IIT PALAKKAD

Journey of A Decade

Nurturing Minds For a Better World
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Sahyadri TECHXPRESS

REFLECTIONS OF IIT PALAKKAD

AT A GLANCE

The Indian Institute of Technology in Palakkad is an autonomous premier science and technology institute under the Ministry of Education, Government of India. Nestled in the Sahyadri mountain range, IIT Palakkad swiftly emerged as one among India's foremost hubs for engineering education. With unwaving dedication to academic brilliance and holistic growth, we champion the mantra of 'Nurturing Minds for a Better World'.

- 1370+ Students
- 140+ Faculty
- 150+ Staff
- 25 Advanced Scientific Labs
- 3371 Research Publications
- 11 Departments & Centres
- 18 Course Based Programs
- 18 Research Based Programs
- 118 Crores Sponsored Projects
- 8.9+ Crores Consultancy Projects

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WHAT'S INSIDE

DIRECTOR'S DESK

Prof. A Seshadri Sekhar, Director, IIT Palakkad

"The journey of a thousand miles begins with a single step".

With great pleasure, I present the latest issue of Sahyadri TechXpress, capturing the vibrant spirit and progress of our institute. Ten years ago, IIT Palakkad began its journey with a bold vision - to create a space where knowledge, innovation, and inclusivity converge. As the institute marks this significant milestone, we reflect on a decade that has been as enriching as it has been ambitious. From our modest beginnings we have grown into a vibrant hub of academic excellence, interdisciplinary research, and meaningful collaboration.

IIT Palakkad is entering an exciting new chapter of growth, with a renewed focus on progressive research and development. Central to this vision is the upcoming research park,the first of its kind in Kerala, envisioned as a dynamic bridge between academic insight and industrial application. This vibrant space will empower startups, entrepreneurs, and small enterprises, creating a fertile ground for ideas to flourish. Complementing these efforts, the institute is enhancing its infrastructure, equipment and facilities, including academic blocks and state-of-the-art laboratories, to create a more vibrant and future-ready environment for learning, research, and discovery.

The institute has continually expanded its academic offerings by introducing several forward-looking programs that span data science, artificial intelligence, sustainable engineering, and liberal arts within technical education. Notably, in the upcoming academic year, we will offer M.Tech programs in ten specializations, opening new avenues for advanced learning and skill development. Our research footprint continues to grow with advancements in material science and AI-driven solutions alongside impactful collaborations with premier national organizations like DRDO and ISRO.

As we look ahead, our focus remains unwavering; to broaden our academic and research frontiers, deepen our collaborations with industry, and cultivate a vibrant and inclusive campus environment. This edition of the newsletter highlights the achievements and milestones of the quarter. Your readership and thoughtful feedback are invaluable in shaping future editions, and I hope you find this issue both informative and engaging.

IN MEMORIAM

“And our little life is rounded with a sleep; passing through nature to eternity.”

With profound sorrow and heavy hearts, we remember the untimely demise of two of our beloved alumni from the Class of 2019 – Vivek Kumar, B.Tech in Electrical Engineering, and Mregank Soni, B.Tech in Mechanical Engineering. The warmth of their smiles and the depth of their enthusiasm continue to echo in the memories of all who had the privilege of knowing them. We extend our deepest condolences to their families and loved ones during this time of remembrance. The time they shared with us will forever remain a treasured memory within the IIT Palakkad community.

Vivek Kumar
(Class of 2019)

Mregank Soni
(Class of 2019)

Deep Scan

CONSTRUCTING CRITICAL NARRATIVES: HUMANITIES AND SOCIAL SCIENCES AT IIT PALAKKAD

The Department of Humanities and Social Sciences (HSS) at IIT Palakkad is a vibrant cluster of varied disciplines that engage with crucial ethical questions through active, interdisciplinary academic and research endeavours, as well as outreach activities. The department currently includes the following disciplines: Economics, English, History, Linguistics, Philosophy, Political Science, Psychology, and Sociology.

As part of its critical research engagements, the department organised a series of six talks and a performance under the title 'The Thematic Explorations Series: The Caste and Gender Question in India.' Internationally acclaimed intellectuals and groups explored the caste and gender question in India, both from historical and contemporary perspectives, during the academic year from August 2024 to May 2025.

