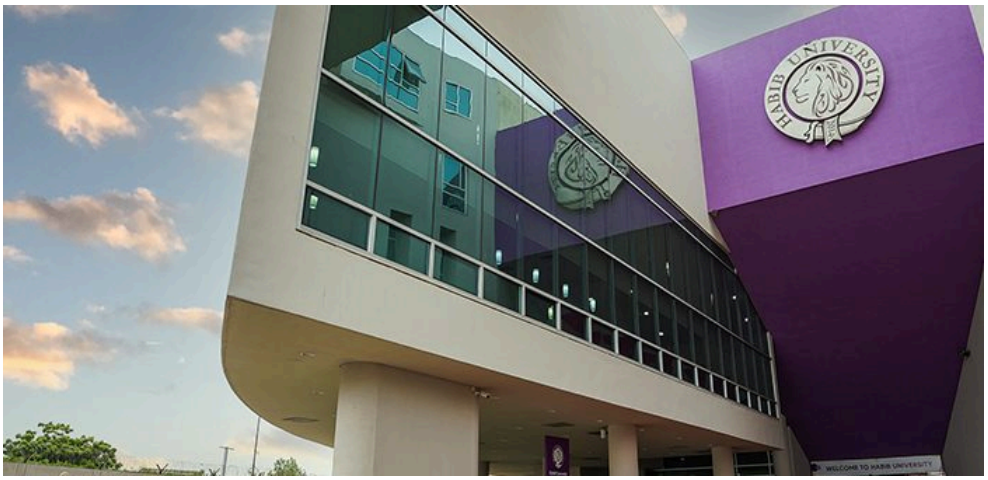
OFFICE OF RESEARCH
AND GRADUATE SCHOOL
CURATION PROGRAM

RESEARCH SHOWCASE ABSTRACT BOOK

Summer Tehqiq Research Program 2024



Habib University
12th September 2024

SUMMER TEHQIQ RESEARCH PROGRAM

INTRODUCTION

The Summer Tehqiq Research Program (STRP) at Habib University, jointly administered by the Office of Research and the Graduate School Curation Program (GSCP), serves as a catalyst for fostering a vibrant undergraduate research culture. This flagship program aims to provide faculty and fellows with research funding and mentoring honorariums, enabling the implementation of small-scale research ideas. Simultaneously, STRP offers students an intensive curated research experience, guiding them in the development of their research projects over four semesters.

PROGRAM STRUCTURE

STRP is structured into two segments: STRP 1, focusing on faculty-led guided research, and STRP 2, supporting students in pursuing independent research. For STRP 1, faculty and fellows submit proposals for ten-week research projects, taking on the roles of Principal Investigators (PIs) and active mentors. Students apply based on thematic areas of interest and are matched with a PI for mentorship. For STRP 2, undergraduate researchers draft their own research proposal and seek the support of a faculty mentor to supervise their independent research.

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STRP 1 – FACULTY-LED RESEARCH PROJECTS

VENUE: HORIZON

LIST OF POSTER PRESENTATIONS

VENUE: HORIZON | SECTION: TRUNK AREA

S. No.	Poster Title	Principal Investigator	Undergraduate Researchers
1.	From Stress to Strength: The Power of Meditation and Walking in Youth Health	Dr. Humaira Jamshed	Azkaa Nasir, Fakiha Faisal, Muhammad Ashar Abbasi
2.	Exploration of AI for Distribution Network Aggregation Considering IBRs	Dr. Syed Muhammad Hur Rizvi	Manal Hasan, Rubab Shah, Batool Zehra Ladh
3.	Impact of Negativity Bias on Perceptions of Inflation	Dr. Faisal Alvi	Nehal Naeem Haji, Syed Zuhair Abbas Rizvi
4.	Estimation of Transmission Line Parameters Based on PMU Measurements and Bad Data Detection in PMU Measurements in Smart Grids	Dr. Mohammad Shahid Shaikh	Aatika Arshad, Basil Khowaja, Zaid Bin Khalid
5.	Advancing Commercial Aviation: A Comprehensive Review and Range Optimization Study	Dr. Usman Salahuddin	Muneeba Badar, M. Manqad Raza, Bilawal Barkat Ali
6.	Solar Panel Cleaning Robot	Dr. Munzir Zafar	Ahsan Fayyaz, Ilsa Sharrif, Qamar Raza, Hania Kashif, Umar Habib
7.	Design & Development of a Web Application for Outcome-Based Education in ECE Program	Dr. Farhan Khan	Ahmed Abdullah Mujtaba, Syed Ahad Ali

VENUE: HORIZON | SECTION: H-508

S. No.	Poster Title	Principal Investigator	Undergraduate Researchers
8.	Assessment of Water Quality of Hand Pump Water from Lower, Middle, and Upper Districts of Sindh, Pakistan	Dr. Humaira Qureshi	Anosha Nangraj, Eman Fatima, Uraib Aftab
9.	Structuring a Framework for Participatory Planning: Case Study - Human Ecology Interface - Baba Island, Karachi	Farhan Anwar	Janita Baloch, Samra Mustafa, Masooma Rehan, Rewa Khan

10.	Exploring Access to Credit Among Small-Scale Farmers of Tando Allahyar: Needs, Perspectives & Challenges	Uswa Ali Memon	Alina Rehman, Zehra Tejani, Fida Hussain

VENUE: HORIZON | SECTION: H-509

S. No.	Poster Title	Principal Investigator	Undergraduate Researchers
11.	Bridging Philosophical Traditions: A Comparative Study of Religious Experiences in Suhrawardi and James	Hamza bin Sajjad	Neha Allar, Maria Adnan
12.	Exploring the Determinants of Student Satisfaction and Engagement at Undergraduate Universities in Pakistan	Dr. Muhammad Aatir Khan	Erum Naushad, Ghos Usmani, Syeda Wania Hussain
13.	Linguistic Equity Within and Beyond Campus: Understanding the Linguistic Landscape at Habib University	Dr. Xiaoxi Zhang	Aqsa Ujjan, Madiha Qasmi, Syeda Neel Kanwal
14.	Digital Parenting and Pakistani Mothers of Young Children	Dr. Neelma Bhatti	M. Huzaifah Riaz, Aisha Abdul Qadir, Qurba Mushtaque
15.	Autonomizing Industrial Tow Trucks: A Mobile Robotics Solution for Toyota IMC	Dr. Munzir Zafar	Suleiman Qureshi, Ailiya Fatima, Sadiqah Mushtaq, Shaheer Abbas, Ehzem Shaikh
16.	Tank Handover Inspection	Dr. Shafayat Abrar	Vezhish Ali, Saif Nazir, Muhammad Abdullah
17.	Maze Marvels: Crafting the Future with Micro-Mouse Robotics	Dr. Waseem Hassan	Muhammad Bilal Qureshi, Maleeha Hussain, Abdullah Amir, Shameer Masroor
18.	Koh-e-Atlas Karachi	Zaineb Makati	Aatika Saleem, Mehlab Kashani, Khubaib Mukaddam, Daniyal Shadab, Saniyah Salman
19.	Impact of Multilateral Aid on Female Access to Education and Employment: A Spatiotemporal Analysis of World Bank (WB) Aid Projects in Pakistan	Muhammad Ashar Khan	Saba Nisar, Zashir Naqvi
20.	Exploring Perceptions and Experiences Regarding Experiential Learning Pedagogy	Dr. Muhammad Aatir Khan	Amsal Malik, Sumaiya Zuberi
21.	Graph Data Model for Science of Science	Dr. Qasim Pasta	Taha Munawwar, Iqra Azfar

