TELEKINESIS

ELECTRONICS AND COMMUNICATION ENGINEERING
DEPARTMENT MAGAZINE

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National Institute of Technology Meghalaya

An Institute of National Importance

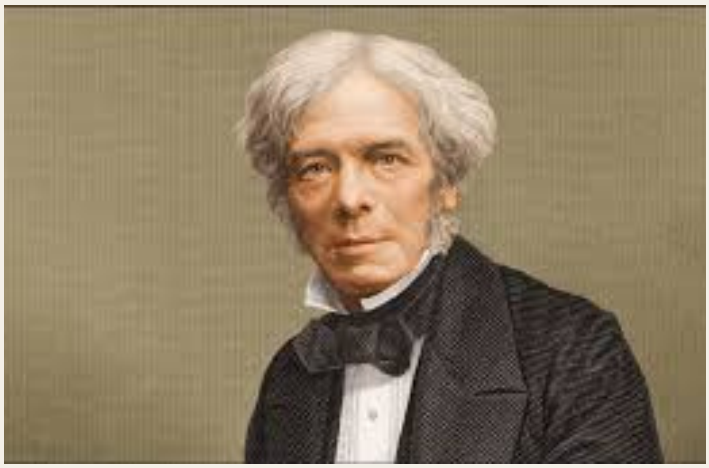
"Telekinesis"

"Telekinesis" combines "Tele," meaning "Distance," and "Kinesis," meaning "Movement" or "Motion."

Together, "Telekinesis" can be interpreted as "Movement at a Distance." It symbolizes the ability to control or influence from afar, aligning with the essence of electronics and communication engineering, where invisible signals, waves, and technologies bridge distances. The name suggests innovation, unseen power, and forward-thinking approaches in the field, making it a great name for this magazine that highlights the latest trends and breakthroughs in electronics and communication engineering.

“Nothing is too wonderful to be true, if it be consistent with the laws of nature.”

-Michael Faraday
(Father of Electronics Engineering)



“The fundamental problem of communication is that of reproducing at one point either exactly or approximately a message selected at another point.”

-Claude Elwood Shannon
(Father of Communication Engineering)

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About the Institute

The National Institute of Technology (NIT) Meghalaya is one of the thirty-one NITs in India established under the NIT Act 2007 (Amended 2012) of the Parliament of India as Institutes of National Importance with full funding support from the Ministry of Education (Shiksha Mantralaya), Government of India.

The Vision

A Centre of Excellence vibrant with academic activities and bubbling with youthful creative energy, making significant contributions to the World of Knowledge and Technology and to the Development of the State, the Region and the Nation.

The Mission

To impart quality education in the fields of engineering, science, and technology at undergraduate and postgraduate levels, with special attention to encouraging innovation and creativity in these fields in a clean and healthy environment.

About the Department

The Department of Electronics and Communication Engineering (ECE) was established in 2010 with the inception of the NIT Meghalaya. The department offers a B. Tech Programme with an intake capacity of thirty & an M. Tech Programme with an intake capacity of twenty in ECE and a Ph.D.Program in various specialized areas. The major research areas of the department include high-speed and low-power VLSI, Computer Arithmetic, Wireless Sensor Networks, Cognitive Radio, Antenna Design, and Signal Processing. The major objective of the Department is to impart high-quality technical education and research with a strong foundation in Electronics and Communication Engineering. The department's major areas of faculty expertise include VLSI Systems, High Performance Computing, Signal Processing, Digital Signal Processing, Communication, and RF & microwave engineering.

The Vision

A Centre of Excellence in knowledge and technological innovation research hub in the field of Electronics and Communication Engineering by the creation of skilled manpower to meet the local, national, and global needs of industry and society.

The Mission

- To impart research & training on cutting-edge technologies on VLSI, Signal Processing, and Communication for societal issues.
- To promote competitive academic programs through industry-relevant skills that support entrepreneurial growth and industry readiness.
- To strengthen moral values and ethics with managerial skills to become technocrats and entrepreneurs.

TECHNICAL Articles

Electronics and Communication Department

Future of Computation -Neuro AI

M.A.SEENIVASAN, Research Scholar, ECE

What is Neuromorphic Computing?

Neuromorphic computing is a new process miming the human brain's structure and operation, using artificial neurons and synapses to process information efficiently, speedily, and with minimal power consumption. This approach is increasingly important in the industry as it can execute artificial intelligence algorithms by replicating the human brain's neural structure. Traditional von Neumann computing, which has separate processors and memory systems, is inefficient for machine learning due to processor-memory bottlenecks. Neuromorphic computing addresses this issue by incorporating multiple neurons and synapses for computation and storage and a neural network for seamless communication, enabling efficient handling of repetitive iterations in machine learning training.

Is it really the technology for tomorrow?

As the demand for high computing power increases, it is crucial to explore alternative solutions, such as neuromorphic computing. Mammalian brains are known for their low power and energy efficiency, making them ideal for future machines. Researchers and the industry should explore bio-inspired neuromorphic structures to address sustainability issues. Neuromorphic computing can remove existing bottlenecks, such as the von Neumann bottleneck, which limits throughput in traditional personal computers. While quantum computing and neuromorphic systems have been proposed, considering the fragile nature of qubits in quantum computing, neuromorphic computing or brain-inspired computing is more likely to be commercialized.

Challenges and Future Outlook

Despite its potential, neuromorphic computing faces challenges such as high costs, complexity, and ethical considerations. However, it can potentially redefine the future of IoT by enabling smarter, more efficient, and adaptive systems that integrate seamlessly with our interconnected world. Drawing inspiration from the human brain and embracing principles like parallelism, event-driven processing, and adaptability, neuromorphic systems offer a path toward intelligent, efficient, and resilient IoT solutions. As research and development continue, the possibilities for innovation and transformation are limitless, resembling the complexity and efficiency of the human mind.