The faculty of the department regularly hold training programs, conduct research and academic interactions, and organise field trips, among other activities, to keep these questions alive and resonant. Highlights include:

A session on Human Rights and Queer-Trans Mental Health in India at a two-day basic Human Rights training programme organised by the National Human Rights Commission (NHRC) and the Department of Social Work, Rajagiri College of Social Sciences, conducted by Dr. Sudarshan R. Kottai.

- A field trip by Dr. Biswajit Sarmah (as part of his course Environment and Society) to Dhoni Forests and Malampuzha Dam.
- A field trip by Dr. Sudarshan R. Kottai to the Primary Health Centre (PHC), Akathethara, as part of his course Mental Health and Society in the Global South.
- A talk by Prof. A.R. Venkatachalapathy on 'The Swadeshi Steam: V.O. Chidambaram Pillai and the Battle against the British Maritime Empire', organised by Dr. Biswajit Sarmah.

The department's keen interest in addressing ethical concerns in contemporary contexts was also reflected in its organisation of an International Symposium on 'Shaping the AI Landscape: A Multidisciplinary Approach to Technology, Society, and the Future,' in collaboration with York University, Canada, held on 3rd and 4th March 2025. The initiatives highlight the department's commitment to exploring complex questions that shape our society.

TECH THAT MATTERS

SILVER NANOPARTICLES FROM GREEN TEA POLYPHENOL DERIVATIVES COMBAT ANTIBIOTIC-RESISTANT BACTERIA

Nearly a century ago, the discovery of antibiotics revolutionized medicine, turning once-fatal infections into treatable conditions. However, bacteria have proven highly adaptable, leading to the emergence of antimicrobial resistance (AMR)-a phenomenon where bacteria evolve to withstand the effects of antibiotics. Over the next 25 years, drug-resistant infections could cause as many as 40 million deaths worldwide, underscoring the urgent need for new treatment strategies.

Inspired by the health-boosting properties of green tea, the research team led by Dr. Sushabhan Sadhukhan focused on its most abundant polyphenol, epigallocatechin-3-gallate (EGCG), to develop a new weapon against multidrug-resistant bacteria. Green tea, derived from the leaves of Camellia sinensis, is known for its antibacterial and anticancer properties, with EGCG believed to be the key active component. To effectively kill drug-resistant pathogens, the team engineered silver nanoparticles from EGCG derivatives (4″-C_n EGCG AgNPs), which demonstrated robust antibacterial activity against clinical isolates of multidrug-resistant bacteria.

Research team led by Dr. Sushabhan Sadhukhan

Although EGCG has some antibacterial properties, its use is limited by high dosage requirements (~1 mg/mL), poor membrane permeability, and low stability. To address this, the team synthesized alkyl ether derivatives of EGCG (4″-C_n EGCG, Fig 1), improving both permeability and stability. However, these faced poor water solubility (Fig 2) despite enhanced antibacterial activity. The breakthrough came with nanoparticle formulation, yielding improved water solubility and significantly enhanced antibacterial effects (Fig 2).

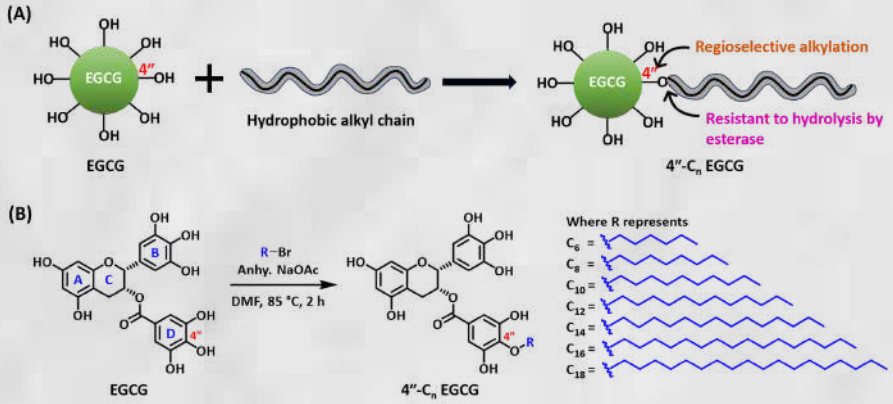

Fig 1. (A) Schematic representation of the design of 4″-C_n EGCG and (B) synthetic scheme of 4″-C_n EGCG.

