

SCHOOL OF BUSINESS AND MANAGEMENT

DATA GEEK MBA-BUSINESS ANALYTICS

FROM SUTHRAVIDHI TO MODERN ALGORITHMS: THE TIMELESS POWER OF NUMBERS IN BUSINESS DECISION MAKING

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EDITOR'S DESK

"VENTURING INTO A GIST OF THOUGHT"

DR. ROSEWINE JOY

EDITOR IN CHIEF, BUSINESS ANALYTICS NEWSLETTER

In an era where data not only fuels decision-making but also shapes the fabric of technological evolution, the significance of analytics continues to transcend conventional boundaries. This edition of our Business Analytics newsletter, titled "Sutravidi to Modern Algorithm: The Timeless Power of Numbers" embarks on a journey through the historical and contemporary impact of numerical intelligence in shaping industries, innovations, and insights.

From the ancient wisdom of Sutravidi—where mathematical principles were deeply intertwined with science and philosophy—to the modern algorithms that drive artificial intelligence, machine learning, and predictive analytics, numbers have remained the cornerstone of progress. Today, in a world where data flows ceaselessly, businesses leverage these numerical foundations to optimize strategies, mitigate risks, and unlock unprecedented opportunities.

In this issue, we explore how analytical methodologies, rooted in time-honored mathematical concepts, continue to revolutionize industries. From financial forecasting and healthcare analytics to supply chain optimization and Al-driven personalization, the power of numbers is omnipresent. We dive into case studies that illustrate how data-driven decision-making is not just a contemporary necessity but a continuum of historical intelligence applied through cutting-edge technology.

As we bridge the wisdom of the past with the computational prowess of the present, we are honored to feature exclusive insights from industry leaders. This edition includes an enlightening conversation with Dr. Abhijit Guha, Head of Generative AI, NLP & Computer Vision at Fractal.AI, and Dr. Srinivas KS, CTO at Rendus Technologies, who share their perspectives on the transformative power of analytics across domains.

We extend our deepest gratitude to our guiding forces whose unwavering support has been instrumental in our journey. Our heartfelt appreciation goes to our Dean, Dr. Jain Mathew, and Associate Deans, Dr. Sathiya Seelan B and Dr. Jeevananda S, for their encouragement. A special thanks to our HoDs, Mareena Mathew and Krishna M.C., for their leadership and guidance. Above all, we sincerely thank the Head of Specialization-BA, Dr. Lakshmi Shankar Iyer, whose vision has been pivotal in shaping this newsletter's discourse.

We invite you to delve into this issue, where history meets modernity, and where the timeless power of numbers continues to chart the future of analytics. Happy reading!

Best Regards, Dr. Rosewine Joy Associate Professor School of Business and Management

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INTERVIEW

"THROUGH THE SPECTRUM OF REAL WORLD INSIGHTS"



DR ABHIJIT GUHA

CLIENT PARTNER (VP) | HEAD OF GENERATIVE AI, NLP & COMPUTER VISION AT FRACTAL.AI | PHD, DATA SCIENCE | AI STRATEGY & INNOVATION

HOW DO YOU SEE GENERATIVE AI AND NATURAL LANGUAGE PRO- CESSING (NLP) RESHAPINGTHE LANDSCAPE OF FINANCIAL SERVICES, INSURANCE, AND HEALTHCARE ANALYTICS IN THE COMING YEARS?

Generative AI and NLP are set to transform financial services, insurance, and healthcare in ways we once imagined only in the future. These technologies will make processes faster, smarter, and more personalized, reducing manual effort and improving decision-making.

In financial services, AI will act as an intelligent assistant—detecting fraud, analyzing risks, and even predicting market trends. Imagine a world where investment advice is instantly tailored to your needs or where compliance reports are generated in seconds instead of weeks. AI-powered chatbots and document processing tools will further enhance customer experience and operational efficiency.

In insurance, AI will streamline claims processing, automate underwriting, and provide better policy recommendations. Instead of waiting days for a claim approval, AI could process it in minutes by extracting key information from documents and past records. Insurers will be able to offer more personalized policies, ensuring better coverage at the right price.

In healthcare, AI will assist doctors in diagnosing diseases, summarizing medical reports, and even recommending treatments. Think of a system that can analyze thousands of medical records and provide insights in real-time—helping doctors make more informed decisions while improving patient care.

With Generative AI, these industries are not just becoming automated; they are becoming intelligent, responsive, and truly customer-focused. The future of analytics is no longerjust about data—it's about understanding, predicting, and acting with unmatched speed and accuracy.

FROM YOUR EXPERIENCE IN RD AND LEADING DATA SCIENCE TEAMS, WHAT KEY SKILLS AND EXPERTISE WILL BE ESSENTIAL FOR PROFESSION ALSO LOOKING TO THRIVE IN THE ERA OF GENERATIVE AI?

The era of Generative AI demands a unique blend of technical expertise, problem-solving ability, and adaptability. From my experience in RD and leading data science teams, I believe professionals looking to thrive in this space must focus on the following key skills:

Strong Fundamentals in AI,ML - A deep understanding of machine learning, deep learning, and NLP is essential. Professionals should be comfortable with transformers, diffusion models, and reinforcement learning.



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Hands-on Experience with LLMs – Working with large language models (LLMs) like GPT, LLaMA, or Gemini, fine-tuning them for tasks, and optimizing them for efficiency is crucial. Understanding prompt engineering and agentic AI will be a game-changer.