As power consumption decreases, devices can run for years on a tiny battery, paving the way for using chips in machines that need computationally complex deep learning operations, such as autonomous vehicles, facial recognition security cameras, and military drones.

Game-Changer Alert:
Impact of Neuromorphic Computing

Neuromorphic computing has the potential to revolutionize computational efficiency and performance in various fields, including edge computing, robotics, drone navigation, industrial robots, autonomous vehicles, sensory processing, speech recognition, image and video analysis, healthcare, and prosthetic control. Its low energy consumption makes it ideal for edge computing, drone navigation, industrial robots, autonomous vehicles, and sensory processing applications. Companies like Innatera are exploring low-power neuromorphic chips for real-time object recognition and autonomous flight control in drones. Prophesee is developing neuromorphic vision sensors to enhance robots' navigation in complex environments. Intel's Loihi and IBM's TrueNorth processors enable real-time decision-making for self-driving cars, processing sensor data efficiently for obstacle detection and path planning. Neuromorphic computing is also used in healthcare for medical diagnosis, image analysis, and disease diagnosis assistance.

Beyond the Hype:

Mystery Behind Neuromorphic Computing:

The neuromorphic chip market is expected to reach an estimated USD 5.83 billion by 2029 at a CAGR of 104.70% from 2024 to 2029. However, this technology is still in its early stages of development and has several years to mature into a pervasive force in AI innovation. Limited investments have been made in neuromorphic research, and a collaborative system is needed to build a cohesive ecosystem. Ethical concerns, such as privacy, security, and potential misuse of advanced cognitive capabilities, have been raised in developing and deploying neuromorphic technology.

Technical challenges include the lack of conclusive proof of superior accuracy over traditional methods, lag in software development behind hardware development, and the current understanding of human cognition. The absence of clearly defined benchmarks also hampers the assessment of neuromorphic computer performance, hindering broader acceptance. Despite these challenges, the neuromorphic chip market is poised for extraordinary growth and continues to evolve in the AI industry.

Outlook

Neuromorphic technology is gaining traction in the machine-learning application domains, with start-up companies emerging to exploit its advantages. The Human Brain Project (HBP) offers small and large-scale demonstration systems for research on human brain information processing, as well as machine learning tasks. These systems are primarily designed for basic research and are expected to deliver applications more efficiently than conventional computers, such as speech and image recognition in smart phones. Large-scale systems may be used to find causal relations in complex data from various fields, allowing temporal predictions on different timescales. In the long term, neuromorphic technology could integrate energy-efficient intelligent cognitive functions into consumer and business products, such as driverless cars and domestic robots. While human-level "strong" artificial intelligence remains a mystery, there are many useful applications that can benefit from more modest cognitive capabilities. The Neuromorphic Computing Platform targets researchers in computational neuroscience and machine learning, offering users the opportunity to study network implementations of their choice, including simplified versions of brain models developed on the HBP Brain Simulation Platform or generic circuit models based on theoretical work. Neuromorphic systems potentially offer higher speed and lower energy consumption compared to traditional HPC resources.

Neuromorphic Ai Advancements 2024

In 2024, neuromorphic AI hardware has seen significant advancements, particularly in the United States, as researchers and companies work to overcome the limitations of traditional computing architectures. The integration of 3D technologies has become a pivotal factor in enhancing the performance and efficiency of neuromorphic systems. Key developments in 3D integration include enhanced performance, scalability, and cost efficiency.

Recent innovations in neuromorphic chip design focus on mimicking the brain's architecture more closely, such as Spiking Neural Networks (SNNs) and adaptive learning. These networks process information in a way that resembles biological neurons, allowing for more efficient data handling and energy use.

Real-world applications of neuromorphic AI hardware include robotics for real-time decision-making in complex tasks, and healthcare for rapid data analysis and pattern recognition in diagnostic tools. Future directions for neuromorphic computing include interdisciplinary research, where collaborations between neuroscientists and engineers are essential to deepen our understanding of brain functions and translate these insights into hardware design. Increased funding and resources are being allocated to explore novel materials and architectures that could further enhance the capabilities of neuromorphic systems.

In summary, the advancements in neuromorphic AI hardware in 2025 reflect a growing recognition of the need for innovative solutions to meet the demands of modern AI applications.

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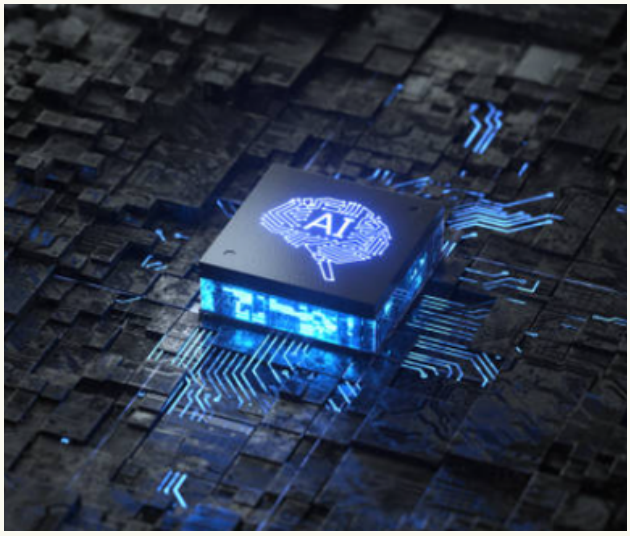


