks
- **Tool Development:** Build open-source tools to implement unlearning across platforms

Biocomputing and Neuromorphic Computing

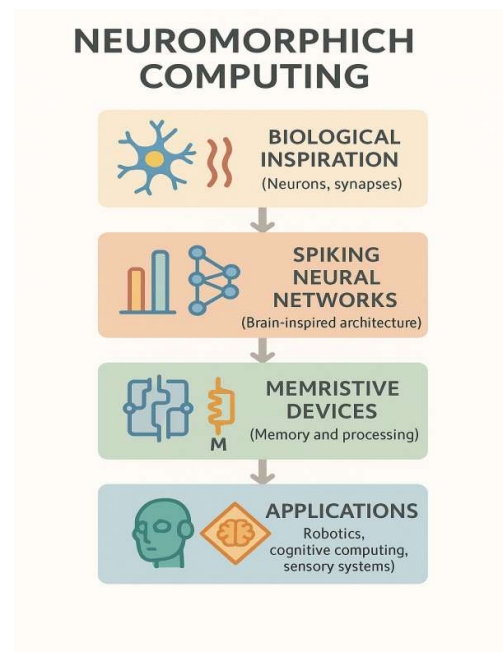
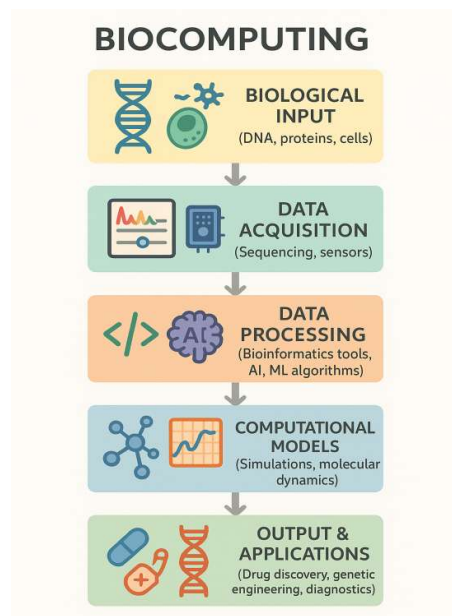
Mr. A Avinash
Assistant Professor, CSE Department

Introduction

Biocomputing utilizes biological materials like DNA for complex problem-solving, while neuromorphic computing emulates human brain functions using silicon technologies. Together, they challenge traditional computing by providing innovative data handling approaches. This integration enhances data processing efficiency and enables systems to mimic human learning and adaptability, influencing future technologies. Understanding these fields fosters interdisciplinary research between biology and engineering, highlighting their transformative potential in computing.

Overview of Biocomputing and Neuromorphic Computing

Biocomputing and neuromorphic computing are innovative areas in computer science inspired by biological systems. Biocomputing leverages biological materials for computations, using DNA for data storage and logic operations, enhancing efficiency and mimicking life-like functions. Neuromorphic computing emulates the human brain's structure for energy-efficient processing and supports advanced adaptive learning algorithms. Collectively, these fields promise breakthroughs in intelligent systems, transforming our methods for addressing complex computations and advancing artificial intelligence capabilities.



Biocomputing

Biocomputing merges biological systems with computational methodologies, utilizing biological materials like proteins and nucleic acids for efficient information processing. This field mimics neural processes and leverages biochemical signaling to handle data with high specificity and low energy use. It enhances our understanding of cognition and learning, aligning with neuromorphic computing. Researchers aim to create synthetic organisms for complex calculations, potentially transforming technology and cognitive science through biocomputing integration.

Applications of Biocomputing in Medicine and Biotechnology

Biocomputing in medicine and biotechnology enhances diagnostic capabilities and therapeutic interventions. Biotechnology chips aid in early disease detection, enabling personalized medicine and drug discovery. These chips facilitate rapid analysis of biological samples, enabling early diagnosis of diseases like cancer and infections. The adaptability and precision of biocomputing technologies improve patient outcomes and medical research.

Neuromorphic Computing

Neuromorphic computing is a paradigm shift in computing architectures, emulating the asynchronous, event-driven processing of the human brain. This bio-inspired approach enhances computational efficiency, enabling real-time processing and learning from unstructured data. It holds promise for artificial intelligence, robotics, autonomous systems, and cognitive computing systems, offering novel solutions to complex real-world problems.

Comparison of Neuromorphic Computing with Traditional Computing Architectures

Neuromorphic computing, based on the human brain's neural architecture, offers a parallel and distributed approach to data processing, reducing energy consumption and improving performance in real-time tasks. This parallel and distributed approach is particularly useful in artificial intelligence, robotics, and other applications, aligning more closely with biological intelligence than traditional computing architectures, which rely on sequential and discrete processing.

Conclusion

The integration of biocomputing and neuromorphic computing is a significant shift in information processing and data interpretation. Biocomputing uses living organisms' biochemical processes for parallel processing and energy efficiency, while neuromorphic computing emulates the human brain's neural architectures for pattern recognition and learning. These technologies could increase computational power and address ethical and sustainability concerns.