The EGCG derivatives, designed with a hydrophilic head and hydrophobic tail, mimic bacterial membrane phospholipids. Among them, C_{14} EGCG and C_{16} EGCG reduced *Escherichia coli* and *Bacillus subtilis* colonies by over 99% at concentrations as low as 1 µg/mL. Mechanistic studies showed membrane disruption and reactive oxygen species (ROS) generation. The nanoparticles demonstrated a 50-fold increase in potency and were effective against multidrug-resistant strains like methicillin-resistant *Staphylococcus aureus* (MRSA) and *Acinetobacter baumannii* (Fig 3), while exhibiting no significant toxicity to mammalian cells. This work, published in ACS Applied Nano Materials, has also led to a patent filing.

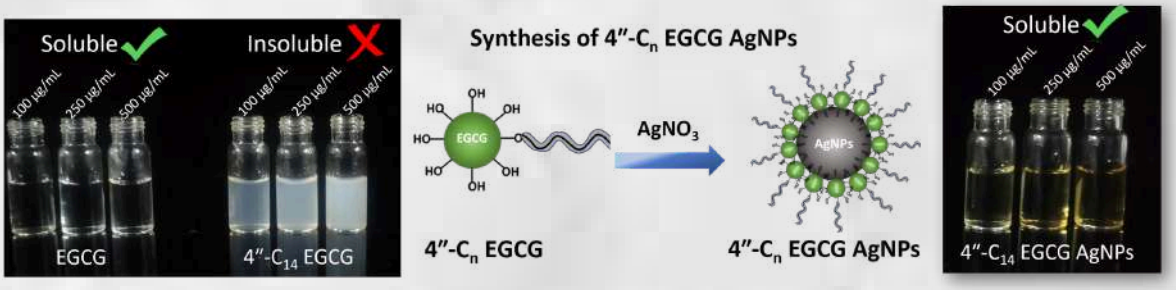

Fig 2. Synthesis of water-soluble silver nanoparticles from water-insoluble EGCG derivatives

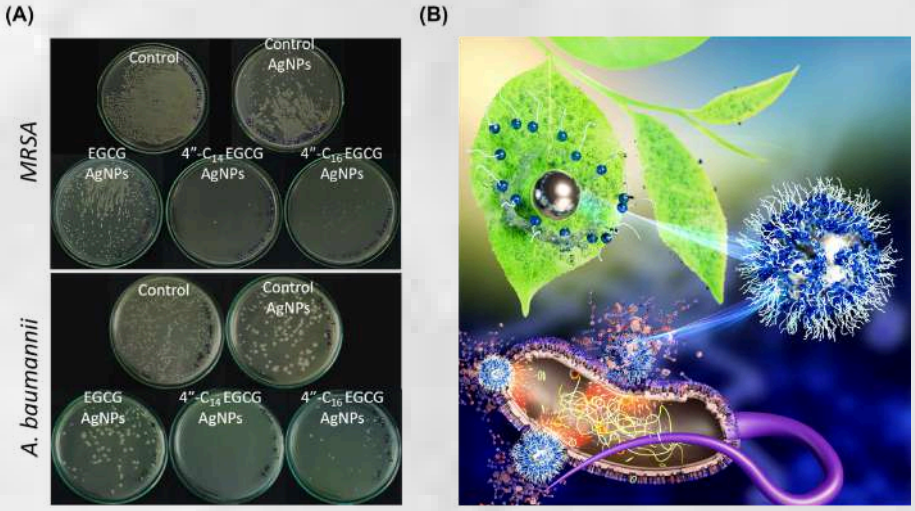

Fig 3. (A) Antibacterial activity of the silver nanoparticles in laboratory tests and (B) a graphic representing the multi-modal mechanism of the engineered silver nanoparticles from green tea polyphenol in killing multidrug resistant bacteria.

TRANSFORMING ELECTRONIC WASTE INTO A DISPOSABLE ELECTROCHEMICAL BILIRUBIN SENSOR: A BREAKTHROUGH IN SUSTAINABLE HEALTHCARE BY THE RESEARCHERS FROM PARUL UNIVERSITY AND IIT PALAKKAD

Electronic waste (e-waste) is one of the fastest-growing environmental challenges worldwide. Discarded mobile phones contribute significantly to this issue, releasing toxic metals that harm both the environment and human health. Recently, there has been a growing emphasis on finding sustainable solutions to valorize e-waste, driven by the principles of a circular economy and the urgent need to mitigate its negative impacts.