PERFORMANCE COMPARISON OF FINFET AND MOSFET BASED CONTENT ADDRESSABLE MEMORY FOR HIGH SPEED APPLICATION

Shyamosree Goswami, Anup Dandapat

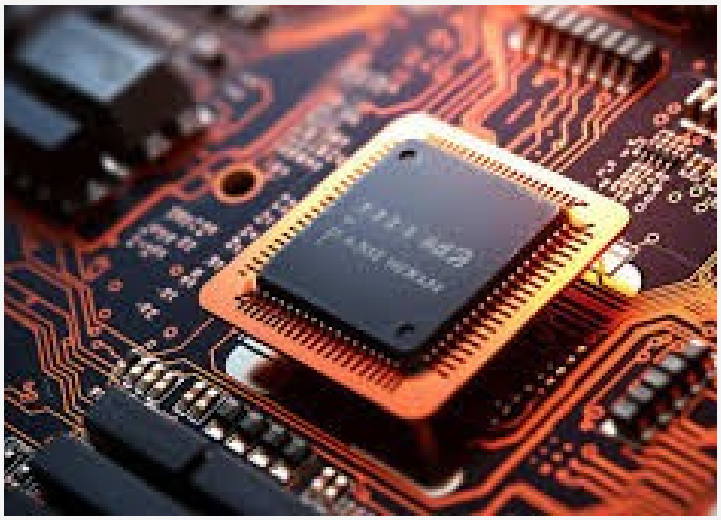
Abstract

Beyond 22nm, a new transistor technology called FinFET (Fin type field-effect transistor) presents an intriguing power-delay trade-off. The work presented here involves the development of a Binary Content Addressable Memory (BCAM) cell using 20nm FinFET technology. We measured the performance metrics and compared them to a CMOS-based design. The CAM cell design presented in this document is based on a NAND type match line (ML) matching scheme, which allows for parallel searching of multiple words. In this work, we analyse the advantages and disadvantages associated with each technology and present a comprehensive evaluation of their performance metrics, including power consumption, speed, Power-Delay-Product (PDP) and Energy Delay-Product (EDP). The results indicate a significant improvement of 67.45%, 48.56%, and 83.26% 87.32% in power consumption, speed, and PDP, and EDP respectively.

Keywords: Content addressable memory, FinFET, High speed, Match line, Average power, Time delay

Introduction

Content Addressable Memory (CAM), also known as associative memory, is a specialized type of memory used for data searching within its contents. Unlike Random Access Memory (RAM), which retrieves data using specific addresses, CAM searches for data through a search line (SL) and outputs the matched address. Conventional CAM designs, with their highly parallel hardware, often exhibit high dynamic power consumption. However, advancements in technology, such as 20-nm FinFET transistors, mitigate short-channel effects and offer trade-offs like enhanced speed and reduced power consumption. This study leverages the faster performance of SG FinFETs to propose a CAM design optimized for speed and power efficiency. Key performance metrics for evaluating CAM designs include power consumption, delay, and power-delay product (PDP). CAM cells generally consume less power compared to memory types like SRAM since power is only required during searches. Advanced fabrication techniques, such as double-patterning lithography and high-k metal gate transistors, enable more compact CAM designs. By minimizing memory-processor communication, CAMs are ideal for applications requiring fast searches and support parallel processing while also performing standard SRAM operations like reading and writing.



Basics of FinFET Technology

A FinFET is a type of multi-gate MOSFET that features a thin vertical fin, unlike traditional planar MOSFETs. Positioned between the source and drain, the fin serves as the channel, with structures often containing multiple fins. FinFETs offer advantages such as higher performance, reduced SRAM retention voltage, low-voltage operation, lower leakage power, and improved current management. They reduce off-state leakage, enhancing both performance and energy efficiency. Further performance improvements are achieved by replacing the silicon channel with higher mobility materials and applying source-drain stressors. As FinFET dimensions shrink for future logic technologies, transitioning to horizontal nanowires—eventually arranged vertically—provides new scaling opportunities.

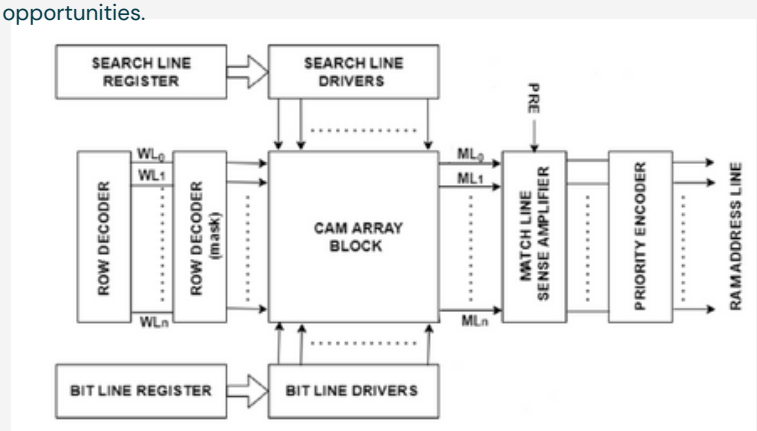


Fig. 1. Conceptual view of a CAM architecture

Fig. 2 Different applications of memory in daily life

Characteristics of a FinFET

The I/V (Current/Voltage) characteristics of FinFET are similar to those of traditional MOSFETs but with some distinct features. Here are the key characteristics:

- Threshold Voltage (Vth): The threshold voltage of a FinFET is the voltage at which the transistor starts conducting current. It is typically lower than that of traditional MOSFETs due to improved electrostatic control.
- Drain-Source Current (Ids): The Ids is the current flowing between the drain and source terminals of the FinFET. It depends on the gate voltage (Vgs) and drain-source voltage (Vds). The Ids increases with increasing Vgs until it reaches a saturation region, where it remains nearly constant with further increases in Vgs.

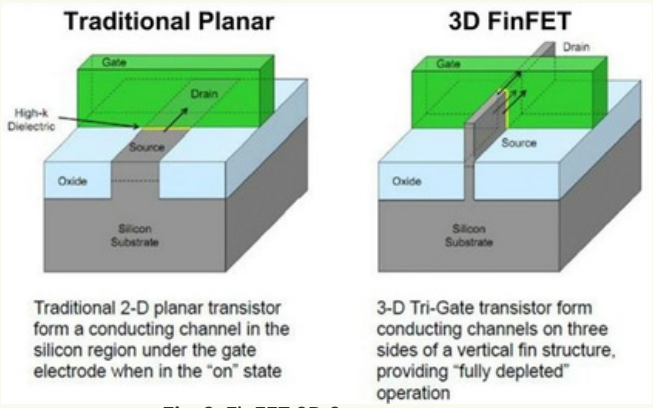


Fig. 3. FinFET 3D Structure

Proposed Cam Cell Components

Content Addressable Memory (CAM) cell design proposed here includes a SRAM circuit, Comparison circuit and NAND type ML architecture used for evaluation logic. All the components are design using FinFET and compared with the conventional CMOS based design.