VENUE: HORIZON | SECTION: PODS AND TIDAL POOL

S. No.	Poster Title	Principal Investigator	Undergraduate Researchers
22.	MirāN Maa: An Ethnographical Study of the mother of Lyari	Dr. Naila Pervaiz	Nayma Ahmed, Hafsa Shams, Syeda Marium Mairaj
23.	Quantifying Pakistan's Judicial System	Dr. Sahaab Bader Sheikh	Aamna Ahmed, Fatima Sami

24.	Devised Theatre - Reimagined	Muneera Batool	Arooj Zahra, Mustafa Jamal, Syed Hassan Rizwan
25.	SpecX – A Linux-Based Tool for ECE Education	Dr. Bilal Wajid	Syed Meesam Abbas Zaidi, Muhammad Hasan Nizami
26.	Data Analysis Across Boundaries	Dr. Syeda Saleha Raza	Zainab Haider, Syeda Samah Daniyal, Areeba Arif
27.	Optimizing Critical Care: Assessing the Availability and Potential of Physiological Monitoring Data for Smart ICUs	Dr. Syeda Saleha Raza	Muhammad Youshay, Raahim Hashmi, Muhammad Ibad
28.	Let's See Sound with Light: Observing Sound Waves Through Light	Dr. Sameena Shah Zaman	Rohaan Ahmad
29.	Initiating Long-Term Microchip Design Ecosystem at Habib University - Using the Rapidly Maturing Open-Source CAD Tools and Open-Source Hardware IP for Design Acceleration	Dr. Syed Arsalan Jawed	Huzaifa Akram, Mysha Zulfiar, Hamad Khan
30.	Fixed-Wing UAV Design with Vertical Take-Off and Landing and Autonomous Flying Capability	Dr. Syed Arsalan Jawed	Moiz Zulfiqar, Mubashir Anees, Syed Ali Nisar Shah

STRP 2 – STUDENT-DESIGNED RESEARCH PROJECTS

VENUE: LIBRARY INFO- COMMONS AND MULTI-PURPOSE ROOM

LIST OF POSTER PRESENTATIONS

VENUE: LIBRARY INFO-COMMONS

S. No.	Poster Title	Principal Investigator	Research Supervisor
1.	Connectivity and Influence: A Study of Co-Principal Authorship Networks among Pakistani Computer Scientists	Asad Ullah Chaudhry	Dr. Qasim Pasta
2.	SimpleText: Scientific Text Simplification using Large Language Models and NLP	Hammad Sajid	Dr. Abdul Samad
3.	Leveraging Gamification for Antibiotic Awareness	Syed Asghar Abbas Zaidi	Saad Umer Baig
4.	AI-Driven Job Selection: Revolutionizing Talent Acquisition with Machine Learning-Powered Resume Screening and Candidate Profiling	Areesha Amir	Dr. Saleha Raza
5.	Tweets Sentiment Analysis on Climate Change Discourse within Pakistan	Syeda Rija Hasan Abidi	Dr. Shah Jamal Alam
6.	Modular Arithmetic and Tihai	Daniyal Areshia	Rameez Ragheb
7.	Analyzing the Socio-Economic and Political Space of Water Tanker Systems in Karachi: A Case Study of Defence Housing Authority (DHA)	Esha Amin	Farhan Anwar
8.	Spirit of Jugaad - Exploring the intersection between class, race, craftsmanship and gender	Soheba Shoaib	Dr. Behzad Khosravi Noori
9.	Analyzing Urban Overheating Through Remote Sensing and GIS Techniques: A Case Study of Karachi, Pakistan	Dua Mohtashim	Zaineb Makati
10.	Reclaiming the Streets as Public Spaces of Karachi: A Case Study of Lyari's Jhatpat Market	Munaza Fatima	Farhan Anwar
11.	Enhanced Gaze Estimation	Samiya Ali Zaidi	Dr. Unaiza Ahsan
12.	A Comparative Study on the Performance of Modern Graph Databases	Ali Muhammad Asad, Asad Muhammad	Dr. Qasim Pasta
13.	Eddy Current Method for Crack Detection: Mathematical Modeling and Simulation for Preventive Maintenance	Syed Muhammad Muslim Hussain	Dr. Tariq Mumtaz
14.	Designing towards an Informed CRISPR Cas13 Based Drug Design for Dengue Virus	Syed Muhammad Ali Naqvi	Dr. Farhan Khan

VENUE: MULTI-PURPOSE ROOM

S. No.	Poster Title	Principal Investigator	Research Supervisor
15.	Cutting the Reel: Censorship's Role in Crafting Pakistan's Film Narrative	Alaina Asim	Tajreen Midhat
16.	Challenging the Myth of The Secular: The Role of Ontotheology and Biopolitics in the Secular State	Soha Sajjad	Sumbul Usman Yusuf
17.	Questioning Survival in the Age of the Anthropocene	Daniyal Ahmed	Dr. Muhammad Haris
18.	Specters of Bhutto	Fatima Javaid	Dr. Behzad Khosravi Noori
19.	Women Farmers' Awareness, Challenges, and Adaptation Needs to Climate Change: Insights from a Remote Village in Neelum Valley, AJ&K	Asiya Azad	Uswa Ali Memon
20.	A Comparative Analysis of Maternal Health Care Across Districts in Pakistan: A Case Study of the 2015 Heatwaves	Sahar Makhani	Zaineb Makati
21.	Analysing Trends in Funding Allocation Among Sports Federations: A Study of High and Low Performers Over the Past Five Years	Mayam Raza	Dr. Qasim Pasta

ABSTRACTS

STRP 1 – FACULTY-LED RESEARCH PROJECTS

1. FROM STRESS TO STRENGTH: THE POWER OF MEDITATION AND WALKING IN YOUTH HEALTH

Principal Investigator: Dr. Humaira Jamshed (Assistant Professor, iSciM)
Undergraduate Researcher(s): Azkaa Nasir (CS), Fakiha Faisal (CS), Muhammad Ashar Abbasi (CS)

Abstract:
Background: Mental health challenges and sedentary lifestyles are significant concerns among young adults. Meditation and walking are two accessible interventions that may improve both mental and physical health. This study explores the effects of a three-week intervention of meditation and walking on health outcomes in university students in Karachi, Pakistan. Methods: Twelve HU students were randomly assigned to either a meditation or walking group. Both groups engaged in 20 minutes of daily activity. Assessments included psychological measures (e.g., mental health, happiness, sleep parameters), physical metrics (e.g., body composition, activity levels), vital signs, blood sugar and cholesterol, nutritional intake, and eating behavior. Results: Both interventions led to significant improvements in mental health, including reduced anxiety, depression, and stress, alongside enhanced sleep quality, life satisfaction, and resilience. Meditation had a more pronounced impact on stress reduction and sleep improvement while walking significantly boosted life satisfaction and resilience. On the physical health front, the walking group exhibited notable increases in bone mass, muscle mass, and BMR, along with a decrease in fat mass. The meditation group, meanwhile, showed an increase in total calorie and nutrient intake, with stable vital signs compared to more variable results in the walking group. Conclusion: Meditation and walking both offer significant health benefits. While both practices are effective, walking appears to offer more substantial physical health benefits, and meditation is particularly effective for stress management and dietary improvements. These findings suggest that integrating both practices into daily routines could enhance overall well-being, particularly among students.