In line with this approach, Dr. Soyebkhan Pathan and a team from Parul University, Vadodara along with Dr. Abdul Rasheed, Prof. Jagadeesh Bayry, and researchers from IIT Palakkad, have developed a novel method to upcycle e-waste into a valuable healthcare sensor for bilirubin detection – a key biomarker for liver health. This work repurposes copper foil extracted from discarded mobile phone batteries to create an electrochemical sensor.

The team synthesised Cu-based metal-organic frameworks (Cu-BTC MOFs) from e-waste through a sustainable method and optimised reaction conditions for maximum yield and purity. Figure 1 shows the schematic of Cu extraction and CuBTC synthesis. The synthesised CuBTC MOFs were then used as a sensing material to modify screen-printed electrodes (SPE) for bilirubin detection (Figure 2). The CuBTC MOF-modified SPE showed a promising response, with a lower oxidation potential for bilirubin oxidation, a detection limit of 0.36 µM, a dynamic range of 5 to 130 µM, and good selectivity (Figure 3).

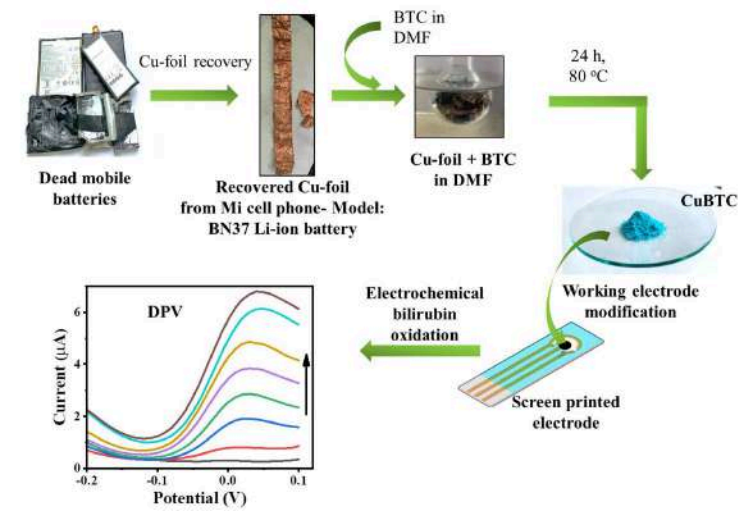

Fig. 1. The schematics of Cu extraction, CuBTC synthesis and modification of SPE with CuBTC

This process offers a cost-effective, environmentally friendly alternative to conventional bilirubin detection methods. The copper extraction technique can be adapted for other lithium-ion batteries with minor modifications. The study not only presents an eco-friendly solution for e-waste management but also bridges sustainability and healthcare, for a greener, affordable point-of-care diagnostics.

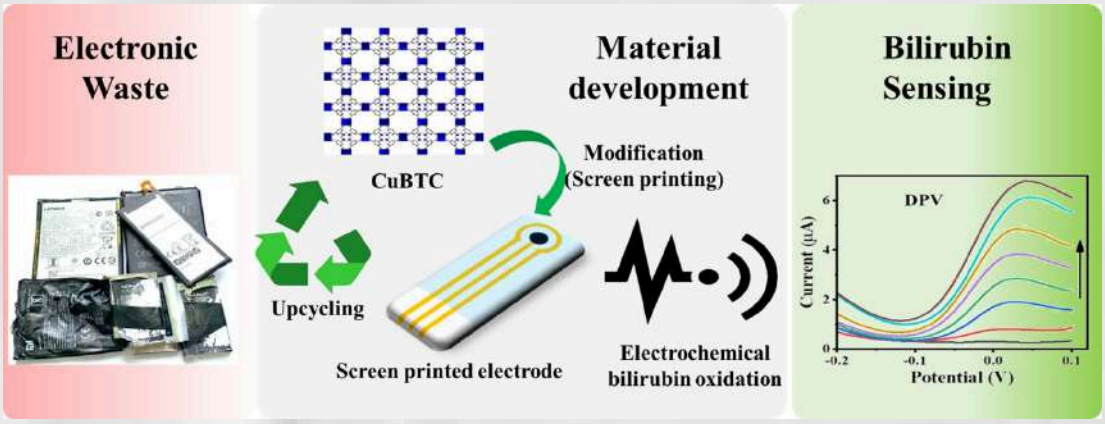

Fig. 2. The protocol for upcycling electronic waste to an electrochemical bilirubin sensor.