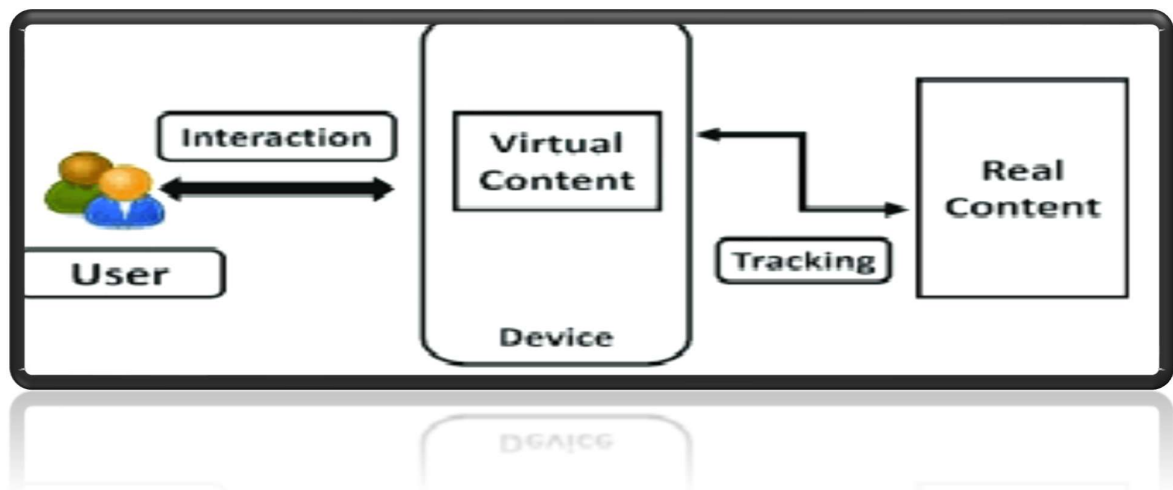
AUGMENTED REALITY - THE FUTURE

IMMERSIVE TECHNOLOGY

Mr. K Chandra Sekhar
Assistant Professor, CSE Department

Augmented Reality (AR) is revolutionizing how we interact with the digital world. Unlike Virtual Reality (VR), which creates a fully artificial environment, AR enhances the real world by overlaying digital information—such as images, sounds, or other data—on top of the user's physical surroundings. With the rapid advancement of smart phones, wearable devices, and 5G connectivity, AR is emerging as a transformative technology with applications across diverse sectors.

AR is a technology that superimposes computer-generated content onto the real world, blending digital components with our physical environment in real-time. This is achieved through devices like smart phones, AR glasses (e.g., Microsoft HoloLens, Magic Leap), and head-up displays (HUDs).



AR is contributing to the development of smart cities by enabling real-time navigation, urban planning visualization, and public safety enhancements .

Example: AR way finding apps can help citizens and tourists navigate complex public spaces like airports or train stations.

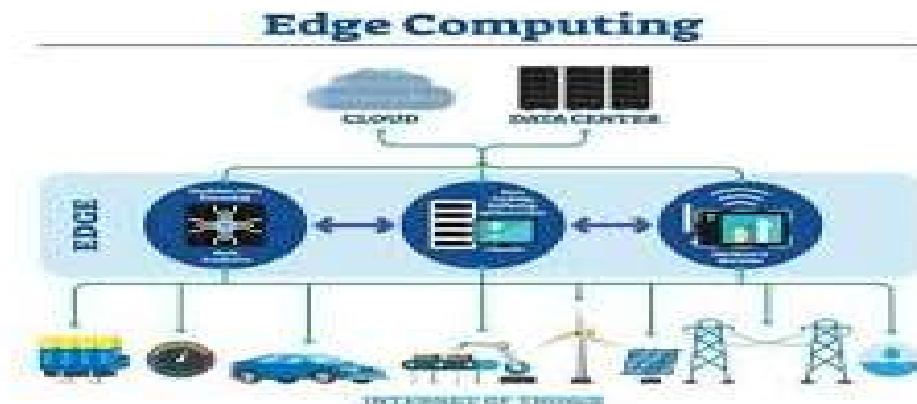
In Conclusion, Augmented Reality represents a powerful shift toward immersive, interactive technology. As AR continues to evolve, it will redefine how we learn, work, shop, and play. The fusion of the physical and digital worlds through AR promises a future where information is seamlessly integrated into our daily lives—truly marking it as the future of immersive technology.

EDGE COMPUTING: THE FUTURE OF DATA PROCESSING

Mr. S K Sankar
Assistant Professor, CSE Department

In today's data-driven world, where billions of devices generate immense volumes of information every second, traditional cloud computing is facing new limitations. Enter edge computing—a transformative technology that processes data closer to where it's generated, reducing latency, improving speed, and enhancing privacy.

In today's data-driven world, where billions of devices generate immense volumes of information every second, traditional cloud computing is facing new limitations. Enter edge computing—a transformative technology that processes data closer to where it's generated, reducing latency, improving speed, and enhancing privacy.



As technologies like smart homes, autonomous vehicles, wearable devices, and industrial automation expand, the demand for instantaneous data processing grows. For example, a self-driving car cannot afford the delay of sending data to a remote server for analysis—it needs to make split-second decisions locally.

Edge computing doesn't aim to replace cloud computing—it complements it. While edge handles time-sensitive data, cloud systems are still ideal for heavy analytics, long-term storage, and broader business intelligence.

In Conclusion, Edge computing represents the future of data processing—distributed, intelligent, and immediate. As devices become more connected and data-hungry, bringing computation to the edge is no longer a luxury, but a necessity for innovation and growth.

The Future of Image Processing: How Explainable AI (XAI) is Set to Revolutionize the Field

Mrs. D. Uma
Assistant Professor, CSE Department

Artificial intelligence (AI) has rapidly transformed image processing, enabling advancements in facial recognition, medical diagnostics, and autonomous vehicles. However, traditional AI models often function as "black boxes," making their decision-making processes obscure. Explainable AI (XAI) is emerging as a game-changer, ensuring transparency, trust, and interpretability in AI-driven image processing.