Keywords: Adolescent Health, Meditation, Physical Activity, Mental Well-Being, Body Composition

2. EXPLORATION OF AI FOR DISTRIBUTION NETWORK AGGREGATION CONSIDERING IBRS

Principal Investigator: Dr. Syed Muhammad Hur Rizvi (Assistant Professor, ECE)
Undergraduate Researcher(s): Manal Hasan (CS), Rubab Shah (CS), Batool Zehra Ladha (EE)

Abstract:
The integration of distributed generation sources, such as photovoltaic (PV) systems and battery energy storage systems (BESS), is transforming traditional power distribution networks, introducing new challenges in grid management due to the dynamic and bidirectional flow of electricity. Accurate estimation of power system parameters is crucial for optimizing performance and maintaining grid stability; however, existing methods are limited by inadequate datasets that fail to capture the complexities introduced by these new technologies. This research addresses this gap by leveraging modern machine learning (ML) techniques to enhance the accuracy of parameter estimation for network aggregation in active distribution networks. Using the IEEE 33-bus system under IEEE 1547 standards as a

case study, we developed a robust data generation framework utilizing OpenDSS simulations and automated extraction methods to create comprehensive and diverse datasets, represented as rank-3 tensors of inhomogeneous shape. These datasets were then employed to train ML models capable of predicting key parameters, including voltage per unit, active power loss, reactive power loss, new ZIPV parameters, and power bases across various operational scenarios. Our findings demonstrate that the ML models achieved a mean squared error (MSE) as low as 0.015 for the loads-only model and 0.014 for the PV BESS system, indicating high prediction accuracy.

Keywords: ZIP, IBRs, Aggregation, ML, Neural Networks, LSTM

3. IMPACT OF NEGATIVITY BIAS ON PERCEPTIONS OF INFLATION

Principal Investigator: Dr. Faisal Alvi (Assistant Professor, CS)
Undergraduate Researcher(s): Nehal Naeem Haji (CS), Syed Zuhair Abbas Rizvi (CS)

Abstract:
This project aims to address the presence of negativity bias in inflation related news within Pakistan's print news sources and its impact on public sentiments towards inflation. We collected approximately 700 news stories related to fuel price inflation from 9 newspapers (5 English and 4 Urdu) for a 3.5-year period from January 2021 up to July 2024. Likewise, more than 200 videos related to fuel price inflation from 6 news channels were also collected and clips of public comments related to fuel price inflation were extracted for the same period. Both sets of data (news articles and videos) were subjected to sentiment analysis using several models, including the state-of-the-art GPT 4-o mini model. Our findings show that while there is little negative sentiment related to fuel price inflation in the news articles, the negativity within the public sentiments is much higher. This negativity is prevalent even though price decreases were announced. This analysis suggests that news articles, especially from the print media may not influence public sentiments, especially negative sentiments towards fuel price inflation.

Keywords: Negativity Bias, Inflation, Sentiment Analysis, News Media, Natural Language Processing

4. ESTIMATION OF TRANSMISSION LINE PARAMETERS BASED ON PMU MEASUREMENTS AND BAD DATA DETECTION IN PMU MEASUREMENTS IN SMART GRIDS

Principal Investigator: Dr. Mohammad Shahid Shaikh (Associate Professor, ECE and Interim Associate Dean for Academic Operations)
Undergraduate Researcher(s): Aatika Arshad (CE), Basil Khowaja (CE), Zaid Bin Khalid (EE)

Abstract:
The electrical power is carried to the consumer premises through a complex network of power-generating equipment, transmission lines, and distribution networks. The devices used to measure the magnitudes and phase angles of voltage and current in the grid are called phasor measurement units (PMU). PMU data, which are called synchrophasors, are used for real-time monitoring and control of the electric grid; the following two challenges have been identified in the literature: (i) The measured data is prone to measurement errors and requires filtering and estimation techniques to extract signals from additive noise, (ii) PMUs communicate with the control center over the internet and hence are prone to usual cyberattacks, such as the injection of false data. We address both these problems as we develop efficient

algorithms that will solve the problem of simultaneously estimating the synchrophasor data and detecting any injection of bad data into the system.

Keywords: Power Systems, Phasor Measurement Units, Synchrophasors

5. ADVANCING COMMERCIAL AVIATION: A COMPREHENSIVE REVIEW AND RANGE OPTIMIZATION STUDY

Principal Investigator: Dr. Usman Salahuddin (Assistant Professor, iSciM)
Undergraduate Researcher(s): Muneeba Badar (CS), M. Manqad Raza (CE), Bilawal Barkat Ali (CE)

Abstract:
This project explores the potential for electrifying commercial aviation, focusing on the range optimization of Airbus aircraft through detailed calculations and analysis. By varying key parameters such as energy density, battery mass ratios, altitude, velocity, drag coefficient, and lift-to-drag ratios, the study reveals significant insights into how these factors influence aircraft range. Additionally, the paper provides a comprehensive review of battery technology advancements, electric propulsion architectures, and the evolving landscape of electric aviation, highlighting future possibilities for sustainable air travel. The findings underscore the importance of a holistic approach to designing and developing electric aircraft, offering a roadmap for future advancements in this transformative field.

Keywords: Electric Aviation, Parametric Optimization, Batteries, Commercial Airplanes, Airbus A320

6. SOLAR PANEL CLEANING ROBOT

Principal Investigator: Dr. Munzir Zafar (Assistant Professor, ECE and Faculty Director Academics, GSCP)
Undergraduate Researcher(s): Ahsan Fayyaz, Ilsa Sharrif, Qamar Raza, Hania Kashif, Umar Habib

Abstract:
Solar panels are vital for converting sunlight into electricity, but their efficiency is significantly hindered by the accumulation of dust, dirt, and other debris, potentially reducing performance by up to 50%. Manual cleaning is labor-intensive, time-consuming, and water-intensive, especially for large solar farms. As solar energy adoption grows in Pakistan, there is a pressing need for cost-effective, automated solutions to maintain panel cleanliness. The proposed Solar Panel Cleaning Robot will offer an affordable, water-efficient, and easy-to-use robotic system for cleaning solar panels, reducing labor costs and safety risks associated with manual cleaning. This project aims to address both efficiency and sustainability challenges in solar panel maintenance.