Data Engineering MLOps – The ability to handle unstructured data, build pipelines, and deploy models at scale is critical. Skills in Kubernetes, cloud platforms, and model monitoring will give professionals an edge. Mathematical Statistical Understanding – A solid grasp of probability, statistics, and optimization techniques is vital for building and fine-tuning AI models effectively.

Domain Knowledge Business Acumen – Al is only as good as its application. Understanding the business problems, industry challenges, and regulatory constraints helps in developing practical and impactful Al solutions.

Ethics Responsible AI – With bias, hallucination, and misinformation being major challenges in Gen AI, professionals must focus on building trustworthy, transparent, and responsible AI systems.

Continuous Learning Experimentation – Generative AI is evolving rapidly. Keeping up with research papers, open-source innovations, and emerging frameworks is necessary to stay ahead.

In this fast-moving field, those who can blend AI expertise with creativity, business understanding, and ethical considerations will be the ones leading the future of AI-driven transformation.

HOW DO YOU PERCEIVE THE SIGNIFICANCE OF EXPLAINABILITY AND ETHICAL AI FRAMEWORKS IN FOSTERING TRUST AND REGULATORY COMPLIANCE WITHIN THE ADOPTION OF GENERATIVE AI SOLUTIONS?

The success of Generative AI depends on trust, transparency, and accountability. Without explainability, AI modelsbecome black boxes,making it difficult for businesses, regulators, and end-users to understand their decisions. This lack of clarity can lead to biases, errors, and a reluctance to adopt AIdriven solutions. By integrating techniques like model interpretability frameworks and attention visualization, organizations can ensure that AI-generated insightsare transparent and understandable. Ethical AI is equally crucialin preventing biases,misinformation, and unintended consequences. AI systems must be continuously monitored, audited, and aligned with human values to ensure fairness and accountability. As global regulations around AI tighten, businesses must proactively adopt responsible AI frameworks to stay compliant and build credibility. When explainability and ethics are embedded into AI development, organizations can foster greater trust, drive responsible innovation, and ensure sustainable AI adoption.



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AS BUSINESSES INCREASINGLY ADOPT AI-DRIVEN DECISION-MAKING, WHAT STRATEGIC STEPS SHOULD THEY TAKE TO ENSURE A BALANCE BETWEENAUTOMATION, INNOVATION, AND HUMAN EXPERTISE?

As businesses integrate Al-driven decision-making, they must strike the right balance between automation, innovation, and human expertise to maximize efficiency without losing strategic oversight. Al should be seen as an enablerrather than a replacement, augmenting human capabilities rather than sidelining them. The first step is to clearly define where Al adds value—whether in automating repetitive tasks, enhancing data-driven insights, or improving customer experiences—while ensuring that critical thinking and ethical judgment remain human-led. Innovation should be fostered by continuously refining Al models with diverse and high-quality data, keeping human experts involved in validation and oversight to mitigate biases and unintended consequences. Organizations should also invest in upskilling their workforce, enabling employees to work alongside Al systems effectively. By building Al systems that are explainable, accountable, and alignedwith business goals, companies can create a future where automation and human expertise complement each other, driving smarter decisions and long-term success.

AS DIRECTOR OF DATA SCIENCE AT FRACTAL ANALYTICS, HOW DO YOU LEAD THE DEVELOPMENT AND IMPLEMENTATION OF GENERATIVE AI SOLUTIONS TO DRIVE BUSINESS IMPACT?

Al, Engineering, and Design—to ensure that our innovations are practical, scalable and impactful. Al forms the intelligence layer, where we leverage advanced models to enhance decision-making and automate complex workflows. Engineering ensures these models are robust, scalable, and seamlessly integrated into enterprise ecosystems. Design plays a crucial role in making Al explainable, user- centric and aligned with real business needs.

By following this structured approach, we identify high-value use cases across industries like

financial services, healthcare, and insurance, where Generative AI can drive measurable business outcomes. From ideation to deployment, we focus on research, prototyping, validation, and responsible AI practices.Collaboration is key, and we work closelywith data scientists, engineers, and business leaders to align AI capabilities with strategic goals.

Beyond technology, we emphasize talent development, ensuring that our teams continuously upskill and experiment with new AI advancements. By integrating AI, Engineering, and Design seamlessly, we enable businesses to adopt Generative AI in a way that is scalable, responsible, and transformative.



DR. SRINIVAS KS

CHIEF TECHNOLOGY OFFICER | RENDUS TECHNOLOGIES | PHD IN COMPUTER SCIENCE | "DRIVING THE FUTURE OF AI, FROM THEORY TO THRILLING REALITY!"

HAVING TRANSITIONED FROM A SOFTWARE ENGINEER TO THE MANAGING DIRECTOR OF A MULTINATIONAL CORPORATION, WHAT KEY LEADERSHIP LESSONS HAVE SHAPED YOUR APPROACH TO TECHNOLOGY AND BUSINESS STRATEGY?

Embracing first-principles thinking helped me transition from software engineering to leading a global organization. By questioning every assumption, I gained clarity and drove innovation, especially in complex fields like AI and quantum computing, where hype often overshadows feasibility. I also prioritize data-driven decision-making, as relying on measurable signals and iterative experimentation ensures long-term success, whether assessing AI projects or improving quantum algorithms. Additionally, fostering a culture of continuous learning is crucial in rapidly evolving domains. By staying updated through reading, collaborating with academic groups, and encouraging knowledge sharing, I keep the team aligned with the latest advancements. Lastly, I believe in purposeful risk-taking, particularly in areas like quantum machine learning. Taking calculated risks through rigorous experimentation and well-structured pilot programs helps avoid dead ends while unlocking significant returns.