The Role of XAI in Image Processing:

XAI techniques aim to provide human-understandable explanations for AI models' decisions. In image processing, where models analyze, classify, and enhance images, XAI helps developers and users interpret results more effectively, enabling informed decision-making and improving reliability.

One of the biggest advantages of XAI in image processing is its ability to enhance trust in AI-powered solutions. For instance, in healthcare, AI systems assist radiologists in detecting tumors in medical scans. XAI ensures these systems provide explanations for why a particular region was highlighted, leading to better physician confidence and reducing misdiagnoses.

Key Aspects of XAI Transforming Image Processing:

Several aspects of XAI contribute to its revolutionary potential in image processing:

1. Feature Visualization & Interpretability

XAI allows deep learning models to visualize learned features, ensuring clarity on why certain patterns in images are emphasized. This helps researchers identify whether the model is accurately detecting relevant features or is misled by irrelevant noise.

2. Saliency Maps & Attention Mechanisms

XAI techniques such as saliency maps and attention mechanisms highlight areas in an image that influence AI decisions. These tools enhance transparency, ensuring the model makes decisions based on critical image regions rather than arbitrary data points.

3. Bias Detection & Ethical AI Implementation

AI models can inherit biases from training datasets, affecting outcomes in facial recognition or medical imaging. XAI helps uncover biases, allowing developers to adjust models accordingly, ensuring ethical and fair AI deployment.

4. Robust Decision-Making in Autonomous Systems

In applications like self-driving cars, AI processes real-time visual data to make decisions. XAI strengthens these systems by providing interpretable explanations for decisions, enhancing safety and regulatory compliance.

The Future Impact of XAI in Image Processing

The integration of XAI into image processing is poised to redefine the industry by fostering trust and accelerating adoption in critical areas like healthcare, security, and automated systems. As XAI techniques continue to evolve, AI-driven image processing will become more transparent and accountable, ensuring ethical and effective applications in real-world scenarios.

XAI bridges the gap between AI's predictive power and human comprehension, making AI a reliable assistant rather than an obscure decision-making entity. In the future, we can expect XAI-driven image processing models to set new standards, revolutionizing fields that rely on AI-based visual analysis.

By prioritizing interpretability, fairness, and transparency, XAI is not just enhancing AI-driven image processing—it is transforming the way we interact with intelligent systems.

Here are some impactful examples of Explainable AI (XAI) applications in image processing that you can include in your article:

1. Medical Imaging & Diagnostics

XAI enhances AI-driven medical imaging by providing interpretable results in MRI, CT scans, and X-rays. It helps radiologists understand why an AI model flagged a particular region as potentially cancerous.

2. Autonomous Vehicles & Traffic Analysis

XAI improves transparency in self-driving car vision systems, ensuring AI decisions (like detecting pedestrians or obstacles) are explainable. Used in traffic monitoring to analyze congestion patterns and predict accidents with interpretable insights.

3. Security & Facial Recognition

XAI helps in fraud detection and surveillance, ensuring AI-driven facial recognition systems explains why a match was made. Prevents biases in biometric authentication by highlighting decision-making factors.

4. Agriculture & Environmental Monitoring

AI-powered crop disease detection benefits from XAI by explaining why certain areas of a plant are flagged as diseased. Used in satellite image analysis to track deforestation and climate changes with interpretable AI models.

5. Retail & E-commerce

XAI improves product recommendation systems by explaining why an item is suggested based on image analysis. Helps in visual search engines, where users upload images to find similar products, ensuring transparency in AI-driven matches.

These examples showcase how XAI is revolutionizing image processing by making AI decisions more transparent, trustworthy, and interpretable.

Beyond Instructions: How AI Learns on Its Own

Mrs. P.Lakshmi Satya
Assistant Professor, CSE Department

Machine learning, a key branch of artificial intelligence, focuses on enabling computers to learn from data and make decisions without being explicitly told what to do. Within this field, two important techniques continual learning and unsupervised learning—are becoming increasingly relevant as technology advances. Continual learning, also known as lifelong learning, refers to a machine's ability to keep learning over time, acquiring new skills or knowledge without losing what it has already learned. This method is inspired by the way humans learn throughout their lives, steadily building on what they already know. For instance, a smart assistant might first learn to answer questions and later adapt to control smart home devices, remembering both tasks efficiently. This ability is crucial because, in many traditional systems, learning new information can overwrite or erase older knowledge, a problem known as catastrophic forgetting. Continual learning solves this by allowing the system to update itself gradually without resetting its past knowledge. On the other hand, unsupervised learning involves training a machine on data that has no labels or instructions. The system must figure out patterns, similarities, or structures in the data without being guided toward a specific outcome. This is similar to giving someone a box of mixed puzzle pieces and asking them to group similar pieces together without showing them the final picture. It's especially useful when working with large, unorganized datasets, such as social media content, customer reviews, or financial transactions. Applications of unsupervised learning include organizing data into clusters, detecting unusual behavior like fraud, or creating recommendation systems for online platforms. When combined, continual learning and unsupervised learning create machines that are not only able to learn without supervision but also continue to improve and adapt over time. This combination is highly valuable in areas where environments change constantly, such as robotics, healthcare, cybersecurity, and autonomous vehicles. A robot, for example, could continue learning from its environment each day and organize new information automatically, improving its decision-making without human intervention. These learning methods also reduce the need for constant retraining and help machines become more efficient and intelligent. With the increasing use of artificial intelligence in everyday life, the ability for machines to learn independently and continuously is becoming essential. Instead of relying on fixed instructions or repeated human input, systems can now learn naturally and flexibly, much like people do. In summary, continual learning allows machines to build and retain knowledge over time, while unsupervised learning helps them explore and understand raw data without guidance. Both methods are shaping the future of machine learning, making AI systems more capable, responsive, and intelligent in solving real-world problems.