The proposed design employs a NAND-type matchline (ML) architecture, where the first evaluation logic cell is grounded, and the rest are connected in series. If all cells match, a discharge path to ground is created, allowing the precharged ML voltage to discharge. However, if there is a mismatch in any cell, the path is disconnected, preventing the ML voltage from discharging. In the Fig.5 we have shown the working graph of the proposed design. We have compared the proposed design with few existing designs and compared their performance with the proposed design.

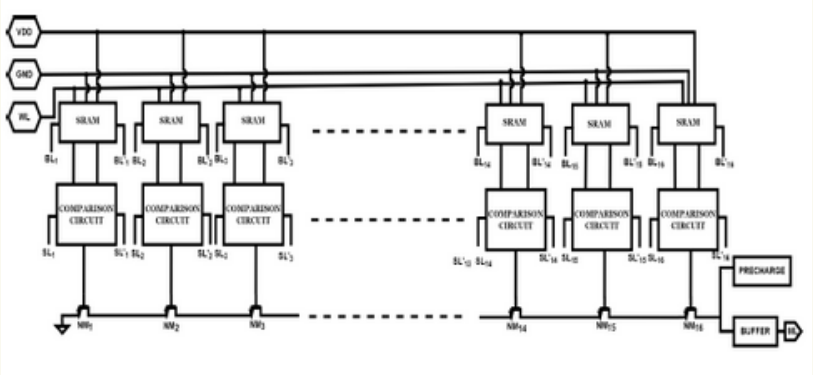


Fig. 4 16 Bit CAM Array Block Design

Table 1. FinFET parameters

FinFET parameters	Technology (nm)	VDD (V)	Leff (nm)	hfin (nm)	tfin (nm)
Value	20	0.9	24	28	15

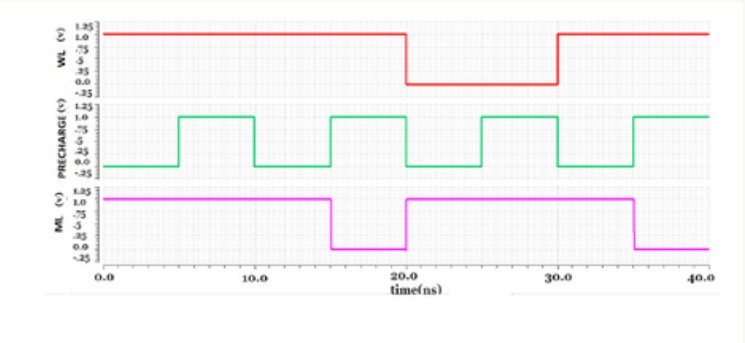


Fig. 5 Output of 16 bit CAM using FinFET

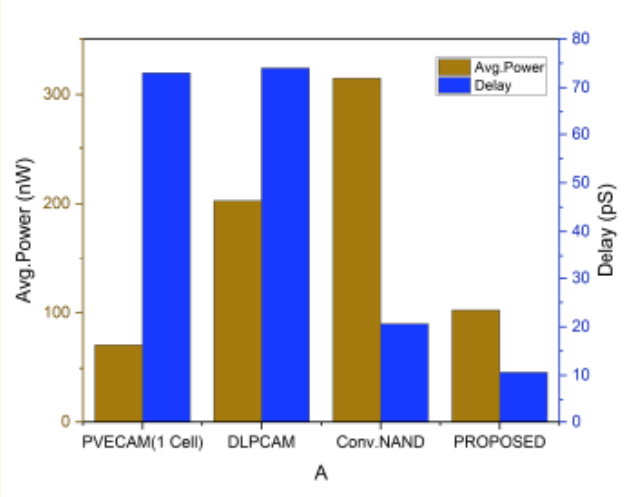


Fig. 6. (A) Power and Delay Comparison of Different CAM Cells

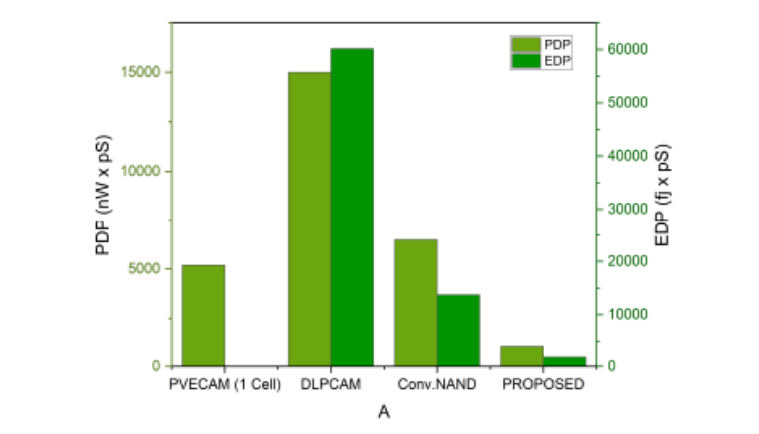


Fig. 6. (B) Power and Delay Comparison of Different CAM Cells

Table 2. Performance of CAM Cells Per Bit

	PVECAM (1CELL)[15]	Conv.NAND CAM (MOSFET)	Proposed CAM (FinFET)
Avg.Power (nW)	71	21.02	15.66
Delay(pS)	73	10.07	3.53
PDP($nW \times pS$)	5183	211.67	55.27