Keywords: Robust Cleaning, Autonomous Cleaning, Automated Solution, Robotic System, Electricity Efficiency

7. DESIGN & DEVELOPMENT OF A WEB APPLICATION FOR OUTCOME-BASED EDUCATION IN ECE PROGRAM

Principal Investigator: Dr. Farhan Khan (Assistant Professor, ECE)
Undergraduate Researcher(s): Ahmed Abdullah Mujtaba (CE), Syed Ahad Ali (CS)

Abstract:
This project aims to conceptualize, design, and implement a comprehensive web application dedicated to facilitating Outcome-Based Education (OBE) in Habib University's ECE program. OBE is a student-centric approach that focuses on defining clear learning outcomes and assessing students' achievements against these outcomes. The proposed web application seeks to streamline and enhance the OBE process, fostering effective curriculum management, assessment, and continuous improvement within educational institutions. The web application will feature a user-friendly interface, allowing educators and administrators to collaboratively design and manage course curricula aligned with specified learning outcomes. The system will support the creation of detailed outcome maps, ensuring transparency and traceability of learning objectives throughout the educational journey. Additionally, the platform will incorporate tools for assessing student performance against these outcomes, providing timely and constructive feedback to both administrators and instructors. The successful implementation of this web application is anticipated to result in improved educational outcomes, enhanced accreditation processes, and greater adaptability to evolving educational standards.

Keywords: Outcome-Based Education, Web Application, Django, SQL Server, Python

8. ASSESSMENT OF WATER QUALITY OF HAND PUMP WATER FROM LOWER, MIDDLE, AND UPPER DISTRICTS OF SINDH, PAKISTAN

Principal Investigator: Dr. Humaira Qureshi (Associate Professor, iSciM)
Undergraduate Researcher(s): Anosha Nangraj (SDP), Eman Fatima (CS), Uraib Aftab (SDP)

Abstract:
Sindh faces critical water quality challenges, with communities heavily dependent on hand pumps amidst deteriorating infrastructure. This study assesses the microbiological, chemical, and physical quality of 90 hand pump water samples in three Sindh districts—Badin (Lower), Sanghar (Middle), and Sukkur (Upper)—and evaluates associated health practices. Microbiological tests using IDEXX Colilert identified Badin as having the highest levels of E. coli (86.7%) and coliform (56.7%) contamination, followed by Sanghar and Sukkur. Physical analysis revealed visible impurities in water from Badin (73.3%), Sukkur (36.7%), and Sanghar (26.6%). Chemical testing indicated that 7.8% of samples exceeded WHO nitrate standards, predominantly in Sukkur, while 40% exceeded WHO TDS (Total Dissolved Solids) standards. Notably, arsenic levels were critically high in Badin (100 ppb) and Sukkur (25 ppb). Health practices revealed that 95.6% of respondents do not boil water before consumption, 98.9% have never tested their hand pump water, 74.4% have animal waste around the hand pumps, and 45.6% do not use soap for handwashing. The results underscore severe contamination issues across all districts, with Badin's high microbial contamination linked to inadequate infrastructure and pollution from the Phuleli canal, Sukkur's nitrate levels exacerbated by agricultural runoff, and alarming arsenic levels calling for urgent intervention. Comprehensive measures to improve water safety and public health are urgently needed in Sindh.

Keywords: Water, Quality, Microbial, Chemical, Contamination

9. STRUCTURING A FRAMEWORK FOR PARTICIPATORY PLANNING: CASE STUDY - HUMAN ECOLOGY INTERFACE - BABA ISLAND, KARACHI

Principal Investigator: Farhan Anwar (Assistant Professor of Practice, SDP)
Undergraduate Researcher(s): Janita Baloch (SDP), Samra Mustafa (SDP), Masooma Rehan (SDP), Rewa Khan (SDP)

Abstract:
The project area comprised the island of Baba located in the Karachi Harbor. The island has no organized system of solid waste management and the practices of either openly burning solid waste or dumping directly into the sea along mangrove forestations have adverse consequences for both human health and the sensitive marine ecology. Interactive engagement with communities residing in the Baba Island led to finding inclusive pathways to facilitate better management of island solid waste. The research approach selected was the Human Centered Design (HCD) approach. Secondary and primary research using both qualitative and quantitative research methodologies was employed. Students learnt how to construct appropriate forms for data documentation such as field observation notes, pictorial and video documentation, discussion notes, card sorting, self-documentation, and field survey etc. The main project deliverables were prototype designs.

Keywords: Participatory, Inclusive, Ecology, Community, Sustainability

10. EXPLORING ACCESS TO CREDIT AMONG SMALL-SCALE FARMERS OF TANDO ALLAHYAR: NEEDS, PERSPECTIVES & CHALLENGES

Principal Investigator: Uswa Ali Memon (Dean's Fellow, SDP)
Undergraduate Researcher(s): Alina Rehman (SDP), Zehra Tejani (SDP), Fida Hussain (SDP)

Abstract:
This research investigates the challenges faced by small-scale farmers in Tando Allahyar, a key agricultural hub, in accessing secure, timely, and sufficient credit. By evaluating the existing financial infrastructure and identifying the barriers that hinder farmers from obtaining necessary funding, the research aims to understand the broader landscape of rural agricultural financing. Utilizing a qualitative exploratory sequential design, the study conducted 12 in-depth interviews and 4 focus group discussions with small farmers and key stakeholders, including informal lenders (aartis) and representatives from both commercial and microfinance institutions. The findings highlight a significant dependence and preference on informal credit sources and highlighted formal credit resources to be unfavorable for the context in which these small farmers operate.

Keywords: Small Farmers, Credit Access, Agriculture

11. BRIDGING PHILOSOPHICAL TRADITIONS: A COMPARATIVE STUDY OF RELIGIOUS EXPERIENCES IN SUHRAWARDI AND JAMES

Principal Investigator: Hamza bin Sajjad (Dean's Fellow, CH)
Undergraduate Researcher(s): Neha Allar (CND), Maria Adnan (CS)

Abstract:
This project offers an in-depth comparative study between the two eminent philosophical and psychological perspectives offered on religious experience in entirely different time periods by Suhrawardi (d. 1191) and William James (d. 1910), respectively. This study identifies similarities and differences in their approaches by exploring major themes including, but not limited to, the nature of divine illumination, the role of intuition, and the impact of religious experiences on individuals. After a critical comparative study of primary texts by both Principal Investigators (Hikmat al-Ishraq by Suhrawardi and The Varieties of Religious Experience by James), the research aims to uncover the religious and spiritual epistemology under question and its veracity. This research helps develop a greater understanding about the nature of spiritual experiences of religious and non-religious individuals alike.

Keywords: Divine illumination, intuition, religious experience, spiritual experience

12. EXPLORING THE DETERMINANTS OF STUDENT SATISFACTION AND ENGAGEMENT AT UNDERGRADUATE UNIVERSITIES IN PAKISTAN

Principal Investigator: Dr. Muhammad Aatir Khan (Assistant Professor, SDP)
Undergraduate Researcher(s): Erum Naushad (CS), Ghos Usmani (SDP), Syeda Wania Hussain (CS)

Abstract:
Students are a key stakeholder for any educational institute. This project aims to explore their level of satisfaction, focusing on out-of-class aspects, and how that determines their engagement with the university. It is crucial to understand this because that becomes the foundation of student experience, and it can help university administrations in improving student experience. A positive student experience is critical for active student engagement, which also leads to a more holistic student development. This study gathers data from students across the country to better understand student satisfaction at different universities, evaluate their engagement levels, and to propose recommendations that can be used to improve the out-of-class experience at universities in Pakistan.