Agentic AI Meets Green Computing: Optimizing Energy for a Sustainable Tomorrow

Mr. K. V. V. Subba Rao
Assistant Professor, CSE Department

Agentic AI is revolutionizing green computing by autonomously optimizing energy efficiency, reducing waste, and enhancing sustainability without requiring constant human intervention. Unlike traditional AI systems that follow predefined instructions, agentic AI dynamically adapts to real-time environmental conditions, making intelligent decisions to minimize resource consumption. In smart energy grids, AI predicts demand fluctuations, balances distribution, and optimizes consumption, reducing energy wastage. It also enhances sustainable data centers by efficiently managing server workloads, minimizing unnecessary power use, and deploying AI-driven cooling mechanisms that adjust to environmental conditions, significantly lowering energy consumption. Additionally, AI improves recycling efficiency with automated sorting systems that accurately identify waste materials and optimizes industrial production to prevent surplus and minimize material waste. In urban sustainability, AI-powered traffic management systems analyze patterns to reduce congestion and emissions, while autonomous water management systems detect leaks and optimize distribution to conserve resources. The integration of agentic AI into green computing extends beyond infrastructure to encompass ethical waste management, optimizing circular economies by streamlining the identification and processing of recyclable materials. These advancements are particularly crucial as industries and governments emphasize sustainability efforts, positioning agentic AI as a cornerstone in achieving environmental goals. By intelligently managing resources and autonomously minimizing waste, agentic AI is paving the way for a future where computing systems align with ecological preservation, accelerating global efforts toward sustainability. Its ability to enhance energy efficiency, promote responsible consumption, and foster ethical AI deployment ensures that technological progress complements environmental responsibility. As AI-driven green computing becomes more advanced, agentic AI will continue redefining standards for energy-conscious digital ecosystems, ultimately transforming the way industries approach sustainability in technology. With its capacity to autonomously optimize energy use across multiple sectors, agentic AI stands as an essential force in shaping next-generation green computing, driving innovation toward a more sustainable and environmentally responsible digital future.

Deep Learning VS Machine Learning and Artificial Intelligence

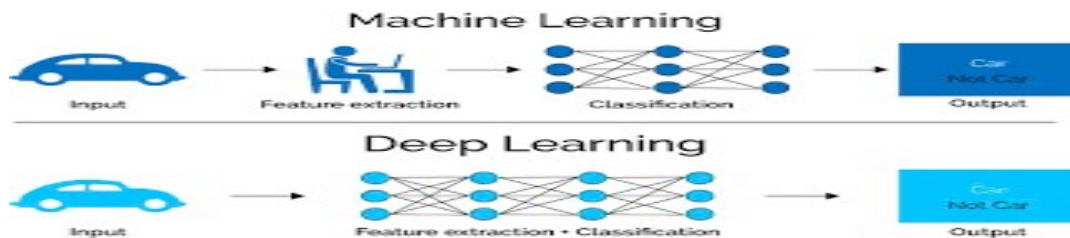
Mrs. T. N. V. Durga
Assistant Professor, CSE
Department

Deep learning is a type of machine learning that uses artificial neural networks to learn from data, similar to how the human brain works



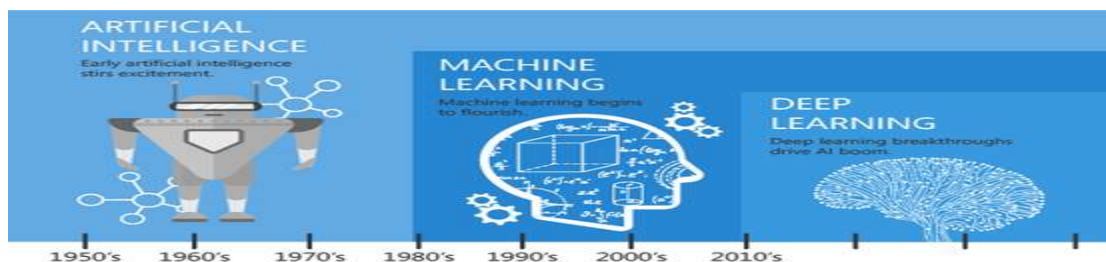
Machine learning v/s Deep learning

Machine learning and deep learning are both types of AI. In short, machine learning is AI that can automatically adapt with minimal human interference.



Artificial intelligence v/s Deep learning

At its most basic level, the field of artificial intelligence uses computer science and data to enable problem-solving in machines.



Conclusion: It is better to develop any environment to satisfy the needs by usage of deep learning combination of machine learning and artificial intelligent.