Table 3. Performance of One Row CAM Cells

	DLPCAM [16]	Conv.NAND CAM (MOSFET)	Proposed CAM (FinFET)
Avg.Power (nW)	202.63	314.60	102.38
Delay(pS)	74.01	20.59	10.59
PDP($nW \times pS$)	14997.14	6477.61	1084.20
Energy (fj)	812.67	665.8	164.1
EDP($fj \times pS$)	60145.7	13708.82	1737.81

Conclusion

In conclusion, this paper presents a simulation-based analysis of CAM designs using MOSFET and FinFET technologies, highlighting the superior performance of FinFETs in speed and efficiency. Simulations confirm successful read, write, and match operations, with FinFET-based designs outperforming MOSFET-based designs, achieving 67.45% lower average power, 48.56% reduced delay, 83.26% improved PDP, and 87.32% better EDP compared to conventional NAND-based CAM designs. The proposed FinFET CAM also surpasses existing FinFET designs, as shown in Fig.7 and Fig.8. This study underscores the potential of FinFETs for faster and more efficient CAMs and emphasizes the importance of technology selection in memory design.

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UNVEILING THE NUANCES OF TIME SERIES DATA PREDICTION: MYTHS AND REALITIES

Jintu Borah, Smart System Co-Design Laboratory, Dept. of ECE, NIT Meghalaya

Time series data prediction or forecasting has become a cornerstone of modern data science and analytics. From predicting stock prices and weather patterns to monitoring air quality and energy consumption, this domain has diverse applications. However, misconceptions surrounding time series forecasting often lead to oversimplified solutions that fail to deliver effective results. One of the most pervasive myths is the belief that a single pipeline or architecture can serve all purposes. In reality, the path to accurate and meaningful time series prediction is far more nuanced and demands customization.

The Myth of a Universal Pipeline

Many believe that a standardized pipeline, composed of data pre-processing, feature engineering, model training, and evaluation, and suffices for all-time series forecasting tasks. While such a general framework provides a good starting point, it overlooks the unique characteristics of different datasets and application requirements.

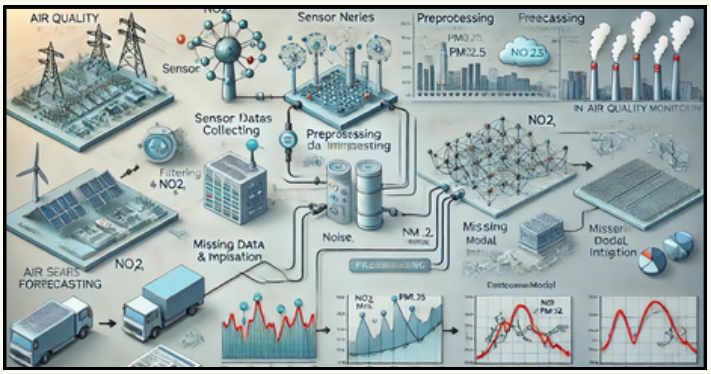
For example, a pipeline optimized for forecasting air pollutant concentrations might not work effectively for predicting stock market trends. Air quality data often exhibit seasonal patterns and spatial dependencies that require specialized feature engineering, such as incorporating meteorological parameters and geographical coordinates. On the other hand, stock market data is highly volatile and influenced by external factors like economic indicators and news sentiment, necessitating entirely different modelling approaches.

Understanding Data Characteristics

The diversity in time series applications stems from the intrinsic properties of the datasets:

- Seasonality and Trend: Some time series, like energy consumption or air quality metrics, exhibit clear seasonal trends. Others, like social media sentiment or stock prices, might lack such periodic patterns.
- Data Frequency: High-frequency data (e.g., financial tick data) requires models capable of handling rapid fluctuations, whereas low-frequency data (e.g., monthly sales figures) may demand simpler, aggregated approaches.
- Missing Data: Sensor-based applications often deal with missing or noisy data, requiring robust imputation techniques and anomaly detection mechanisms.
- Exogenous Factors: Many time series are influenced by external variables, such as weather conditions, macroeconomic indicators, or policy changes, which must be integrated into the forecasting pipeline.

The Need for Customization



A successful forecasting pipeline must align with the specific needs of the application. This involves tailoring each stage of the process:

- Pre-processing: Techniques like resampling, smoothing, or imputation must be chosen based on the nature and quality of the data. For instance, low-cost air quality sensors may require advanced noise filtering to ensure reliable predictions.
- Feature Engineering: Extracting meaningful features is critical. Domain knowledge often plays a key role in identifying relevant variables and transformations.
- Model Selection: The choice of model depends on the complexity of the dataset. Classical models like ARIMA or exponential smoothing may suffice for simpler patterns, while deep learning models like LSTMs or transformers are better suited for complex, non-linear dynamics.
- Evaluation Metrics: Performance metrics should reflect the end-use of the predictions. For example, in air quality monitoring, over-predicting pollutant levels can be as detrimental as under-predicting them, necessitating careful selection of error metrics.

Takeaway from Real-World Applications

In our research on zone-specific air quality prediction for applications such as end-of-life vehicle recycling facilities, we have observed how domain-specific adaptations significantly enhance forecasting accuracy. These facilities exhibit unique pollutant patterns due to localized emissions, requiring customized pipelines to capture such variations. Integrating spatio-temporal dependencies and external meteorological data proved instrumental in achieving robust predictions.

Moving Towards Domain-Aware Forecasting

Time series prediction is not just a technical challenge; it is a domain-driven process that demands a deep understanding of the application context. Researchers and practitioners must resist the temptation to generalize pipelines across applications. Instead, they should invest time in exploring the unique characteristics of their datasets and the specific requirements of their use cases. By embracing this ideology, we can unlock the true potential of time series forecasting, delivering solutions that are not only accurate but also meaningful and impactful.