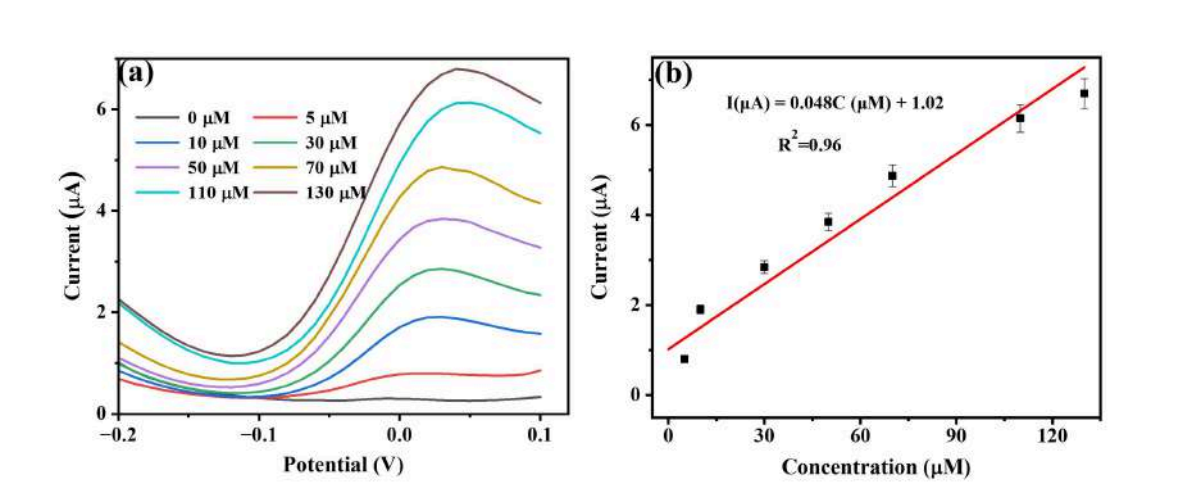

Fig. 3. Differential pulse voltammetry (DPV) responses of CuBTC/SPE with varying concentrations of bilirubin in 0.1 M PB solution (a), and corresponding calibration plot of concentration of bilirubin versus anodic current (b).

The research is published in the Chemical Engineering Journal, a prestigious international journal from Elsevier. Full citation: *Pathan S, Raveendran J, Memon M, Chavda V, Niyas K, Bayry J, and Rasheed PA. 2025. Chemical Engineering Journal, 511, 162217.*

https://www.sciencedirect.com/science/article/pii/S1385894725030438?via%3Dihub

COURTS, GROUNDS, AND GRIT: INSIDE IIT PALAKKAD'S SPORTS ARENA

Nestled in the serene landscapes of Kerala, IIT Palakkad is not just a cradle of academic excellence but also a vibrant hub for sports and fitness. The institute prides itself on fostering a dynamic sporting culture that celebrates the spirit of teamwork, resilience, and holistic well-being. With world-class infrastructure and a passionate student community, IIT Palakkad offers the perfect arena for budding athletes and fitness enthusiasts to thrive.

WORLD-CLASS FACILITIES, BOUNDLESS OPPORTUNITIES

The sprawling campus is adorned with meticulously maintained courts and grounds that cater to a wide range of sporting interests. The facilities include: basketball court, football ground, cricket ground, athletics track, badminton court, table tennis (TT) court and volleyball ground. Each space is designed to provide students with the ideal setting to train, compete, and grow–both as athletes and as individuals.

A CULTURE OF WELLNESS

The campus houses two fully-equipped gyms, located in the Malhar and Kedaram hostels, offering a sanctuary for fitness lovers. These centres are not just about building physical strength, but also about cultivating discipline, balance, and mental well-being.

THE INTER IIT SPIRIT

Every year, IIT Palakkad's athletes gear up for the prestigious Inter IIT Sports Meet, showcasing their talent and determination on a national platform. In preparation for this grand event, the institute organises its very own General Championship– a spirited internal competition that mirrors the Inter IIT format. It serves as both a training ground and a celebration of athletic excellence.