Keywords: Student Experience, Student Satisfaction, Student Engagement, Student Development, Student Success

13. LINGUISTIC EQUITY WITHIN AND BEYOND CAMPUS: UNDERSTANDING THE LINGUISTIC LANDSCAPE AT HABIB UNIVERSITY

Principal Investigator: Dr. Xiaoxi Zhang (Global Fellow, CH)
Undergraduate Researcher(s): Aqsa Ujjan (CND), Madiha Qasmi (SDP), Syeda Neel Kanwal (CH)

Abstract:
Currently, at Habib University, a liberal arts university with a mission toward "Reparative Futures" and a university with a diverse body of individuals speaking multiple languages in different capacities, there still appears to be a lack of understanding of and consensus over the importance of English, Urdu, the regional languages of Pakistan (and South Asia in general" and the foreign languages (especially those of international prominence) to the different members of our community, both in academic settings and in people's daily lives. In our project, by staging semi-structured conversations with members of our community in the forms of interviews and surveys, and by consulting relevant secondary literature and conducting observations in certain relevant public spaces, we studied the linguistic situation at HU more carefully to achieve better clarity on the questions, misunderstandings, confusions, suspicions members of our community are having on the language problem at HU and in Pakistan in general, to better contextualize these concerns and observations, to identify room for meaningful intervention.

Keywords: Language, Indigeneity, Postcolonialism, Justice, Community

14. DIGITAL PARENTING AND PAKISTANI MOTHERS OF YOUNG CHILDREN

Principal Investigator: Dr. Neelma Bhatti (Assistant Professor, CS)
Undergraduate Researcher(s): M. Huzaifah Riaz (CS), Aisha Abdul Qadir (SDP), Qurba Mushtaque (CS)

Abstract:
Despite the widespread presence of screen-based devices in Pakistani households, the ways in which Pakistani mothers—who are primary caregivers of young children—utilize these tools as parenting aids to meet their specific needs remain unexplored. This study applies the Uses and Gratifications Theory to investigate how these mothers navigate technology choices within their unique cultural and socioeconomic context. Our research identifies key uses of digital media among Pakistani mothers and proposes three profiles of digital parenting practices. Semi-structured interviews reveal that mothers strive for purposeful screen time, ensuring their children's digital media use is intentional, educational, and contributes positively to their development. Additionally, while Pakistani mothers use digital media for education and family connections similarly to global practices, they place a stronger emphasis on religious education and uphold traditional family hierarchies. These findings offer valuable insights for designing culturally relevant technology solutions that support the digital parenting needs of Pakistani mothers.

Keywords: Parent-Child Computer Interaction, Digital Childcare, Digital Parenting, Uses and Gratifications, Early Childhood Media Exposure

15. AUTONOMIZING INDUSTRIAL TOW TRUCKS: A MOBILE ROBOTICS SOLUTION FOR TOYOTA IMC

Principal Investigator: Dr. Munzir Zafar (Assistant Professor, ECE and Faculty Director Academics, GSCP)
Undergraduate Researcher(s): Suleiman Qureshi, Ailiya Fatima, Sadiqah Mushtaq, Shaheer Abbas, Ehzem Shaikh

Abstract:
This project, a collaboration between Habib University and Toyota Indus Motor Company (IMC), focuses on converting manual tow-trucks used in IMC's car manufacturing plant into fully autonomous vehicles. The tow-trucks, which currently operate manually to transport trailers with parts between various shops, need to navigate a complex environment with both indoor and outdoor sections, varying loads, and dynamic obstacles. To address these challenges, the project involves several key components: the electronic control of actuators, the integration of sensors for enhanced perception, and the development of sophisticated path planning and control algorithms. Key achievements include the implementation of sensor fusion techniques combining data from Inertial Measurement Units (IMU) and odometry, as well as advancements in low-level hardware control and intervention.

Keywords: Autonomous tow trucks, Mobile robotics, Industrial automation, Path planning, Control algorithms, Sensor fusion, Localization, LIDAR, IMU (Inertial Measurement Unit), GPS, Real-time navigation, Obstacle detection, Autonomous vehicle control, Kinematic constraints, Autonomous material transport, Toyota IMC, Port Qasim plant, Robot perception systems, Safety markers detection, Trailer towing automation.

16. TANK HANDOVER INSPECTION

Principal Investigator: Dr. Shafayat Abrar (Associate Professor, ECE)
Undergraduate Researcher(s): Vezhish Ali (EE), Saif Nazir (CE), Muhammad Abdullah (EE)

Abstract:
Industrial giants in Pakistan, such as Engro, face ongoing challenges due to the deterioration of large storage tanks, many exceeding 10 meters in diameter and height. The gradual decline in tank integrity poses significant risks, leading to operational downtime and substantial financial losses. Traditional preventive maintenance methods, while essential, often lack the advanced technology needed to inspect these tanks without consuming significant time and labor resources. This project aims to enhance tank health inspection methods at Engro Polymers by developing an autonomous system capable of measuring tank wall physical quality and surface condition. Automating the inspection process not only eliminates the need for disruptive scaffolding and manual inspections, potentially saving millions of Pakistani rupees in mitigated downtime, but also enhances worker safety by reducing exposure to hazardous residues inside the tanks. The research focuses on designing and testing remote-operated systems for monitoring the health of chemical storage tanks, aiming to reduce the time required for inspections using current methods. The project involves a comprehensive literature review, simulations of theoretical concepts, and site visits to test the proposed methods for corrosion detection and thickness measurement.

Keywords: Industrial Inspection, Remote Sensing, Non-Destructive Testing, Corrosion Detection, Crack Detection

17. MAZE MARVELS: CRAFTING THE FUTURE WITH MICRO-MOUSE ROBOTICS

Principal Investigator: Dr. Waseem Hassan (Assistant Professor, ECE)
Undergraduate Researcher(s): Muhammad Bilal Qureshi (EE), Maleeha Hussain (EE), Abdullah Amir (CE), Shameer Masroor (EE)

Abstract:
The project "aimed to develop a maze-solving robot using the STM32F3 Discovery Board. This project had two primary objectives: evaluating Zephyr RTOS and STM32F3 for a potential embedded systems elective course and assessing students' capabilities in implementing a maze-solving robot. The first goal was achieved successfully, with students demonstrating a solid understanding and enthusiasm for RTOS concepts. However, the second goal encountered challenges. Although the Hand-on-Wall algorithm with a PID controller was implemented effectively to 85% functionality, the Flood Fill algorithm was only simulated due to issues with encoder precision and delays in receiving the necessary robotics kit. These obstacles led to a partial implementation of the maze-solving robot, providing valuable insights into the technical and logistical complexities of robotics projects.

Keywords: Maze-Solving Robot, Zephyr RTOS, Embedded Systems, PID Controller, ARM Cortex Micro-controllers

18. KOH-E-ATLAS KARACHI

Principal Investigator: Zaineb Makati (Dean's Fellow, SDP)
Undergraduate Researcher(s): Mehlab Kashani (SDP), Khubaib Mukaddam (CS), Daniyal Shadab (CS)

Research Collaborators: Aatika Saleem, Saniyah Salman (SDP graduates)

Abstract:
Koh-e-Atlas Karachi is an initiative aimed at creating maps and spatial information for Karachi, a city of over 20 million people with one of the lowest liveability indices in the world. Keeping this in view, this project serves three main objectives: First, it addresses the significant lack of open-source spatial data for the city. Second, it develops policy-relevant maps that focus on current urban challenges. Finally, it seeks to highlight various socio-economic issues facing the country, particularly the impacts of climate change, urban planning deficiencies, and the loss of cultural heritage. The collection contains map on administrative boundaries, population density, literacy rates, shrines and Parsi heritage sites in the city among others.