The Future of Creativity with Generative AI: Human-AI Co-Creation

Ms. A Harini
Assistant Professor, CSE Department

As we move deeper into the 21st century, the boundaries of creativity are being radically expanded by the emergence of generative artificial intelligence (AI), ushering in a transformative era of human-AI co-creation. Generative AI refers to advanced machine learning models capable of producing novel content—including text, images, music, video, and even complex designs—based on patterns learned from massive datasets. Far from replacing human creativity, these technologies are rapidly evolving into collaborative partners that amplify and extend the creative capacities of individuals and teams across diverse fields. By integrating human intuition, emotion, and cultural context with AI's unparalleled speed, scalability, and pattern recognition, co-creative workflows enable a new mode of innovation that blends the best of both worlds. This collaborative paradigm is democratizing creativity by lowering traditional barriers such as technical expertise, time, and resources, allowing a broader and more diverse population to participate in creative processes. From artists and writers to musicians, designers, filmmakers, and marketers, the symbiosis between humans and AI fosters unprecedented experimentation, rapid prototyping, and iteration. The generative AI tools provide countless variations and novel ideas that challenge creators to think beyond conventional limits and reimagine their crafts. Yet, this new frontier also raises significant questions about ethics, authorship, and intellectual property, as the lines blur between human-generated and machine-generated content. Transparent frameworks and regulations are urgently needed to address concerns around authenticity, ownership, and the responsible use of AI-generated works. Despite these challenges, the human element remains central—generative AI lacks the lived experience, emotional depth, and moral judgment that underpin meaningful creativity. Instead, it functions as an empowering extension of human imagination, a co-creator that suggests possibilities rather than dictates outcomes. Looking ahead, the future of creativity lies in this synergistic partnership where humans and machines collaborate fluidly, each complementing the other's strengths. This fusion heralds a new creative renaissance, one marked by greater inclusivity, innovation, and impact, enabling humanity to explore ideas, narratives, and expressions previously unimaginable. As AI continues to advance, embracing co-creation will be essential for artists, innovators, and organizations striving to remain relevant and visionary in a rapidly evolving cultural landscape. Ultimately, generative AI is not the end of creativity but a powerful catalyst that redefines what it means to create in the digital age—opening pathways to novel art forms, enriched storytelling, and inventive problem-solving that celebrate the dynamic interplay between human ingenuity and artificial intelligence.

Digital Twins: Bridging Real and Virtual Worlds

Mrs. P Kanaka Tulasi
Assistant Professor, CSE Department

Digital Twin technology is revolutionizing the way we interact with physical systems by creating dynamic digital replicas that mirror real-world objects, processes, or environments. These virtual counterparts are powered by real-time data collected through IoT sensors, combined with simulation models and machine learning algorithms. As a result, digital twins offer deep insights, predictive capabilities, and enhanced decision-making by virtually replicating the behaviour and performance of their physical counterparts.

Initially developed in aerospace and manufacturing, digital twins are now being adopted across industries such as healthcare, transportation, energy, and urban planning. For example, in manufacturing, a digital twin of a machine can predict equipment failures before they occur, reducing downtime and maintenance costs. In healthcare, personal digital twins are being developed to simulate patient health and treatment responses using data from wearables and medical records.

Smart cities utilize digital twins to model traffic flows, energy usage, and infrastructure health, allowing city planners to optimize operations and respond proactively to issues. These models also support sustainability by enabling efficient resource management and disaster readiness.



Technologically, digital twins integrate IoT, cloud and edge computing, AI, and big data analytics. With the growing adoption of 5G and edge computing, these systems are becoming more real-time and scalable.

Despite the promise, challenges remain. These include ensuring data security, model accuracy, system interoperability, and managing the costs of deployment. Ethical concerns like data privacy and transparency also demand attention.

In conclusion, digital twins are more than virtual models—they are intelligent systems that enable a deeper understanding and control of the physical world. As this technology continues to evolve, it is poised to transform industries by bridging the real and virtual with unprecedented precision.

The Evolution of AI in Medicine

P Sai Ganesh
23A31A0515

Artificial intelligence (AI) has revolutionized medicine, transforming the way diseases are diagnosed, treated, and prevented. From simple rule-based systems in the early days to sophisticated machine learning models today, AI continues to push the boundaries of healthcare innovation.

Early Beginnings

The journey of AI in medicine began with expert systems in the 1960s and 70s. These were programmed with medical knowledge to assist doctors in diagnosing diseases. While useful, they lacked the ability to learn or adapt.



The Human Side of AI in Medicine

The words can feel a bit cold, can't they? But in hospitals and clinics across the world, AI isn't some futuristic machine rolling down the hallway, it's quietly helping doctors care for people like you and me. Imagine your grandmother walking into a clinic for a routine checkup. Her doctor, with years of wisdom in her eyes, consults an AI tool that analyzes Grandma's blood-work, genetic background, and past scans all in seconds.

Every Revolution Has a Beginning

Back in the 60s and 70s, medicine first dipped its toes into the world of AI. Computers were clunky and slow, but researchers were already dreaming big. They built "expert systems", kind of like really smart flowcharts. They couldn't think for themselves, but they could help doctors make tricky decisions. It wasn't perfect, but it planted the seed.

Working Hand-in-Hand

Today, AI isn't meant to replace anyone. It's a teammate. It can read lab results in record time, guide robotic arms in the OR, or remind nurses when patients need extra monitoring. Some tools even pick up on emotion, a pause in your voice, a drop in your mood, the kind of cues a busy doctor might miss during a rushed visit. And in underserved areas where specialists are rare, AI becomes a bridge, bringing high-quality insights to places that need them most. It helps the healing, but never forgets the human.

Machine Learning in Disease Predictions and Preventions

Veera Sai Prudvi Chaitanya
23A31A05J4

Machine learning is turning futuristic visions into present-day realities. It's quietly revolutionizing healthcare, not with robots in lab coats, but with algorithms that spot the invisible, guide treatment choices, and keep patients a step ahead. And behind every line of code is a very human goal: better, earlier, more compassionate care.

Seeing Tomorrow: How Machine Learning Is Changing Disease Prediction and Prevention

There was a time when we didn't visit the doctor until something felt wrong, a cough that lingered, a strange ache, a sense that something just wasn't right. But today, medicine is becoming smarter and more proactive, thanks in large part to machine learning. This powerful technology helps predict illness before symptoms surface and guides prevention strategies tailored to each individual. It's not just changing treatment; it's reshaping our entire approach to staying healthy.