YOUR EXTENSIVE EXPERTISE IN ARTIFICIAL GIVEN INTELLIGENCE AND LEARNING, MACHINE WHICH EMERGING ΑΙ INNOVATIONS DO YOU ANTICIPATE WILL EXERT THE MOST PROFOUND TRANSFORMATIVE INFLUENCE ACROSS INDUSTRIES OVER THE NEXT DECADE?

We're transitioning from narrowly specialized models to large-scale foundation models that can be adapted to a vast range of tasks. Their ability to generalize across multiple domains—from language understanding to molecular design—can redefine industry best practices. Deep learning excels at statistical pattern recognition, but the future may involve combining neural networks with causal reasoning frameworks or symbolic methods. Doing so will improve interpretability and decision-making in finance, healthcare, supply chains, and beyond.

As models grow larger, optimizing computational resources becomes paramount. From advanced GPUs and TPUs to specialized ASICs, hardware innovation is critical. Techniques like quantization and pruning ensure that AI models can run efficiently at scale. No longer confined to board games, RL-based approaches can optimize robotics, autonomous vehicles, and complex operational workflows (e.g., logistics routing). Addressing sim-to-real transfer, robust training, and safety constraints remains key to industrial deployment. Quantum computing leverages phenomena like superposition and entanglement to solve problems that are beyond classical methods. Key applications include Quantum Machine Learning (QML), which could revolutionize optimization and pattern discovery, and quantum simulation for breakthroughs in drug discovery and materials science.



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Additionally, quantum-resistant cryptographic schemes will be essential for secure communication systems. While still in its early stages, developing quantum-informed AI solutions and fostering industry-academia partnerships will accelerate progress toward commercial viability.

WHAT CRITICAL ATTRIBUTES DO YOU PRIORITIZE WHEN EVALUATING POTENTIAL INVESTMENTS, AND WHAT ARE THE MOST PREVALENT PITFALLS THAT EMERGING ENTREPRENEURS SHOULD BE COGNIZANT OF AND STRIVE TO MITIGATE?

I prioritize technical differentiation, where a proprietary technique—whether a novel AI algorithm, quantum-inspired approach, or unique dataset—creates a true competitive edge. Market alignment is equally critical, as even groundbreaking technology must solve real business problems and deliver measurable impact. A strong team that blends deep technical expertise with sharp business acumen is essential, especially in cutting-edge fields that require both research and execution. Lastly, the scalability of intellectual property and a clear go-to-market strategy are vital, particularly for quantum ventures still in R&D-heavy phases.

Entrepreneurs often fall into common pitfalls, such as focusing too much on valuation without achieving solid technical milestones, leading to misaligned incentives. Neglecting product-market fit can cause even the most powerful AI or quantum breakthroughs to fail. Additionally, underestimating data quality and access is a major risk, as AI relies on data, and quantum computing requires partnerships with specialized labs to refine algorithms. Lastly, scaling too quickly with emerging technology can be detrimental, as iterative learning is key to validating potential before expansion.

HOW DO YOU ENVISION ACADEMIA AND INDUSTRY FOSTERING DEEPER SYNERGIES TO BRIDGE THE EXISTING CHASM BETWEEN AI RESEARCH AND ITS PRAGMATIC DEPLOYMENT WITHIN BUSINESS ECOSYSTEMS?

Collaborative research programs, such as joint Al/quantum labs or industry-funded university research centers, accelerate innovation by allowing industry to access fresh discoveries while academics work with real-world constraints and high-quality datasets. Open-source contributions, including sharing code, datasets, and performance benchmarks, foster trust and collective progress, which is crucial for both AI and quantum computing platforms like Qiskit and Cirq. An industry-focused academic curriculum that integrates real-world case studies, co-ops, and structured practicums helps bridge the gap between theory and practical skills, ensuring a steady pipeline of talent. Additionally, incentivizing translational research through grants and rewards ensures that breakthroughs, like new quantum algorithms or large language models, move beyond labs and drive real economic impact.



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CHIEF TECHNOLOGY OFFICER | RENDUS TECHNOLOGIES | PHD IN COMPUTER SCIENCE | "DRIVING THE FUTURE OF AI, FROM THEORY TO THRILLING REALITY!"

HOW DO YOU BALANCE INNOVATION, RESEARCH, AND REAL-WORLD AI APPLICATIONS TO DRIVE MEANINGFUL ADVANCEMENTS?

Driving innovation requires constant engagement with the latest research in Al architectures and quantum algorithms. Regular replication studies and internal seminars help the team stay ahead. Rapid prototyping is key to validating real-world performance early, allowing teams to quickly test Al, quantum, or hybrid models and identify the most promising paths. Cross-functional collaboration is essential, as deep tech only succeeds when aligned with domain needs like healthcare, finance, or logistics. Pairing researchers with industry experts ensures that solutions are practical and relevant. Lastly, addressing ethical and societal concerns—such as algorithmic bias or quantum cryptographic risks—not only mitigates reputational damage but also supports long-term sustainability and positive societal impact.

AS CTO OF RENDUS AND AN AI-FOCUSED VC, HOW DO YOU BALANCE DRIVING INNOVATION WITHIN YOUR COMPANY WHILE SUPPORTING EMERGING AI STARTUPS?

I foster innovation through internal incubators, where small "innovation pods" work on moonshot ideas like new deep learning architectures or quantum advantage scenarios, cultivating an entrepreneurial culture. When investing externally, I provide more than capital, offering mentorship, domain expertise, and ecosystem partnerships—essential for AI and quantum startups navigating uncertain markets. Hosting joint seminars and hackathons creates a valuable knowledge exchange, allowing startups to gain operational insights while we benefit from fresh thinking and novel techniques. Most importantly, I maintain a humble outlook, especially in the evolving field of quantum computing, where continuous learning, open feedback, and scientific realism are key to staying adaptive and grounded.