Keywords: Karachi, Atlas, Spatial Analysis, Climate Change, Urban Planning

19. IMPACT OF MULTILATERAL AID ON FEMALE ACCESS TO EDUCATION AND EMPLOYMENT: A SPATIOTEMPORAL ANALYSIS OF WORLD BANK (WB) AID PROJECTS IN PAKISTAN

Principal Investigator: Muhammad Ashar Khan (Dean's Fellow, SDP)
Undergraduate Researcher(s): Saba Nisar (SDP), Zashir Naqvi (SDP)

Abstract:
This research examines the impact of World Bank (WB) aid on female education and employment in Pakistan using a spatiotemporal analysis of WB projects. Since 1950, Pakistan has received around $40 billion in aid from the WB, with ongoing projects worth $15 billion aligned with the WB's "Gender Strategy 2030." Key initiatives include the 'Girls Learn Women Earn' (GLWE) and Punjab Family Planning Program, which aim to improve women's education and labor market participation. The study uses a quasi-experimental design with Demographic and Health Survey data and geocoded WB projects, employing a difference-in-difference (DID) approach to assess impacts at the district level from 2005 to 2018. Results show a positive but statistically insignificant effect of WB projects on female education and employment, with indications of sectoral shifts in employment. The study calls for further research to address potential biases and explore variations in impacts across project types and economic conditions.

Keywords: Economic Development, Aid, World Bank, Labor Market, Empowerment

20. EXPLORING PERCEPTIONS AND EXPERIENCES REGARDING EXPERIENTIAL LEARNING PEDAGOGY

Principal Investigator: Dr. Muhammad Aatir Khan (Assistant Professor, SDP)
Undergraduate Researcher(s): Amsal Malik (SDP), Sumaiya Zuberi (SDP)

Abstract:
Student learning outcomes are a key goal of any educational institution, and pedagogy directly impacts student learning and retention. This project explores student and faculty perceptions about experiential learning pedagogy and their experiences with the same. By understanding these experiences, this project aims to understand where this pedagogy can be most beneficial, and to develop a guide for successful use of the same. The nature of learning is fast changing, but pedagogical approaches are slow to respond. This study explores experiential learning as a pedagogical tool to evaluate user experience and to recommend a guide for its effective use in the classroom.

Keywords: Pedagogy, Experiential Learning, Student Learning Outcomes, Student Perceptions & Experiences, Faculty Perceptions & Experiences

21. GRAPH DATA MODEL FOR SCIENCE OF SCIENCE

Principal Investigator: Dr. Qasim Pasta (Assistant Professor, CS)
Undergraduate Researcher(s): Taha Munawwar (CS), Iqra Azfar (CS)

Abstract:
The science of science applies scientific methods to understand patterns in research, collaboration, and knowledge dissemination, using tools from data science and network analysis. This project developed a model for storing bibliographic data from migration studies in a graph database using Neo4j. A graph property model was proposed, and the data was successfully imported according to this model. The graph includes approximately 1.4 million nodes and 5.8 million edges, representing papers, Principal Investigators, journals, and topics along with their relationships such as citation, Principal Authorship, publication, field association, co-citation, and co-Principal authorship. By moving beyond traditional citation analysis, the project uncovers potential collaborations and research connections that may not be apparent through simple citation counts. The graph database and link prediction models offer a framework for understanding migration studies, identifying influential Principal Investigators, and predicting future research trends. Techniques like TF-IDF, character embedding, fuzzy logic, and word embedding were used for handling missing Principal Investigator IDs, with fuzzy logic proving most effective. Limitations in Principal Investigator name disambiguation and evaluation metrics were acknowledged, paving the way for future research.

Keywords: Science of Science, Bibliographic Data, Graph Data Science, Machine Learning, Link Prediction

22. MIRāN MAA: AN ETHNOGRAPHICAL STUDY OF THE MOTHER OF LYARI

Principal Investigator: Dr. Naila Pervaiz (Visiting Assistant Professor, CH)
Undergraduate Researcher(s): Nayma Ahmed (CH), Hafsa Shams (CND), Syeda Marium Mairaj (SDP)

Abstract:
Sufism goes far beyond the set patterns of shariah bound Islam that is very much in practice, this is how common people see Sufism. Women have been one of the most important parts of mystical tradition of Islam right from the beginning. Unfortunately, they have been silenced and marginalized and remained almost unheard in the history of Sufism throughout the Islamic world. Their male counterparts made it sure to project them almost as a non-existent entity in this tradition and otherwise. Having said that, Mirān Maa, a female virgin saint of Lyari, Karachi, is one of the few exceptions as she occupies a significant position in the history of Lyari. Residents of Lyari give her immense importance in their lives. The shrine is one of the few shrines which are entirely run by women right from the beginning and is famed for its karāmāt like getting unmarried girls married, kids for the childless, malnourished children becoming healthy after drinking the water left over by the birds in the courtyard of the shrine and so on. This study will also focus on the social and political behaviors of the people of Lyari. It will not focus on the violent side of Lyari but will elaborate how they played a significant role in the women empowerment through education and development of the society. The present study is an attempt to highlight the significance of the shrine as according to the legends, the land was reserved specifically for Mirān Maa by Pirān-i-Pīr, Shaykh Abdul Qadir Jilani.

Keywords: Women Sufi, Silencing, Marginalization, Unheard Voices, Lyari

23. QUANTIFYING PAKISTAN'S JUDICIAL SYSTEM

Principal Investigator: Dr. Sahaab Bader Sheikh (Assistant Professor and Program Director, SDP)
Undergraduate Researcher(s): Aamna Ahmed (SDP), Fatima Sami (SDP)

Abstract:
This study investigates the intricacies of Pakistan's justice system, focusing on 33,423 cases from the Sindh High Court for the years 2011 and 2012. Utilizing a mixed-methods approach, we explore the factors contributing to delays and inefficiencies in the judicial process. Qualitatively, we note that the legacy of colonialism continues to impact Pakistan's justice system via Frontier Crimes Regulation, Canal and Drainage Act, Laws for Khawajasara Community, Land Acquisition Act as well as court practices and procedures. Empirically, our findings reveal that median case duration in Pakistan of about 2 years is slightly better than comparable large countries such as US and India. However, many factors impact case duration significantly including case matter, plaintiff and defendant types, bench type and case year. Interestingly, court location does not impact case duration.