SPORTACUS AND BEYOND

Adding to the excitement is Sportacus, a much-anticipated event held during the odd semester. It brings together the entire student community in a celebration of sportsmanship, unity, and friendly rivalry. Beyond Sportacus, the calendar is dotted with various tournaments and recreational activities, ensuring that the joy of sports is a year-round affair.

Alumni Spotlight

"I'm currently a third-year PhD student in the ECE department at Georgia Tech. I chose a career in research as I enjoy thinking deeply about interesting problems. My first real exposure to research was during my time working with Dr. Arvind Ajoy at IIT Palakkad. Participating in lab meetings and contributing to a range of projects, from low-cost instrumentation to device simulations, helped me discover my passion and gain clarity on what I wanted to do next. To undergraduates who are uncertain about their direction, don't hesitate to explore. if you're confused about what you want to do, then try everything! Jump at every opportunity you come across until you find something that excites you."

Priyankka G R
Class of 2022
B.Tech Electrical Engineering
Current Position: P.hD at ECE department at Georgia Tech

Surakshith Reddy Mothe
Class of 2019, Electrical Engineering
Current Position: Silicon Design Verification Engineer at Google, Mountain View, CA

"Being part of the first B.Tech batch at IIT Palakkad was truly foundational. We created clubs and a vibrant sports culture from the ground up, fostering a strong sense of initiative and ownership. The hands-on coursework, enriched with engaging projects and honed my problem-solving skills, deepened my understanding of core electrical engineering concepts. Organising events like Ek Bharat Shreshtha Bharat and serving as the institute volleyball secretary helped develop my leadership abilities. The close-knit community encouraged diverse interactions, and I also found creative expression through dance and intercultural events. Supportive professors constantly pushed us to innovate, instilling a growth mindset that continues to guide my career."

Shidhin Tom
Class of 2021
M.Tech in Manufacturing and Materials Engineering
Current Position: Scientist at ISRO(Vikram Sarabhai Space Centre)

"IIT Palakkad has played a significant role in shaping me both professionally and personally. I am especially grateful to my M.Tech guide, Dr. Kanmani Subbu, for his invaluable mentorship, fresh perspectives, and for helping shape the person I am today. The industry-oriented curriculum, particularly the focus on emerging technologies like additive manufacturing, proved to be extremely beneficial and greatly supported my transition into the professional world."

"My journey at IIT Palakkad has been nothing short of a roller coaster ride. As part of the first batch, I had the privilege of contributing to the founding of several student-led initiatives, including the Sports Committee, Quiz Club, Student Media Body, and Petrichor. These experiences shaped my leadership skills and personal growth. The campus also offered immense exposure. I had the chance to travel across the country for Inter-IIT sports meets and represent the institute at Inter-IIT cultural meets in IIT Roorkee and IIT Kanpur, as well as at the IIT-IIM quiz competition at IIM Ahmedabad. These opportunities enriched my learning beyond the classroom. I owe a great deal to exceptional teachers like Vinod Sir, Kutty Sir, Valsakumar Sir, Kashi Sir, and Sahoo Sir, who were not just educators but mentors. I am especially grateful to Vinod Sir, whose guidance enabled me to secure an internship at a reputed institution like NTU Singapore."

Rajath. R
Class of 2019
Electrical Engineering
Current Position: Product head, GYANPATH group

Indian Civil Services Examination Rank 169

Syed Shafiulla
Class of 2024
M.Tech in power electronics and power systems
Current Position: P.hD at TU Delft, Netherlands

"After joining IIT Palakkad to deepen my understanding of various subjects, I soon realised that the institute had much more to offer than I had initially expected. My time there was a holistic journey of academic, professional, and personal growth. Under the mentorship of experienced faculty, I gained valuable insights into the essence of research, how to approach it, conduct it, and contribute meaningfully to the research community. The serene, green campus provided the ideal environment to focus, explore, and grow. IIT Palakkad is truly a remarkable place for those who seek knowledge and purpose."

RESEARCH HIVE

Say hello to *The Research Hive* - a new space where we shine a light on the exciting research, internships, and projects our students and scholars have been working on. From conference presentations to creative innovations, this section is all about celebrating curiosity and discovery on campus.