DEPARTMENTAL PROGRAM

- **B.Tech**
  - 2021-2025 Batch: 35
  - 2022-2026 Batch: 29
  - 2023-2027 Batch: 37
  - 2024-2028 Batch: 32
- **M.Tech**
  - 2023-2025 Batch: 02
  - 2024-2026 Batch: 12
- **Ph.D.**
  - Total: 30 (Full Time)

STUDENT DETAILS

Ph.D. Scholars & M.Tech

FACULTY ACHIEVEMENTS

Dr. Shubhankar Majumdar

Dr. Shubhankar Majumdar was awarded with the prestigious Young Faculty Research Fellowship (YFRF) under the Visvesvaraya PhD Scheme, Ministry of Electronics and Information Technology, Govt. of India.

STUDENT ACHIEVEMENTS

"EXCELLENCE IS THE GRADUAL RESULT OF ALWAYS STRIVING TO DO BETTER."

- Pat Riley

DARISKHEM PYNGROPE

She is a Fulltime PhD scholar in Smart System Co-design Laboratory (SSCL) supervised by *Dr. Shubhankar Majumdar*. She had the honor of presenting at ICSMMT-2024, sharing insights on advancing ultra-wide bandgap (UWBG) semiconductor technologies for high-power and high-frequency applications. Her work is focused on the integration of ferroelectric ScAlN with GaN HEMTs, emphasizing its impact on 2DEG density and device performance through empirical and analytical models.

PH.D. AWARDEE

(OCT 24 - DEC 24)

DR. GOURI SHANKAR CHETIA

Thesis Title: Development of Blind Hyperspectral Unmixing Method for Variants of Endmembers
Supervisor Name: Dr. Bishnulatpam Pushpa Devi
Date of Award: 22/11/2024

DR. GAURAV BHARGAVA

Thesis Title: Automation of GaN Based Power Amplifier for Sub-6 GHz Applications
Supervisor Name: Dr. Shubhankar Majumdar
Date of Award: 19/12/2024

DR. KATTEKOLA NARESH

Thesis Title: Towards Sophisticated Applications: Designing Approximate Computing Circuits for Neural Networks and Microwave Imaging
Supervisor Name: Dr. Shubhankar Majumdar
Co-supervisor Name: Dr. Y. Padma Sai
Date of Award: 23/12/2024

ALUMNI MESSAGE

DR. MOIRANGTHEM SANTOSHKUMAR SINGH

He is currently working as an Assistant Professor in the Department of ECE, School of Engineering, Siddhartha Academy of Higher Education (deemed to be University) Vijayawada, India.

Message: I am delighted to share that I have successfully completed my Ph.D. from the National Institute of Technology Meghalaya in the Department of Electronics and Communication Engineering. This incredible journey has been a transformative experience filled with immense learning, personal growth, and countless cherished memories. Throughout these years, I had the privilege of working under the guidance of esteemed faculty members whose expertise and mentorship have played a crucial role in shaping my academic and research skills. Their unwavering support and valuable insights have helped me gain a deep understanding of my field and expand my technical knowledge significantly. Apart from academics, my time at NIT was enriched by the camaraderie and support of my batch mates, seniors, and juniors. Engaging in discussions, brainstorming ideas, and collaborating on research projects created a dynamic and inspiring learning environment. The friendships built during this time will always hold a special place in my heart. Beyond research and studies, I thoroughly enjoyed the vibrant campus life. From late-night study sessions to cultural and technical events, every moment was an opportunity to learn and grow. This journey has been an unforgettable chapter in my life, and I am grateful for everything that NIT has given me.

DR. GAURAV BHARGAVA

Pursuing a PhD in RF and Microelectronics Circuit Design at NIT Meghalaya has been a transformative journey of intellectual growth, resilience, and discovery. My coursework included in-depth studies on Gallium Nitride based power amplifier design techniques. My research focused on the automation of GaN-based power amplifiers for sub-6 GHz applications, addressing critical challenges in power amplifier circuit design. I have also designed and fabricated RF circuits like antennas, filters, power dividers/combiners, etc.

Throughout this journey, I immersed myself in advanced concepts like the development of power amplifiers. Working extensively in state-of-the-art simulation tools (Keysight's Advanced Design System, Cadence Virtuoso, CST) and experimental setups (spectrum analyzer, mixed-signal oscilloscopes, vector network analyzer) available at our Center of Excellence, i.e., the advanced wireless communication lab, I gained hands-on expertise in designing and validating innovative circuit solutions that align with industry needs.

DR. KATTEKOLA NARESH

It has been a fulfilling experience for me to pursue my PhD at NIT Meghalaya. I am deeply grateful for the encouraging and supportive guidance I received from my supervisor, Dr. Shubhankar Majumdar, and my co-supervisor, Dr. Y. Padma Sai. Their mentorship was instrumental in helping me navigate the challenges and make meaningful progress in my research. One of the most challenging yet rewarding aspects of my journey was completing the course registrations every semester, which required a lot of dedication to finish the subjects successfully. The constructive feedback and input from the DRC team members also significantly shaped my research approach and mindset. During the COVID-19 pandemic, I used the time to focus on improving my technical writing skills. I also learned LaTeX through Overleaf, which greatly enhanced the quality of my research papers and presentations. I am thankful for the excellent lab facilities and the incredible support from my colleagues during technical discussions, which enriched my understanding and problem-solving capabilities. Being a part of NIT Meghalaya has been an incredibly fulfilling experience, and I feel fortunate to have been part of such a vibrant and supportive academic community.