Keywords: Court, Case, Judicial, Law, Colonial

24. DEVISED THEATRE - REIMAGINED

Principal Investigator: Muneera Batool (Assistant Professor, CND and Associate Dean, Teaching and Learning)
Undergraduate Researcher(s): Arooj Zahra (CND), Mustafa Jamal (CND), Syed Hassan Rizwan (CND)

Abstract:
The proposed research study aims to reimagine the syllabus for the 'Devised Theatre*' course. The syllabus aims to reimagine the creation of a theatre show in the 16-weeks by introducing rigorous performance and ensemble building exercises for novice performers. The study also aims to research on the best practices in traditional theatre as used by Pakistani theatre makers especially those trained at the National Academy of Performing Arts (NAPA). Considering the potential of theatre to address pertinent themes in the culture and to bring these in front of an audience through the performances of students, this course aims to help students understand, articulate, and perform devised theater as well as add pedagogical value to the milieu at Habib University. *Devised Theatre - a type of theatre where theatre improvisations on a research topic lead towards the creation of a script. This is in direct contrast to traditional theatre where the script leads the way towards the performance.

Keywords: Theatre, Performance, Action research

25. SPECX – A LINUX-BASED TOOL FOR ECE EDUCATION

Principal Investigator: Dr. Bilal Wajid (Assistant Director, CS)
Undergraduate Researcher(s): Syed Meesam Abbas Zaidi (EE), Muhammad Hasan Nizami (CS)

Abstract:
The project area comprised the island of Baba located in the Karachi Harbor. The island has no organized system of solid waste management and the practices of either openly burning solid waste or dumping directly into the sea along mangrove forestations have adverse consequences for both human health and the sensitive marine ecology. Interactive engagement with communities residing in the Baba Island led to finding inclusive pathways to facilitate better management of island solid waste. The research approach selected was the Human Centered Design (HCD) approach. Secondary and primary research using both qualitative and quantitative research methodologies was employed. Students learnt how to construct appropriate forms for data documentation such as field observation notes, pictorial and video documentation, discussion notes, card sorting, self-documentation, and field survey etc. The main project deliverables were prototype designs.

Keywords: Linux, Electrical Engineering, Computer Engineering

26. DATA ANALYSIS ACROSS BOUNDARIES

Principal Investigator: Dr. Syeda Saleha Raza (Associate Professor and Program Director, CS)
Undergraduate Researcher(s): Zainab Haider (CS), Syeda Samah Daniyal (CS), Areeba Arif (SDP)

Abstract:
"Data Analysis across Boundaries" is an initiative aimed at aggregating, analyzing, and visualizing data from various international sources, with a special emphasis on Muslim-majority countries. This project draws on credible data from organizations such as the World Data Bank, the Climate Action Dashboard, and the Organization of Islamic Cooperation (OIC) to deliver a comprehensive analysis of multiple indicators, including economics, agriculture, health, business environment, climate, technology, and innovation. Through the application of advanced analytical methods and the creation of an interactive Power BI dashboard, this project represents the initial phase of developing a robust analytics and visualization platform for policymakers and researchers, facilitating informed strategic planning and decision-making.

Keywords: Data Analysis, Data Visualization, Dashboard, Muslim Countries, Power BI

27. OPTIMIZING CRITICAL CARE: ASSESSING THE AVAILABILITY AND POTENTIAL OF PHYSIOLOGICAL MONITORING DATA FOR SMART ICUS

Principal Investigator: Dr. Syeda Saleha Raza (Associate Professor and Program Director, CS)
Undergraduate Researcher(s): Muhammad Youshay (CS), Raahim Hashmi (CS), Muhammad Ibad (CS)

Abstract:
This research, titled "Optimizing Critical Care: Assessing the Availability and Potential of Physiological Monitoring Data for Smart ICUs," explores the challenges and opportunities of utilizing physiological monitoring data in Intensive Care Units (ICUs), particularly in resource-limited settings like Pakistan. The study investigates the existing availability and format of ICU data globally and within Pakistani hospitals, focusing on integrating this data into data-driven systems. By utilizing publicly available datasets, such as MIMIC-IV, the research develops a predictive model demonstrating the potential for early warning systems for critical events, while also highlighting practical challenges such as the lack of digital infrastructure. The research proposes a framework for integrating machine learning into ICU care, emphasizing the need for capacity building and interdisciplinary collaboration to foster innovation and address ethical and regulatory issues. The findings aim to establish the groundwork for developing Smart ICUs in Pakistan, contributing to both academic discourse and practical healthcare advancements.

Keywords: Smart ICU, Patient care, MIMIC, Health informatics, Machine learning

28. LET'S SEE SOUND WITH LIGHT: OBSERVING SOUND WAVES THROUGH LIGHT

Principal Investigator: Dr. Sameena Shah Zaman (Assistant Professor, iSciM)
Undergraduate Researcher(s): Rohaan Ahmad (CS)

Abstract:
In this research study, our objective was to develop an experimental apparatus capable of physically visualizing sound as patterns using laser light. This study is pivotal in advancing the general comprehension of wave behavior, the interaction with vibrating media, principles of reflection, resonance, and pattern formation, particularly within foundational physics courses for class demonstrations. We identified resonance frequencies for sound within the range of 70-210 Hz. Most of the observed patterns correspond to either ellipses or circles known as Lissajous figures, alongside some intermediate forms which are supposed to be superposition of the two. Further, it was acknowledged that variables such as the mirror width, size, shape, distance between mirror surface, and screen also play a critical role in observing a specific resonance pattern at a particular frequency. We have also discussed the limitations of our findings for possible future study.

Keywords: Resonance Frequency, Sound Waves, Laser Light Patterns, Lissajous Figures

29. INITIATING LONG-TERM MICROCHIP DESIGN ECOSYSTEM AT HABIB UNIVERSITY - USING THE RAPIDLY MATURING OPEN-SOURCE CAD TOOLS AND OPEN-SOURCE HARDWARE IP FOR DESIGN ACCELERATION

Principal Investigator: Dr. Syed Arsalan Jawed (Assistant Professor of Practice, ECE)
Undergraduate Researcher(s): Huzaifa Riaz (CE), Mysha (EE), Hamad Khan (CE)

Abstract:
This project took the first step towards initiating IC design ecosystem at Habib University through a pilot project in mixed-signal VLSI design of an intelligent neuromorphically-inspired buffer/repeater for network switching fabric's physical layer. The foundation of ecosystem was laid down by setting up and using open-source CAD tools framework to get onboard with free IC manufacturing in the future for students through open-source initiatives such as Google free shuttle program or Chips Alliance program.

Keywords: Microchip, Integrated Circuits, Semiconductor

30. FIXED-WING UAV DESIGN WITH VERTICAL TAKE-OFF AND LANDING AND AUTONOMOUS FLYING CAPABILITY

Principal Investigator: Dr. Syed Arsalan Jawed (Assistant Professor of Practice, ECE)
Undergraduate Researcher(s): Moiz Zulfiqar (CS), Mubashir Anees (CE), Syed Ali Nisar Shah (EE)

Abstract:
Conventional fixed-wing UAVs require runways for take-off and landing, which limits their operational flexibility. By integrating Vertical Take-Off and Landing (VTOL) capabilities, we aim to overcome these limitations, enabling deployment in diverse environments.