CONCLUDING PERSPECTIVE:

Bridging academic discoveries with real-world impact is at the heart of my leadership ethos—whether that involves large-scale AI deployments or early quantum research. By maintaining a humble posture, devouring the latest literature, and fostering a dynamic exchange of ideas, I can better steward investments and guide internal teams. The synergy of AI and quantum computing stands to redefine industries in profound ways, but it requires consistent, well-directed effort and a willingness to fail fast and iterate. Ultimately, this balanced approach—firmly rooted in both technical depth and business pragmatism—is what drives sustainable, game-changing outcomes.

STUDENT ARTICLES

"THE COLLECTION OF PEN DOWN SERIES FROM OUR CEATIVE ANALYST MINDS"



Quasi-Experimental Comparison of AI-Based and Human Teaching: Impacts on Effectiveness, Engagement and Retention

ARYAN JHA 2327514

The integration of Artificial Intelligence (AI) into education has opened transformative possibilities, challenged traditional teaching highlighted methods, and their irreplaceable human elements. This study compares Al-driven instruction -exemplified by the Teach Me App, an adaptive learning platform-with conventional human-led teaching, on learning outcomes, focusing engagement, knowledge retention, and student satisfaction. AI tools like Teach provide the Me App personalized tutoring and 24/7 accessibility, but human teachers remain unrivaled in providing deeper emotional understanding and connection. The research emphasizes the need for hybrid models that blend Al's efficiency with the quidance of teachers.

FRAMEWORK

The project focuses on developing the Teach Me App and analyzing its effectiveness against human instructions. The app uses multimodal learning (text, voice, and images) and adaptive pathways addressing individual student needs. To evaluate its impact, the study employed pre-and post-tests to measure learning gains, tracked engagement through participation assessed retention metrics, via follow-up evaluations, and gauged satisfaction through student surveys. While limited by a one-size-fits-all

approach, traditional classrooms provided a baseline for comparing cognitive emotional and outcomes.

KEY INSIGHTS

This study revealed that the human teachers yielded better grades and, in the long-term, showed significantly higher student retention rates, which proved that their ability to explain tough topics keep their students and to engaged is better than that of AI. On the other hand, the AI app had better engagement as the students interacted with the AI app more frequently and were pulled in by the quick feedback system and interactive approach. Moreover, this involvement had nothing to do with the retention of students. Another rate that Al's inference was the psychological the impact on students. The students who learned using the app had less confidence in their performance, even if their performance was similar. This shows the importance of human touch.

THE ROLE OF MOTIVATION AND COMPLEXITY

factor important in particularly for oversight. retention rate, subjects. Human challenging naturally teachers incorporate motivational strategies—through

feedback personalized or empathetic support—that AI systems currently lack. The AI struggled to adapt to highly complex topics, where human touch and adaptability are needed. These insights emphasize the need for AI tools to integrate motivational frameworks, such as gamification or progress-tracking features while human educators for reserving conceptually demanding material.

REAL-WORLD APPLICATIONS AND CHALLENGES

The Teach Me App represents a scalable personalized learning solution, particularly in resourceconstrained environments. For example, the AI system can support classroom teaching by providing practice modules or some other remedial support, freeing the teachers to focus on critical thinking and creativity. However, there are still many issues, like data privacy concerns, which were also in the require Metaverse and robust safeguards for student information. Al systems do not have emotional intelligence, and because of this, they do not have the ability to address emotions and concerns The study found motivation as an related to anxiety or disengagement, student underscoring the need for human



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TOWARD A COLLABORATIVE FUTURE

The study is about the collaboration of AI systems and human teaching. For example, the AI system should be able to handle repetitive tasks like grading or foundational concept drills. At the same time, teachers can focus on mentoring their students and providing advanced problemsolving. This synergy would optimize scalability without sacrificing emotional depth. Future research should focus more on hybrid models. For example: insights from AI can be used to support human teaching or can be used in VR classrooms to combine AI tutoring with live instructor support.

CONCLUSION

Al is not a replacement for human teachers but a powerful ally. Al comes with better accessibility and data-driven insights, which can go hand in hand with the human capacity for empathy, motivation, and contextual understanding. As educational technology is evolving, the focus is shifting towards utilizing these strengths by not displacing the human touch to provide high-quality learning to the students. If challenges like data ethics and emotional intelligence gaps are addressed, human teachers and technologists can co-exist and democratize education.



IMAGE SOURCED THROUGH ED-TECH EVOLVED



Game Changer: A Data-Driven Approach to Football Player Analysis

K R MARYVALSA 2327428

The intersection of football and artificial intelligence is reshaping how clubs, analysts, and game developers evaluate player talent. A recent study collected and used the data from football video games, which is like a treasure of player like attributes speed, passing accuracy, and defensive prowess, used them and to predict performance, categorize players, and estimate their market value. This research offers an alternative approach to the intuition based traditional player scouting.