FOCUS ON WHAT MATTERS: GUIDING VISION TRANSFORMERS TOWARDS JUSTIFICATION

Thomas John, Dr. Mrinal Das (Department of Data Science)

In this insightful article, Mr. Thomas John and Dr. Mrinal Das explore the limitations of Vision Transformers (ViTs) and introduce justifiable Vision Transformers (jViT). The authors demonstrate how even simple annotations can significantly enhance model reliability, especially in sensitive applications like medical imaging and autonomous systems.

In recent years, transformers have revolutionised the way machines understand and generate information. Originally designed for processing language, transformers power many of today's most widely used AI tools—such as ChatGPT, Google Translate, and even content recommendation systems. Their strength lies in the self-attention mechanism, which allows models to weigh the importance of different parts of input data, enabling them to understand context more effectively than previous architectures.

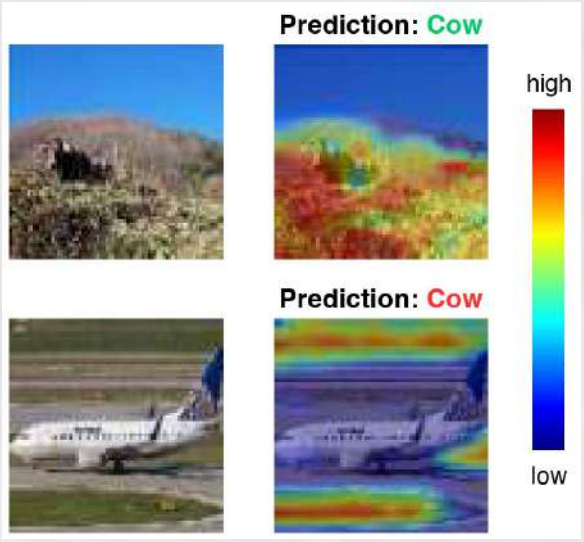

Figure 1: Saliency heat maps highlighting important regions in the image for model predictions.

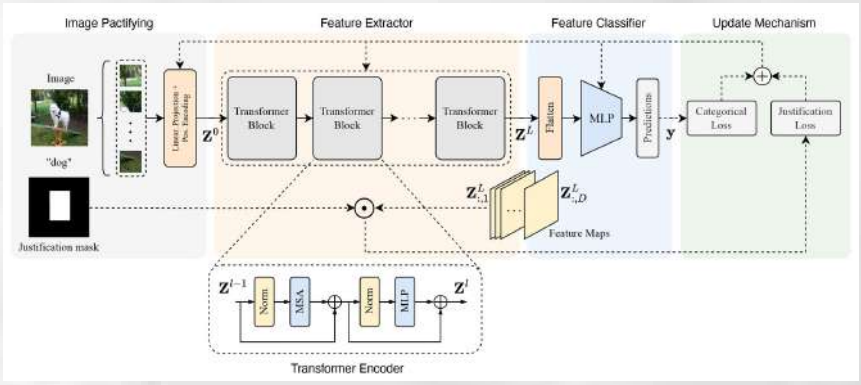

Figure 2: Illustration of the proposed methodology

Although transformers first gained fame in natural language processing (NLP), their success has rapidly expanded to other domains, most notably, computer vision. Vision Transformers (ViTs) have recently outperformed - state-of-the-art convolutional networks. While classifiers are expected to capture relevant, class-discriminative features, ViTs often learn features that merely co-occur with ground-truth labels—regardless of their actual relevance. Consequently, ViTs may assign labels based on spurious cues, leading to predictions that lack human-like justification. This poses serious risks in high-stakes domains like medical imaging and autonomous driving. Relying solely on quantitative metrics like accuracy, that does not take into account whether the model predictions are justified from a human point of view, may be inadequate.

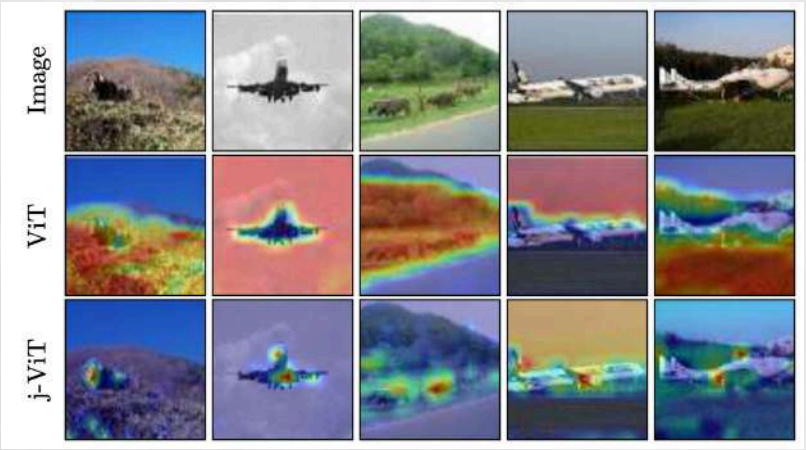

Figure 3: Heatmaps confirm that jViT focuses on class-discriminative features, mitigating reliance on spurious correlations.