From Patterns to Predictions

At its core, machine learning is about learning from data, millions of patient records, lab results, scans, and more. It doesn't just look at one symptom, but thousands of variables at once, identifying subtle patterns that the human eye might miss. Imagine a program that's analyzed the health data of millions of people. It starts to notice that those with a particular heart rhythm, combined with a certain lifestyle and genetic trait, are more likely to develop a heart condition in the next five years. It then uses that knowledge to flag the risk in someone new, someone who feels totally fine today.



Personalized Prevention: One Size Doesn't Fit All

The beauty of machine learning lies in its ability to personalize healthcare. We're moving past general recommendations like "drink more water" or "exercise daily," and toward advice that's just for you. Say your wearable device shows your sleep is disrupted, your heart rate has changed slightly, and your stress levels are higher than normal. Machine learning can connect those dots, suggesting you're at risk for hypertension—even if you're young and active. Your doctor then works with you on a personalized prevention plan, catching what could have gone unnoticed.

Neuromorphic Computing: Redefining Intelligence with Brain-Inspired Technology

Amrutha Lakshmi
23A35A0515

Neuromorphic computing is emerging as a transformative force in artificial intelligence and computing architecture by mimicking the structure and functioning of the human brain. Unlike traditional von Neumann models that separate memory and processing units, neuromorphic systems integrate them, enabling massively parallel processing with ultra-low power consumption. Inspired by the behavior of biological neurons and synapses, neuromorphic chips leverage spiking neural networks (SNNs) to perform complex cognitive tasks efficiently and in real time.

One of the most significant advantages of neuromorphic computing lies in its ability to process sensory data — such as vision, hearing, and touch with exceptional energy efficiency, making it ideal for edge AI applications. Devices equipped with neuromorphic hardware can analyze large streams of data locally, reducing dependency on cloud infrastructure and drastically minimizing latency and energy usage. This is particularly critical for autonomous vehicles, smart wearables, and real-time robotics, where responsiveness and battery life are paramount.

In smart environments, neuromorphic processors enable adaptive learning by continuously evolving their response based on context and experience. This opens the door to intelligent IoT systems capable of learning from their surroundings without constant reprogramming. Additionally, neuromorphic hardware supports asynchronous event-driven computation, allowing systems to react only when necessary much like a human brain ignoring unnecessary stimuli further enhancing computational efficiency.

Beyond hardware, neuromorphic computing fosters new directions in AI development by promoting biologically plausible learning methods that move away from traditional backpropagation. This shift not only enhances interpretability and robustness but also aligns AI development more closely with neuroscience, paving the way for more natural and intuitive machine intelligence.

As leading tech companies and research institutions, including Intel (with its Loihi chip), IBM, and the Human Brain Project, push the frontiers of neuromorphic design, the potential for widespread adoption grows. In a future increasingly defined by ubiquitous AI, neuromorphic computing promises to redefine the foundations of machine learning by marrying biological inspiration with silicon-based logic.

With its unparalleled energy efficiency, real-time adaptability, and cognitive mimicry, neuromorphic computing is set to play a pivotal role in shaping sustainable, intelligent, and human-like computing systems of the future.

Enhancing Trust in AI-Driven Healthcare Decisions with Explainability

Kushal Padala
23A31A0513

In the rapidly evolving realm of healthcare, artificial intelligence (AI) has become a transformative force from early disease prediction to robotic-assisted surgeries. However, as these models increasingly influence life-altering decisions, a critical question emerges: ***Can we trust what we don't understand?*** Enter Explainable AI (XAI), a movement at the intersection of transparency, ethics, and clinical confidence.

AI models like deep neural networks excel at pattern recognition but often operate as “black boxes,” leaving clinicians and patients in the dark about how certain conclusions are drawn. This opacity poses a real challenge in clinical settings where accountability, accuracy, and empathy are essential. Without explainability, even the most accurate model can be met with scepticism.



XAI addresses this gap by making AI predictions understandable and traceable. For instance, if an AI recommends a certain cancer treatment, XAI tools like SHAP (Shapley Additive explanations) or LIME (Local Interpretable Model-agnostic Explanations) can highlight which features such as age, genetic markers, or lifestyle factors contributed to the decision. This demystification allows healthcare professionals to validate outputs, reducing blind reliance on algorithms and restoring human oversight. Trust, however, isn't built solely on technical transparency. It also demands collaborative design, where developers, clinicians, and ethicists co-create systems with interpretability baked in from the start. Visual dashboards, natural language explanations, and interactive diagnostic tools are all part of the growing toolkit to enhance usability and confidence.

Beyond clinical trust and usability, explainability also plays a crucial role in **addressing ethical and legal accountability**. In sensitive domains like healthcare, where AI decisions can significantly impact a person's life, explainability ensures that systems comply with regulations such as the GDPR or the proposed EU AI Act. More importantly, it empowers patients by fostering shared decision-making, where individuals are not merely subjects of AI output but active participants in their own care. As AI evolves, this human-centric approach to transparency may be the key to sustaining both innovation and integrity in modern medicine.

Adaptive Robotics: How Robots Learn to Evolve in Dynamic Environments

N. Sai Charan Teja

23A31A05B8

Adaptive robotics represents a growing field within artificial intelligence that focuses on developing machines capable of adjusting their behaviour in response to changing environments. Rather than following fixed instructions, adaptive robots leverage continual learning and unsupervised learning to improve over time without requiring constant human intervention.