STUDY FOCUS

The study focuses on three main objectives: predicting player performance, segmenting athletes by skill sets, and estimating market value. Regression models like Random Forest and Linear Regression analyzed player characteristics like shooting accuracy and defensive capabilities to predict the player performance. The Random Forest model was the most effective in this use case. It achieved an 85% accuracy rate (R^2 score) and a mean error margin of €4.63 million, far outperforming linear models. This highlights its ability to decode complex relationships between player traits and on-field success. Next, clustering techniques like K-Means grouped players into three distinct roles:

attackers (high shooting stats, e.g., strikers with an 87 overall midfielders rating), (balanced and defense), passing and defenders (exceptional tackles and interceptions). This segmentation helps scouts identify talents. undervalued such as midfielders with underrated playmaking skills. Finally, classification models estimated market value with 98% accuracy, categorizing players into Elite, Mid-Level, and Entry-Level tiers. Factors like wage, age, and critical_for potential were instance, young players with high potential were flagged as longterm investments.

can be integrated to match statistics, injury histories, and psychological factors. Real football and virtual football can be brought together with this research.

CONCLUSION

This study shows how AI can transform football into a data-driven sport and modernize scouting. By transforming insights from game analytics into strategic insights, developers can produce immersive experiences, football clubs can make smart investments, and fans can interact with the game more deeply.

KEY INSIGHTS

Clubs will be able to minimize recruitment risks by utilizing the data-backed player profiles, and the game developers can gain insights to refine the in-game player ratings. E-sports and fantasy leagues benefit from predictive tools to optimize virtual team strategies. However, there are still some more challenges that should be addressed. The study analyzes data from football video games, and this data does not provide any real-world variables like leadership and resilience to injuries. The model





SMART DIETARY SYSTEM FOR COMPREHENSIVE HEALTH INSIGHTS

M. JOOHI 232<u>7629</u>

The groundbreaking Al-powered platform, Smart Dietary System, moves beyond static calorie counting to address overall health and aims to redefine the overall nutrition management. This system integrates food recognition, disease risk and mental health prediction, analysis to deliver dynamic and personalized dietary recommendations. This model identifies nutrient imbalances, predicts chronic diseases, and links dietary patterns to mental welloffers users with being, an actionable plan for their well being

BEYOND DIET: AI-DRIVEN HEALTH BLUEPRINT

Central to the system is its Nutrient Trade-Off Analysis, which evaluates past meals to compensate for deficiencies excesses. For or example, if a user skips a protein-rich breakfast, the platform suggests iron-heavy lunches or dinners to restore balance. Machine learning models also predict disease riskssuch as obesity (85% accuracy) and hypertension-using BMI, activity levels, and sodium intake metrics. Mental health assessments analyze sleep patterns and stress indicators, recommending interventions like mindfulness exercises or omega-3rich meals to alleviate anxiety. In trials, users adhering to the platform's meal plans reported 40% higher compliance than with generic

apps, attributed to culturally tailored like options Mediterranean or vegetarian diets. The one thing that sets this apart is the different health metrics that come along. A user with a high obesity risk (89% probability) and moderate hypertension (42%) will receive a unified plan with a combination of low-calorie meals. reduced sodium intake, and stresstechniques. management This that dietary ensures recommendations and mental health goals are also achieved. There are still challenges regarding Privacy concerns around health data collection and earlier apps' "one-size-fits-all" requires careful navigation. Future iterations could incorporate for data genetic hyperpersonalized nutrition or partner healthcare with providers to integrate medical histories seamlessly.

SYNCING WEARABLES: AI MEETS YOUR PLATE

To enhance adoption, the study emphasizes syncing with wearable devices like Fitbit or Apple Watch for real-time health monitoring, such as tracking heart rate or sleep quality. Explainable AI (XAI) dashboards are also proposed to demystify recommendations. For instance, visualizing how reduced consumption of sugar reduces diabetes risk. The database can be further expanded to include not only common foods, but also regional cuisines to improve user satisfaction. The Smart Dietary System revolutionizes personalized healthcare with the use of AI. It integrates nutrition. disease prevention, and mental well-being, it transforms meal planning from a mundane task into a proactive health strategy. As technology systems evolves, could such democratize access to holistic care. empowering users to turn everyday dietary choices into lifelong wellness habits.





FORECASTING ONION PRICES: THE ROLE OF DATA ANALYTICS

THARANGINI A 2327059

Onions are an essential element in alobal cuisine and major a agricultural commodity. However, their prices can be unpredictable, sometimes soaring and other times plummeting without warning. This instability creates serious challenges farmers. traders. for and policymakers. Sudden price fluctuations make it extremely distressing for producers and the destabilizing for consumer markets. Understanding the driving factors for price changes is, therefore, very important for better prediction and for developing effective forecasting strategies. By leveraging historical data and machine learning techniques, it uncovers the hidden relationships between climate conditions and market trends.

THE CHALLENGE OF ONION PRICE VOLATILITY

The onion supply chain is particularly sensitive to external forces like changing weather patterns, limited storage facilities, and inefficiencies in the transport. Therefore, there would often be intermittent surges or sudden dips in prices as a result of these fluctuations, which ripple through all those engaged in trade with dire economic implications. In India, where onions are a key staple, price variations, however slight, impact society and the economy very severely.

The unpredictability of price trends makes it difficult for farmers to plan their harvests which leads to overproduction and wastage or low supply and prices high. Price forecasting still relies on static data models where this means denying real time information like changes in weather conditions.

HARNESSING DATA AND WEATHER ANALYTICS FOR PRICE PREDICTION

To forecast onion prices accurately, the study integrates from data multiple sources, including NASA/POWER WCRP for meteorological parameters and Agmarknet for price trends. The analysis considers key climatic variables such as temperature, humidity, rainfall, wind speed and soil moisture. Applying machine learning algorithms, including SARIMA, LSTM, and Hybrid ARCH-Boosting models, which effectively identify patterns in pricing behavior and predict future trends precision, greater with helps capture seasonal fluctuations and detect anomalies market in behavior.