Figure.1 illustrates this phenomenon: a ViT trained to distinguish 'aeroplane' from 'cow' images might rely on background cues like 'sky' or 'grass' that frequently co-occur with the labels. While this doesn't impact training accuracy, it can cause misclassifications during testing-e.g., predicting a 'cow' for an 'aeroplane' in a grassy context-hurting generalisation.

Such reliance on shortcuts raises concerns about the justification of model decisions. Notably, while explainability and interpretability clarify how models make decisions, justification focuses on aligning those decisions with human reasoning. We argue that ViTs inherently lack justification, as their feature extraction is disconnected from human reasoning. To address this, we propose providing the model with additional human guidance alongside class labels. We introduce justifiable Vision Transformer (jViT), which uses justification masks to highlight human-justifiable regions in images (see Figure 2). These masks can be minimal—a bounding box which requires just two pixels per object in about 10% of training images. Our method requires no changes to the model architecture and no guidance during inference. We augment the loss function with a justification component, training the model to minimize both classification error and deviation from justifiable features.

We observe that the model adapts well to this simple alteration and focuses on learning genuinely class-discriminative features (see Figure 3), thereby making its predictions more justifiable from a human standpoint. A key challenge in this approach is the tedious nature of providing additional human guidance. Nevertheless, we demonstrate that achieving justification is possible by leveraging a few justification masks, thus alleviating the need to provide guidance for every training sample. Additionally, we observe that our method is resilient to different types of contextual perturbations. Additionally, we observe that our method is resilient to different types of contextual perturbations, as illustrated in figure 4.

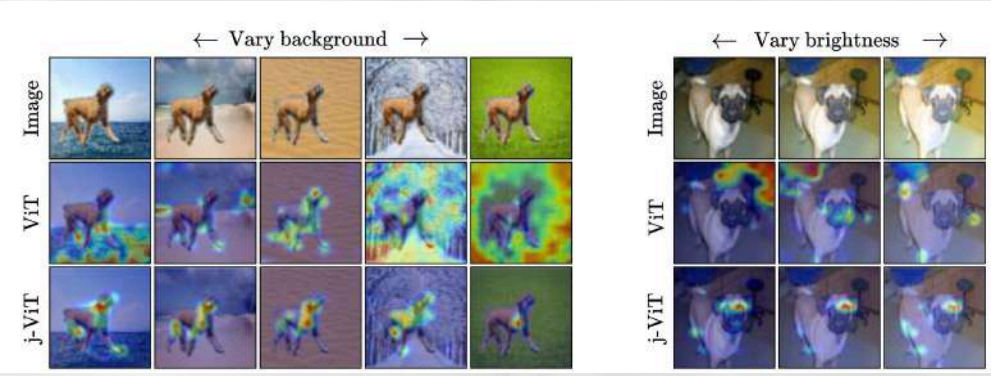

Figure 4: "Illustration of robustness of jViT to perturbations in background. Note that while the standard ViT is very sensitive to background and brightness variations, our model remains invariant to such changes"s.

GC 2

GENERAL CHAMPIONSHIP 2025

EVENTS AND COLLABORATIONS

MoU with AutoDesk

Science Quest

GHATS 2025

Environment Day

MoU with NAMTECH

Symphony of Seven

Kaliveedu - Balyam Vihar

Invest Kerala Global Summit

MoU with GEC Barton Hill

Workshop for KPWD Engineers

Pravaha RSD 7.0

Gunvatta Yatra - Awareness program by GSCOE & CCE

Discussion with University of Groningen

Substance Abuse Awareness Workshop by IITP & IMA Palakkad

Precision Quantification: Digital PCR Workshop

Field visit to the Akathethara PHC

Women's Day celebration

Institute Colloquium

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REACH US

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Indian Institute of Technology Palakkad
Nurturing Minds For a Better World