Continual learning, also known as lifelong learning, allows robots to progressively build upon their existing knowledge while retaining past skills. This enables them to expand their capabilities across tasks without “forgetting” what they’ve already learned—a common challenge known as catastrophic forgetting. For instance, a robot deployed in a hospital might begin with basic navigation skills, then gradually learn to recognize medical equipment, interact with patients, and assist in administrative tasks, all while preserving previously acquired knowledge.

At the same time, unsupervised learning empowers these robots to analyze raw, unstructured data without labeled instructions. They can detect patterns, group similar elements, and discover new information by observing their surroundings. In a warehouse, for example, an unsupervised learning system could enable a robot to identify different product categories, optimize storage patterns, or detect unusual item placements without needing a human to program every detail.

When these two approaches are combined, adaptive robots become self-improving agents. They not only understand their environment better over time but also respond to unforeseen situations more intelligently. For example, in agriculture, a farming robot might learn soil quality patterns, adapt watering schedules based on weather data, and adjust harvesting strategies according to crop health—all without external input.

The use of adaptive robotics is becoming crucial in environments where change is constant. In healthcare, they can assist in dynamic clinical settings by learning from new cases and adjusting patient interaction styles. In logistics, robots can streamline operations by continuously improving the way they handle and move goods. The flexibility of adaptive robots reduces the need for frequent reprogramming, making them more efficient, autonomous, and reliable over the long term.

In conclusion, adaptive robotics bridges the gap between static automation and dynamic intelligence. By combining continual learning and unsupervised learning, these systems reflect a more human-like ability to learn, adapt, and evolve. This capability is expected to redefine the future of robotics across industries, making robots not just tools, but intelligent partners in our everyday lives.

Self-Organizing Intelligence: How AI Makes Sense Without Being Told What to Do

D. Immanuelu

24A35A0507

Self-organizing intelligence is a rapidly advancing capability in artificial intelligence, built upon the foundation of unsupervised learning. Unlike traditional AI models that require labeled data to make predictions or classifications, self-organizing systems can explore unstructured data independently, identifying hidden patterns, clusters, and relationships without any predefined instructions. Much like someone entering a disordered library and naturally grouping books by author or topic, self-organizing AI brings structure and meaning to chaotic information using its own internal logic.

This ability allows machines to analyze high-dimensional datasets—such as transaction histories, social media activity, or student interactions—and make sense of them without external guidance. A common example of this in action is fraud detection: the system monitors thousands of financial transactions and flags anomalies without needing prior examples of fraudulent behaviour. In the field of education, self-organizing intelligence can be used to detect patterns in student engagement, identify learning styles, or even predict dropout risks. It also plays a key role in media and content platforms, where it can group articles, videos, or user preferences to improve personalized recommendations.

At the heart of self-organizing intelligence are techniques such as clustering, which groups similar data points together, and dimensionality reduction, which simplifies complex datasets for easier interpretation. These methods allow AI to process large volumes of information efficiently and draw meaningful conclusions without the need for exhaustive labelling.

The true strength of self-organizing systems lies in their scalability. As the world generates more unstructured data—ranging from sensor outputs to online content—traditional supervised learning models struggle to keep up due to the need for human-annotated data. Self-organizing AI, however, thrives in such environments, adapting in real-time and continuously learning from new data.

In summary, self-organizing intelligence represents a major step forward in developing AI that is flexible, autonomous, and capable of functioning in ever-changing data landscapes. Its potential to power intelligent decision-making across industries makes it a cornerstone of next-generation artificial intelligence.

Thinking Smaller: How Quantized Language Models Are Changing AI

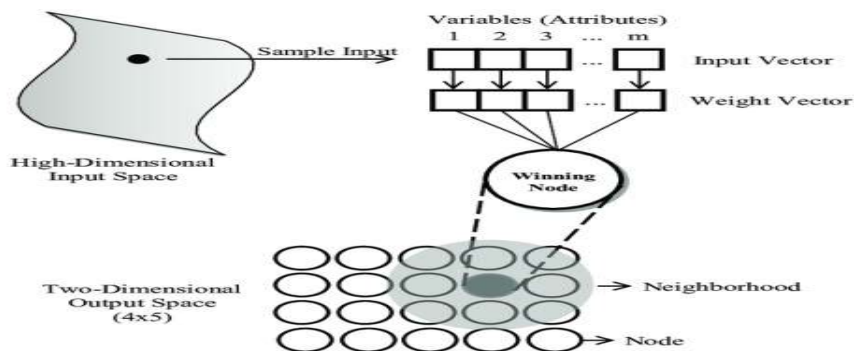
Yeswanth Madasu

23A31A05B5

Large language models (LLMs) have transformed artificial intelligence, enabling machines to understand and generate human-like text. However, their enormous size and resource demands limit where and how they can be used. To address this, researchers apply a technique called quantization, which reduces a model's memory and processing requirements with minimal loss in performance. Quantization works by converting high-precision numerical values used in the model, such as 32-bit floating points, into lower-precision formats like 8-bit integers. This drastically reduces model size and speeds up computation. While some accuracy is lost, carefully applied quantization preserves core functionality and allows models to run efficiently on everyday hardware.

This technique is essential for deploying language models on mobile phones, embedded systems, and devices with limited power or memory. For instance, quantized models enable offline virtual assistants, translation tools, or AI services in areas with unreliable internet. When combined with other optimization methods like pruning and distillation, quantization further improves efficiency without heavily compromising performance.