KEY FINDINGS AND MARKET INSIGHTS

The research highlights a strong relationship between weather conditions and onion prices. Among the various climatic factors analyzed, relative humidity is the

significant determinant of most price fluctuations. The study finds that colder temperatures are generally associated with higher onion prices, while warm and humid conditions contribute to lower prices. Seasonal variations also play a crucial role, with price spikes frequently occurring in October. These anomalies can be attributed to supply chain disruptions and shifts in demand during this period. The study effectively classifies market behavior by using machine learning techniques such as K-Means clustering and DBSCAN providing detection, anomaly deeper insights into how regional pricing patterns evolve.

IMPACT ON BUSINESS AND POLICY

Having a better handle on price predictions has potential to benefitting а large number of different participants. Row-crop farmers can better plan harvest strategies and temporary storages with reliable predictions about prices. This will help them steer clear of distressed sales as well as allowing them to take more informed regarding the decisions market. primarily traders, and Businesses, retailers use price forecasting to make better procurement and inventory management decisions. Predicting price fluctuation would reduce financial risks and ensure



FORECASTING ONION PRICES: THE ROLE OF DATA ANALYTICS

THARANGINI A 2327059



stability in supply chains. Onion storage and distribution companies can streamline their functioning on predictive projections and losses due to abrupt price changes can be avoided to a greater extent. These predictive models can also provide value for policymakers. Governments can use data driven insights to protect consumers and producers from market volatility by stabilising prices. Through the implementation of well-informed policies it becomes possible to reduce the harmful impact of price changes while improving the affordability and availability of essential goods like onions.

CONCLUSION

This study highlights how integrating with climate data advanced analytics can significantly improve accuracy of onion the price forecasts. The strong link between weather conditions and pricing trends underscores the need for Aldriven market intelligence tools. Expanding such models to other agricultural commodities could further strengthen global food supply chains, improve price stability, and enhance market resilience. Data analytics will ensure that agricultural markets predictable, remain sustainable, and profitable for all stakeholders as technology evolves.



IMAGE SOURCED THROUGH ESTEEMED COLUMS OF INDIA TODAY



Bringing Back Natural Beauty: Breaking Up with Microplastics

NANDINI SINGH 2327533

decades the beauty Over the industry has experienced significant change by moving away from strict beauty standards towards inclusive and sustainable practices. Even though the industry has progressed toward better standards and sustainable practices major a and health environmental issue which microplastics. persists is Skincare and cosmetic products frequently contain plastic small particles which serve as exfoliants and stabilizers yet endanger both marine organisms and human wellbeing.

Despite rising consumer awareness and increasing regulatory restrictions, many beauty brands use microplastics due to their affordability formulation and benefits. As India's beauty market expands, the demand for sustainable, microplastic-free alternatives This grows. study explores the historical and current usage of microplastics in the beauty sustainable industry, examines evaluates alternatives, and the impact of global regulations on the sector.

THE GROWING PROBLEM OF MICROPLASTICS IN BEAUTY PRODUCTS

To forecast onion prices accurately, the study integrates data from multiple sources, including NASA/POWER WCRP for

meteorological parameters and Agmarknet for price trends. The analysis considers key climatic variables such as temperature, humidity, rainfall, wind speed and soil moisture. Applying machine algorithms, including learning SARIMA, LSTM, and Hybrid ARCH-Boosting models, which effectively identify patterns in pricing behavior and predict future trends with greater precision, helps capture seasonal fluctuations and detect anomalies in market behavior.

EVOLUTION OF MICROPLASTIC USAGE IN BEAUTY PRODUCTS

Before the 1980s, beauty products relied on natural exfoliants such as sugar, oats, and crushed walnut shells. However, the widespread adoption of synthetic polymers like polyethylene (PE) and polypropylene (PP) in the late 20th century led to the dominance of microplastics in the industry. By the early 2000s, nearly 50% of beauty products contained microplastics. Their ability to enhance product performance made them an attractive option for manufacturers. However, the 2010s marked a turning point, with growing environmental concerns leading to regulations and stricter shifting consumer preferences. By 2020, 88.3% of global beauty products were microplastic-free, but India lagged at 74.8%. While international brands moved toward sustainable

alternatives, many Indian companies in the budget segment still relied on microplastics.

SHIFT TOWARDS SUSTAINABLE AND MICROPLASTIC-FREE ALTERNATIVES

Regulatory pressures and changing consumer expectations drive the movement toward beauty. microplastic-free worldwide Governments have started banning microplastics in cosmetics, forcing brands to find biodegradable alternatives. Increased transparency in builds ingredient labeling consumer trust and fosters brand loyalty. Natural substitutes such as rice powder, bamboo extract, and silica are gaining popularity as effective exfoliants and stabilizers. However, the transition comes with challenges. The study found that microplastic-free beauty products tend to be priced higher, making them less accessible to middleclass consumers. While brands like Mamaearth and The Moms Co. have embraced clean beauty, budget-friendly brands like Lakme and Himalaya continue to include microplastics in some formulations.



Bringing Back Natural Beauty: Breaking Up with Microplastics

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WHY IT MATTERS: IMPACT ON BUSINESS, SOCIETY AND ENVIRONMENT

Implementing microplastic reduction in beauty products has myriad positive aspects for business, society, and the environment. For business, change to formulations free of microplastics gives beauty brands a leading edge in the expanding clean beauty market. With increased transparency in ingredients, people will trust more and be more loyal to a brand in the long term and thus provide long-term profitability.

health risks Consumers have minimized by microplastics and, through increased awareness, also have pushed a wider demand for safe and sustainable care items. An increase in biodegradable ingredients also implies an added impetus for green chemistry and sustainable product development. At an environmental level, it sheds marine pollution and safeauards life harm while aquatic from improving water quality.