DR. GOURI SHANKAR CHETIA

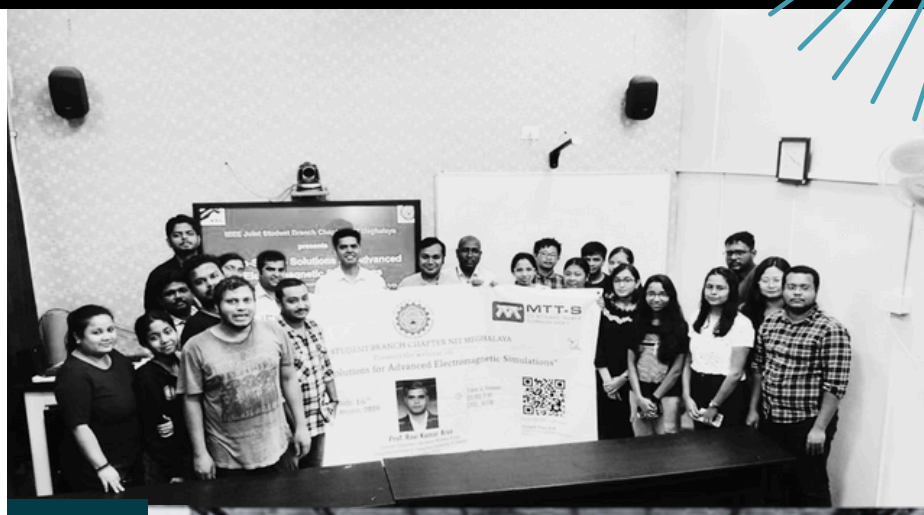
He is currently working as an Assistant Professor in the Department of ECE, BV Raju Institute of Technology, Narsapur, Telengana.

Message: My Ph.D. journey at NIT Meghalaya has been a rewarding experience, filled with challenges that sharpened my skills and fueled my curiosity about hyperspectral imaging. Fascinated by the power of spectral images to reveal details beyond the scope of human vision, I dedicated my research to developing advanced unmixing techniques for analyzing high-dimensional satellite data. This endeavor allowed me to enhance my expertise in designing and implementing state-of-the-art algorithms to tackle real-world problems in remote sensing.

EVENTS

ECE DEPARTMENT

INVITED LECTURES



AWARENESS PROGRAMS

Invited Lecture by
Dr. Debabani Choudhury - Intel USA
Talk Topic: *RF to mm-Wave Front-End Technologies for Connected Future*
Event Date: 20 December, 2024

Department faculties and Ph.D. scholars with Dr. Debabani Choudhury

UPCOMING EVENTS

TO BE ORGANISED BY CONCERN FACULTY

Dr. Shubhankar Majumdar

Distinguished microwave lecture to be held on 27th February, 2025 (Virtual Mode) with the NIT Meghalaya IEEE Joint Student Branch Chapter ECE. Topic: Power without pain: High Power MMIC PA Design, The pitfalls and how to avoid them.

Meet in

Organized by
IEEE Joint STUDENT BRANCH CHAPTER
National Institute of Technology Meghalaya

PUBLICATIONS

CONFERENCE, JOURNAL AND BOOK CHAPTERS

- *J. Borah, T. Chakraborty, M. S. M. Nadzir, M. G. Cayetano, F. Benedetto and S. Majumdar, "A Novel Hybrid Approach For Efficiently Forecasting Air Quality Data," in IEEE Sensors Letters, vol. 9, no. 1, pp. 1-4, Jan. 2025, Art no. 6001204, doi: 10.1109/LSENS.2024.3519719.*
- *Tammineni, V., Beura, S.K., Murthy, M.V.H.B. et al. Optimized recursive approximate multipliers for edge detection and image smoothing applications. Microsyst Technol (2024). https://doi.org/10.1007/s00542-024-05810-z*
- *A. Paul, G. Bhargava, D. Adak, S. Dutta and S. Majumdar, "Design and Validation of a Microstrip Log-Periodic Feedline-Based Filter for Microwave Imaging of Rebar," in IEEE Transactions on Instrumentation and Measurement, vol. 73, pp. 1-8, 2024, Art no. 8005808, doi: 10.1109/TIM.2024.3481566.*
- *Gidon, J.S., Borah, J., Sahoo, S. et al. Neural network approaches for enhanced landslide prediction: a comparative study for Mawiongrim, Meghalaya, India. Nat Hazards (2024).*
- *J. Borah, M. S. M. Nadzir, M. G. Cayetano, H. Ghayvat, S. Majumdar and G. Srivastava, "Timezone-Aware Auto-Regressive Long Short-Term Memory Model for Multipollutant Prediction," in IEEE Transactions on Systems, Man, and Cybernetics: Systems, vol. 55, no. 1, pp. 344-352, Jan. 2025, doi: 10.1109/TSMC.2024.3463960.*
- *S. Devi, J. Talukdar, N. Manzoor Laskar & S. Choudhury, Exploring the Potential of Tunnel Field-Effect Transistors in Biomedical Devices: A Comprehensive Survey. IETE Journal of Research, 1–12. https://doi.org/10.1080/03772063.2024.2412790*
- *Suresh Penchala, S. K. Bandari, Venkata Mani Vakamulla & A Drosopoulos, "Controlled Wireless Channel using Multi-Antenna Multi-IRS Assisted Communication System: A Comprehensive Performance Analysis", in IEEE Latin America Transactions, Vol. 23, pp. 114-124, 2025.*
- *Suresh Penchala, S. K. Bandari, Venkata Mani Vakamulla & Sai Krishna Kondoju, "Performance Analysis of Multi-Antenna Multi-IRS-Assisted System over Generalized Fading Channel", in Wireless Personal Communications, Springer, pp. 1-27, 2024.*
- *Sarkar, Debbarni, Vipin Pal, Satyendra Singh Yadav, and Sarat Kumar Patra. "IRS-aided NOMA-based communication architecture for 6G wireless networks: An enhanced error-control and reliable data transmission." Physical Communication 65 (2024): 102394.*