Recent research has shown that with techniques like quantization-aware training, even very large models can retain most of their original accuracy after compression. This allows organizations to scale AI applications across a wide range of use cases, from personal productivity tools to mission-critical systems in healthcare or security, while keeping infrastructure costs low.



In a world where AI needs to be fast, portable, and accessible, quantization ensures that powerful language models are no longer restricted to data centres. Instead, they become practical tools that can operate across a wide range of environments. By compressing models intelligently, quantization helps bring advanced AI capabilities to more users, devices, and industries.

Faculty Publications:

1. Personalized recognition system in online shopping by using deep learning

Dr D V Manjula , HOD, CSE Department

ABSTRACT:

This study presents an effective monitoring system to watch the Buying Experience across multiple shop interactions based on the refinement of the information derived from physiological data and facial expressions. The system's efficacy in recognizing consumers' emotions and avoiding bias based on age, race, and evaluation gender in a pilot study. The system's data has been compared to the outcomes of conventional video analysis. The study's conclusions indicate that the suggested approach can aid in the analysis of consumer experience in a store setting.

2. Correlation-Based Comparative Machine Learning Analysis for the Classification of Metastatic Breast Cancer Using Blood Profile

Dr D V Manjula , HOD, CSE Department

ABSTRACT:

Histopathological and mammography image-guided diagnosis is a common practice for the detection of cancer grade, which is often associated with poor survival outcomes in breast cancer patients. A deep learning (DL) based clinical decision support system was developed for histologic grading of breast cancer, which often requires invasive procedures or expensive imaging equipment. Hence, our study aimed to establish a machine learning model based on simple blood profile data. The dataset consists of blood profiles of 1250 breast cancer patients and 259 normal subjects. Statistical methods were used to select the relevant feature for machine learning model development. Selected features were fitted into various Machine Learning classifiers to predict breast cancer with highest accuracy. Correlation-based feature selection revealed that blood profile ratio counterparts were statistically significant ($p < 0.05$) and were used for the classification of metastatic breast cancer patients as compared to normal subjects. The ensemble stacking classifier outperformed other algorithms with an accuracy, sensitivity, specificity, and F1 score with values of 96%, 98%, 98% and 98% respectively and it can be used for non-invasive laboratory-based diagnosis for early prediction of breast cancer.

3. An Ensemble Neuro Fuzzy Algorithm For Breast Cancer Detection And Classification

Dr D V Manjula , HOD, CSE Department

ABSTRACT:

Breast cancer remains a critical global health concern, necessitating advanced and accurate diagnostic tools. This study introduces an Ensemble Neuro-Fuzzy Algorithm (ENFA) designed for the detection and classification of breast cancer. In the background, we address the limitations of existing methods, emphasizing the need for enhanced accuracy and interpretability in diagnostic models. The methodology involves the fusion of neuro-fuzzy systems within an ensemble framework, leveraging the complementary strengths of both neural networks and fuzzy logic. The primary contribution lies in the development of a robust ENFA, which not only improves diagnostic accuracy but also provides interpretable insights into decision-making processes. The ensemble nature of the algorithm enhances resilience and generalization across diverse patient profiles. Experimental results demonstrate superior performance compared to existing methods, showcasing heightened sensitivity and specificity in breast cancer detection. The findings underscore the potential of ENFA as a reliable tool for early and accurate breast cancer diagnosis. This research signifies a significant step towards advancing the efficacy of computational models in medical diagnostics.

4. Investigating the Impact of Maternal Characteristics and Smoking on Birth Weight: An Ensemble Regression Analysis

Dr D V Manjula , HOD, CSE Department

ABSTRACT:

Low birth weight is a significant public health concern associated with increased risk of infant mortality and long-term health issues. Understanding the maternal factors that influence birth weight is crucial for developing effective interventions to improve neonatal outcomes. This study investigates the relationships between birth weights and maternal characteristics including gestation period, age, height, weight, and smoking status. The analysis begins with data preprocessing, including handling missing values through imputation techniques. Then descriptive statistics and correlation analysis are computed to summarize the central tendencies, variability and correlation between features in the dataset. An ensemble regression model is employed to assess the influence of gestation period, age, height, weight, and smoking status on birth weight. An ensemble Random Forest regressor model performed high R2 score. The presented work in this study provides valuable insights into the factors influencing birth weight, emphasizing the significant impact of maternal smoking and predicting birth weight.

5. A novel user centric privacy mechanism in cyber physical system

Manas Kumar Yogi Asst. Prof., CSE Dept

ABSTRACT:

User-centric privacy preservation is of paramount importance in the realm of Cyber-Physical Systems (CPS), where making decisions based on nature of data is crucial. This abstract presents a novel approach to safeguarding user privacy within CPS environments by leveraging user query trends and dataset trends while incorporating the principles of differential privacy. By meticulously analyzing historical query patterns and dataset dynamics, this methodology empowers users to retain control over their sensitive data. The application of differential privacy techniques ensures that individual user information remains confidential while enabling comprehensive data analysis to unveil valuable insights, trends, and changes in data distribution. This approach fosters a dynamic privacy ecosystem where users can interact with CPS systems, query their data, and extract valuable knowledge, all while preserving their personal privacy. As we navigate the evolving landscape of CPS, characterized by increasing interconnectivity and data sharing, this user-centric privacy framework not only guarantees data protection but also ushers in a new era of responsible data-driven decision-making, where privacy and utility coexist harmoniously, ultimately enhancing the trust and confidence of users in the CPS environment.

Activities and Club Events of Pragati

Pragati Toastmasters Club





NSS Volunteers

Pragsoft Club





AR-VR Club



Rotaract Club