Another environmental benefit is moving toward biodegradable plantbased ingredients, thus reducing dependence on synthetic petroleumbased products and leading to a cleaner, more sustainable environment.

EMBRACING A FUTURE WITHOUT MICROPLASTICS

Sustainability has become an essential requirement for the beauty industry which stands at a pivotal turning point. Although microplastics have traditionally improved cosmetic products their environmental impact persists as an unavoidable concern. Beauty brands need to innovate and reformulate their products because regulatory bodies are enforcing stricter bans while consumers are demanding cleaner products. Moving collaboration, forward, industry consumer education, and government support will be key in phasing out microplastics. The future of beauty lies in sustainability, and the transition toward microplasticfree products will play a defining role in shaping a cleaner, greener world.





Federated Learning: A Game Changer in IoT Botnet Detection

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The rapid expansion of the Internet of Things (IoT) has transformed industries such as healthcare, smart cities, and industrial automation by enabling seamless data exchange intelligent decision-making. and However, this increased connectivity has also introduced critical security challenges, with botnet attacks emerging as one of the most severe threats. These attacks exploit vulnerabilities in IoT devices, such as weak authentication and outdated firmware, to launch large-scale cyberattacks, including Distributed Denial-of-Service (DDoS), malware propagation, and data breaches.

Traditional centralized security systems often struggle with real-time botnet detection due to limitations in scalability, latency, and privacy concerns. A decentralized, scalable, and adaptive botnet detection system using Federated Learning has been proposed to address these challenges. This system enhances security by leveraging collaborative intelligence while maintaining data privacy, making it a groundbreaking solution for protecting IoT networks.

CHALLENGES OF BOTNET ATTACKS IN IOT

The increasing number of IoT devices has resulted in an increase in cyberthreats, with botnets being a key danger. These compromised networks of devices, often without the owner's

knowledge, can be remotely commanded to perform acts of maliciousness. Weak authentication systems, outdated firmware versions, and coordination with unprotected communication databases make IoT devices most vulnerable to attacks. However, the current security solutions, such as Intrusion Detection Systems (IDS), or some centralized security frameworks, continue to fail dreadfully in curbing these kinds of threats. Some IoT devices hardly the computational possess capability required to apply invasive profilina models. Besides, centralized data collection raises privacy issues as well as is in conflict with such laws as GDPR and CCPA. With the scaling of these IoT networks, conventional security methodologies expressed have failure to invoke a hardline within the zones and respond to other evolving cyber threats.

ENHANCING IOT SECURITY WITH FEDERATED LEARNING

Federated Learning supports in decentralized model training across multiple IoT nodes that, incredibly, do not require any sharing of raw data. This keeps user privacy intact while enabling low bandwidth consumption. The Transformer-Based Self-Attention Model increases the accuracy of detection due to its capability to capture complex twork traffic patterns, hence better identification of botnet activities. Adaptive Thresholding allows detection sensitivity to be dynamically increased accordina verification of real-time to network conditions and ensures responsiveness against emerging threats. This approach offers a formidable technological edge in detection accuracy and adaptability, when compared to conventional signature-based and rule-based security solutions.

MODEL PERFORMANCE AND RESULTS

The study analyzed a publicly available IoT botnet dataset containing labeled network traffic data. Data preprocessing involved feature engineering, handling missing values, and using the Synthetic Minority Over-sampling Technique (SMOTE) to balance distributions. Several class machine-learning models were tested for botnet detection. Convolutional Networks Neural (CNN) achieved a 91% accuracy rate but struggled with detecting rare botnet variations. Recurrent Neural Networks (RNN) performed slightly better at 92% but suffered from vanishing gradient issues. Bidirectional Long Short-Term Memory (BiLSTM) also reached 91% accuracy but required high computational resources. TabNet



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provided 92% accuracy with improved interpretability, while Gated Recurrent Units (GRU) balanced high precision and recall, achieving 92% accuracy. The proposed system outperformed traditional methods by incorporating Federated Learning and Transformer-Based Self-Attention, demonstrating detection accuracy while high maintaining privacy and scalability.

HOW FEDERATED LEARNING IS RESHAPING IOT SECURITY

The decentralized, privacy-preserving botnet detection system therefore shows great potential for IoT security by decreasing the likelihood of DDoS attacks, data breaches, and malware infections, all of which actually towards contribute enhanced resilience of IoT networks. In a sense, federated learning removes the central data-aggregation process, giving a very suitable privacy option for the communities without sacrificing security measures. The scalability to which this relatively decentralized and adaptive particularly approach gives is beneficial, especially with largescale IoT networks, as it would sustainably adjust to a new attack pattern in real-time. Thus, several industries that include smart cities, healthcare, finance, and

ndustrial automation will greatly gain from these technologies to secure critical infrastructures and sensitive data.

CONCLUSION: A NEW ERA OF IOT SECURITY

As IoT networks expand, securing these devices against sophisticated botnet attacks becomes increasingly critical. Traditional security measures are no longer sufficient to address the scale and complexity of modern cyber threats. This study highlights how Federated Learning, combined with Transformer-Based Self-Attention and Adaptive Thresholding, offers a cutting-edge solution for botnet detection in IoT environments. This approach paves the way for a more secure IoT ecosystem by prioritizing privacy, scalability, and real-time adaptability. As industries embrace this advanced security framework, the future of IoT will be defined stronger defenses, by enhanced data protection, and a more resilient digital infrastructure.