- *Sarkar, Debbarni, Satyendra Singh Yadav, Linga Reddy Cenkeramaddi, and Om Jee Pandey. "TDRA: transformer based deep recurrent architecture for automatic modulation classification (AMC) pertinent to intelligent reflecting surface assisted internet of things (IoT) networks." IEEE Internet of Things Journal (2024).*
- *Gupta, Chirag, Ramani Kumar Das, Rabindra K. Barik, Shahazad Niwazi Qurashi, Diptendu Sinha Roy, and Satyendra Singh Yadav. "GANCE: Generative Adversarial Network Assisted Channel Estimation for Unmanned Aerial Vehicles Empowered 5G and Beyond Wireless Networks." IEEE Access (2024).*
- *Sarkar, Debbarni, Satyendra Singh Yadav, Vipin Pal, Yogita, and Sarat Kumar Patra. "Performance Evaluation of ML-Based Classifiers for IRS-Aided NOMA-Based 6G Cognitive Radio Networks." Wireless Personal Communications (2024): 1-23.*
- *R. Saikia, R. Deka, A. Sarma, S. S. Devi, "Hyperparameter Tuning of Fine-Tuned VGG19 Using Sine Cosine Algorithm for Acute Lymphoblastic Leukemia Detection," 2nd International Conference on Data Science and Network Engineering (ICDSNE 2024) (Under Production)*
- *Perugu Thirupathi, Bishnulatpam Devi, T.kishore Kumar " Spwamnet: Breast Cancer Detection Using MRI images " in the 1st International Conference on Artificial Intillegence, Device Computing,Communication,and Signal Processing(AIDCCSP-2024).*
- *K. Gogoi, M. Tetseo, G. Kumar, S. Kumar, P. K. Rathore, "An Idea of Implementing MOSFET-based resistive load Differential Amplifier circuit on pressure transducer", MNDCS 2025, NIT Silchar.*
- *M. Tetseo, K. Gogoi, G. Kumar, P. K. Rathore, S. Kumar, "Design and Simulation of MOSFET differential amplifiers for MEMS mass sensor", MNDCS 2025, NIT Silchar.*
- *Aggarwal, Kush, Sahib Singh, Vipin Pal, and Satyendra Singh Yadav. "A Framework for Enhancing Accuracy in AI Generated Text Detection Using Ensemble Modelling." In 2024 IEEE Region 10 Symposium (TENSYMP), pp. 1-8. IEEE, 2024.*
- *Vineet Malewar, Tanisha Kant, Debbarni Sarkar, Vipin Pal, Satyendra Singh Yadav, "An Efficient Ensemble Deep Learning Model-based Signal Detection in 6G Wireless Communication" IEEE Global Conference on Information Technologies and Communications (GCITC) 2024*

- *Ghosh, Soumendu, P. Megh Sainadh, Abhishek Sarkhel, and Saptarshi Ghosh. "Wideband Superstrate-Loaded Metasurface-based Multifunctional Polarization Converters,"IEEE Antennas Wireless propag lett., jan. 2025 (accepted)*
- **Mukhopadhyay, Sunanda, Abhishek Sarkhel, and Satyendra Singh Yadav. "A Wideband Digitally Coded Metasurface Using Staggering Tuning Mechanisms for Beam Steering Application in 6G mm-Wave Communication." In Millimeter Wave and Terahertz Devices for 5G and 6G Systems,. Springer, Nov 2025.(accepted)**
- *Suting, Habanaibok, Soumendu Ghosh, Abhishek Sarkhel, and Prabir Saha. "A Single-Layered Linear-to-Circular Polarization Converter for Dual-Band 5G Millimeter Wave Communications Systems Using Frequency Selective Surface." In Millimeter Wave and Terahertz Devices for 5G and 6G Systems,. Springer, Nov 2025.(accepted)*
- *Chattapadhyay, Debojyoti, Soumendu Ghosh, Satyendra Singh Yadav, and Abhishek Sarkhel. "A Polarization-Insensitive Triple Band Millimeter-Wave Absorber for 6G Radar Communication." In Millimeter Wave and Terahertz Devices for 5G and 6G Systems,. Springer, Nov 2025.(accepted)*

RESEARCH AND DEVELOPMENT PROJECT

S. No	Name of the faculty member	Title of the Project	Period (From-To)	Sponsoring Organisation	Amount [INR]
1.	Dr. S. Majumdar.	Fully acoustics testing of low velocity impact damage in composite plate using the concept of local defect resonance	2022-25	Aeronautics R and D Board	24,02,800/-
2.	Dr. P. Rangababu, Dr. A. Sarkhel. Dr. S. K. Bandari, Dr. S. Majumdar, Dr. S. S. Yadav, Dr. P. K. Rathore, Dr. Prabir Saha, Dr. A. Dandapat.	AI Empowered Advanced Wireless Communication Systems	2021-2026	DST-FIST	80,00,000/-
3.	Dr. P. K. Rathore	Development of High Sensitivity CMOS-MEMS Integrated Pressure Sensor and System for Space Application	2019-2024	Indian Space Research Organisation (ISRO), Department of Space, Government of India	32,46,000/-
4.		Design and Development of Highly Sensitive Non-Conventional Ring Channel Shaped MOSFET Based Current Mirror Integrated Pressure Sensors	2021-2024	Department of Science & Technology, Ministry of Science and Technology, Government of India	44,93,601/-
5.	Dr. S. Majumdar	BRO Project - Sensor Based Big Data Analysis for Prognostics and Health Management of RCC Bridges	2023-2025	BRO	37,00,000/-
6.	Dr. P. Saha, Dr. P. K. Rathore, Dr. S. Majumdar.	SMDP Project - Development of On-chip MEMS Pressure Sensor based Tensiometer for Agriculture.	2023-2028	MIETY	1,10,00000/-
7.	Dr. P. Saha, Dr. A. Sarkhel, Dr. S. K. Bandari, Dr. S. Majumdar, Dr. S. S. Yadav.	TCIL Project- UAV Assisted Soil Moisture Content Determination through 5G Network	2023-2028	DoT	1,14,00000/-
8.	Dr. A. Sarkhel, Dr. S. S. Yadav.	Design and Development of Intelligent Reflecting Surface for Ubiquitous Connectivity Among IoT Enabled Devices	2025-2027	36,25,189	36,25,189/-

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