Unveiling New Worlds: How Machine Learning is Revolutionizing Exoplanet Detection

SREEKAR 2328257

The search for exoplanets, planets that orbit stars beyond our solar system, has been one of the most groundbreaking advancements in modern astrophysics. Since the first confirmed exoplanet was discovered in 1995, scientists have identified thousands more, some of which lie in the habitable zone of their stars, the possibility of raising extraterrestrial life. Machine Learning and Deep Learning have transformed exoplanet detection by analyzing stellar light curvesgraphs representing a star's brightness over time. These techniques help identify the subtle dips in brightness that indicate an exoplanet transiting in front of its star. However, detecting exoplanets remains a complex challenge due to data imbalance, interference, and noise false positives caused by stellar activity and instrument errors.

THE EVOLUTION OF EXOPLANET DETECTION

methods The used to detect evolved exoplanets have significantly over time. Early discoveries relied on the radial velocity method, which tracks the movement of a star caused by the gravitational pull of an orbiting planet. The transit method, which observes periodic dips in a star's brightness, has become the most widely used approach, thanks to

telescopes like NASA's space Kepler and TESS. As telescopes aenerate vast amounts of observational data, traditional classification manual methods have become inefficient. This has led to the rise of machine learning techniques, which allow for automated and scalable analysis of exoplanet candidates.

THE ROLE OF MACHINE LEARNING IN EXOPLANET DISCOVERY

his study developed a robust ML pipeline for analyzing stellar light curves to address these challenges. The study analyzed a 5,657 stellar light curves dataset, with 42 samples labeled as potential exoplanets. The approach includes advanced data preprocessing techniques such as median and Savitzky-Golay filtering to enhance signal quality. To tackle class imbalance, the Synthetic Minority Over-sampling Technique (SMOTE) was applied, helping improve the model's ability exoplanet to recognize rare signals. Various machine learning models were evaluated for their effectiveness in detecting exoplanets, including Convolutional Networks Neural (CNNs) Short-Term and Long (LSTM) networks. Memory Interpretability techniques like

PSHAP values and feature importance analysis were also incorporated to enhance model The CNN transparency. model achieved 97.5% accuracy, making it most effective for the transit detection. The HDBSCAN clustering algorithm outperformed all others by successfully detecting spatially distributed patterns in light curves, improving recall rates significantly.

CHALLENGES IN EXOPLANET DETECTION

Detecting exoplanets using machine learning presents several challenges. One of the most significant issues is data imbalance, as datasets contain far more nonexoplanet samples than exoplanets. This makes it difficult for ML models to distinguish accurate exoplanet signals from background noise. Another challenge is noise and interference. Variability in stellar brightness, instrumental noise, and cosmic events can obscure transit leading signals, to inaccurate classifications. Additionally, false positives caused by binary star stellar flares, systems, and instrumental artifacts can mimic the of characteristics exoplanet transits, further complicating the detection process.



Unveiling New Worlds: How Machine Learning is Revolutionizing Exoplanet Detection

SREEKAR 2328257

THE BROADER IMPACT OF ML ON SPACE EXPLORATION

Recent advancements in machine have areatly learning impacted exoplanet detection, bringing significant benefits to space exploration and astrophysics. By automating the detection process, machine learning reduces the need for astronomers to manually sift through vast amounts of data, allowing them to focus on analyzing and confirming potential exoplanets. This not only improves efficiency but also optimizes the use of space telescope resources while lowering operational costs This leads to more efficient use of space telescope resources and lowers operational costs. Beyond astrophysics, ML-driven exoplanet detection extends into broader applications such as climate science and financial forecasting. The ability to detect patterns in timeseries data has widespread potential across multiple domains.

FUTURE DIRECTIONS IN EXOPLANET RESEARCH

As machine learning evolves, future research should focus on expanding datasets by integrating findings from space missions like TESS and PLATO. These additional observations will provide a richer pool of data, improving the chances of identifying

new exoplanets. Advanced models, such as Transformers, could further enhance pattern recognition, allowing scientists detect to planetary signals with areater accuracy. Processing such vast amounts of data requires significant computing power, and cloud-based systems offer a more efficient and cost-effective solution. By leveraging these resources, researchers can make data analysis easier while reducing the financial burden of deep learning. Also, adjusting model parameters will improve detection methods, making the search for exoplanets more accurate and reliable. These improvements will enhance the ability to find and study faraway planets, helping us to mysteries uncover the of the universe.

CONCLUSION

Machine learning has revolutionized the exoplanet search from a timeconsuming and complex labor to an automated, efficient, and highly accurate assignment. The study illustrates how the AI techniques like LSTMs, CNNs, and clustering algorithms such as HDBSCAN have improved transit detection, solved data imbalances, and enhanced the precision of exoplanet classification. With each discovery, we move one step closer to answering the

fundamental question: Are we alone in the universe? As machine learning continues to push the boundaries of astrophysics, the future of exoplanet research looks promising, paving the way for groundbreaking discoveries that may one day reveal Earth-like planets beyond our solar system.





CREATIVE CORNER

"WHY SO SERIOUS!? , DWEL INTO FUN ELEMET OF DATA WORLD "

MEMES FROM DATA WORLD







EVENTS & WORKSHOPS

"WALKING THROUGH THE MEMORY LANE OF HARNESSING FUN AND PEER LEARNING "



AVGAMAH - CAPSTONE PROJECT PRESENTATIONS









Ø DATA DRIVEN DECISION MAKING





DATA VISUALIZATION USING POWER BI – WORKSHOP



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