Keywords: Fixed-Wing UAV Design, Autonomous Flying Capability

STRP 2 – STUDENT-DESIGNED RESEARCH PROJECTS

1. CONNECTIVITY AND INFLUENCE: A STUDY OF CO-PRINCIPAL AUTHORSHIP NETWORKS AMONG PAKISTANI COMPUTER SCIENTISTS

Principal Investigator: Asad Ullah Chaudhry (CS)
Supervisor: Dr. Qasim Pasta (Assistant Professor, CS)

Abstract:
This paper provides a comprehensive analysis of co-authorship networks among computer science faculty in Pakistan, focusing on collaboration patterns across 422 researchers from 27 top institutions. Using a dataset of over 14,000 publications sourced from Google Scholar, we employ social network analysis techniques to examine various network metrics, such as degree centrality, betweenness centrality, and clustering coefficients, to identify influential authors and collaborative clusters. We explore the authorship patterns of key hubs in the region, shedding light on how much they contribute as well as how often. We also take a look at extreme publishing authors in the region to analyze their contribution and impact on the overall network. By mapping these academic networks, the study provides insights into how collaboration patterns can be optimized to improve the overall research output of the country. Our findings offer a foundation for policy-making and institutional strategies aimed at strengthening research synergies within Pakistan's academic landscape.

Key Words: Co-Principal Authorship, Network Analysis, Publication Pattern, Excessive Publishing, Ego Network

2. SIMPLETEXT: SCIENTIFIC TEXT SIMPLIFICATION USING LARGE LANGUAGE MODELS AND NLP

Principal Investigator: Hammad Sajid (CS)
Supervisor: Dr. Abdul Samad (Associate Professor, CS)

Abstract:
Our research aims to simplify scientific texts for improved readability and comprehension for non-experts. We strive to use state-of-the-art language models for simple yet accurate explanations of scientific texts for the general public. Our solution is based on a multi-step approach utilizing the GPT-3.5 model to solve Tasks 1, 2, and 3 i.e., passage extraction, identification and explanation of difficult concepts, and summarization. Our approach for Task 1 involved a sentence embedding-based vector database for narrowing the corpus, Ms-Marco for document ranking, and GPT-3.5 for selecting informative passages. For Task 2, we fine-tuned the GPT-3.5 model to identify and explain difficult terms and generate explanations. For Task 3 also, we fine-tuned the GPT-3.5 model with a specific prompt to simplify given scientific abstracts and sentences. The effectiveness of our approach was assessed based on the quality of results, demonstrating the potential of advanced language models in making scientific education more accessible to the general public. Our solution proposes using fine-tuned large language models as a reliable source for scientific education.

Key Words: Large Language Models, GPT-3.5 Turbo, Elastic Search, BERT, Text Simplification

3. LEVERAGING GAMIFICATION FOR ANTIBIOTIC AWARENESS

Principal Investigator: Syed Asghar Abbas Zaidi (CE)
Supervisor: Saad Umer Baig (Lecturer II, ECE)

Abstract:
This research explores the potential use of gamification to address the critical public health issue of antimicrobial resistance (AMR). The study focuses on the use of Game-Based Learning (GBL) and Computer Supported Collaborative Learning (CSCL) in Serious Game (SSG), and how the complex relationship between antibiotics and bacteria can be taught through them to healthcare providers and general public to spread awareness. The research systematically maps existing literature done on the use of GBL in different disciplines including medical. Additionally, it also investigates similar small-scale implementations and identifies the critical gap for it in the market. It also tries proposing and defending a framework of how a potential bigger-scale serious game on this could look like.

Key Words: Gamification, Antimicrobial Resistance (AMR), Serious Games (SSG), Game-Based Learning (GBL), Computer-Supported Collaborative Learning (CSCL)

4. AI-DRIVEN JOB SELECTION: REVOLUTIONIZING TALENT ACQUISITION WITH MACHINE LEARNING-POWERED RESUME SCREENING AND CANDIDATE PROFILING

Principal Investigator: Areesha Amir (CS)
Supervisor: Dr. Syeda Saleha Raza (Associate Professor and Program Director, CS)

Abstract:
Machine learning has significantly advanced talent acquisition, yet current recruitment systems face challenges like overwhelming candidate volumes, inconsistent resume formats, biased screening, and inefficient job fit assessments. This research introduces a novel approach using advanced machine learning models and diverse datasets for more effective resume screening and job matching. The system leverages natural language processing to standardize diverse resume formats and employs embedding models to enhance job fit assessments. It uses the Gale-Shapley algorithm to optimize candidate-recruiter matching by considering preferences from both sides. Additionally, it integrates dynamic job recommendations and real-time feedback mechanisms, allowing continuous learning and adaptation to market changes. By addressing these gaps, this research aims to improve hiring efficiency, reduce biases, and enhance candidate selection accuracy, providing a more comprehensive and scalable solution. The proposed approach represents a significant advancement in recruitment methodologies, offering substantial improvements for both candidates and employers.

Key Words: Machine Learning, Talent Acquisition, Resume Screening, Job Matching, Natural Language Processing

5. TWEETS SENTIMENT ANALYSIS ON CLIMATE CHANGE DISCOURSE WITHIN PAKISTAN

Principal Investigator: Syeda Rija Hasan Abidi (CS)
Supervisor: Dr. Shah Jamal Alam (Associate Professor, CS, and Interim Associate Dean for Undergraduate Education & Accreditation)

Abstract:
This study investigates Twitter users' sentiment dynamics around climate change-related discussions within Pakistan, specifically focusing on the temporal and spatial variations, the impact of climate events — particularly floods — and the influence of language on tweet sentiments. A dataset of 60,000 tweets is collected over two years which is reduced to 24,824 tweets post-cleaning forms the basis of this study. The results reveal patterns in sentiments regarding climate change fluctuating between negative

and positive based on the time of the year: positive peaks in winter and negative peaks in summer. The findings also suggest that the catastrophe of the floods of August 2022 resulted in a 26% decline in positivity. Spatial analysis uncovers areas with heightened sensitivity to climate-related discussions. It is also found that the negative sentiment in Urdu tweets is on average 23.6% higher than in English. This research contributes to understanding the public's perception of climate change in Pakistan and underscores the importance of targeted communication strategies to address regional and linguistic nuances in climate change discourse.

Key Words: Tweets, Twitter, Sentiment Analysis, Climate Change, Pakistan

6. MODULAR ARITHMETIC AND TIHAI

Principal Investigator: Daniyal Areshia (CE)
Supervisor: Rameez Ragheb (Lecturer II, iSciM)

Abstract:
The rhythmic tradition in Hindustani Classical Music is renowned for its complexity and intricate patterns. A notable example is the Tihai, where a phrase (palla) is repeated thrice to land on the first beat of the next rhythm cycle. This research explores whether master Tabla players can start a Tihai from any beat within a single cycle of taal (rhythmic cycle), focusing on the common TeenTaal (16 beats). By forming equations based on the modular nature of Tihai, we used Python's sympy library and MS Excel to solve Linear Diophantine equations and visualize Tihais. In a single cycle, Bedum tihais have solutions for tempo $\equiv 1, 2 \pmod 3$ at matras $\equiv 0, 1 \pmod 3$ respectively, while Dumdaar tihais have solutions for tempo $\equiv 1, 2 \pmod 3$. However, for tempo $\equiv 3 \pmod 3$, no solutions exist if the number of dums $\equiv 3 \pmod 3$ matras.

Key Words: Tabla, Taal, Tihai (Bedum & Dumdaar), Modular Arithmetic, Linear Diophantine Equation

7. ANALYZING THE SOCIO-ECONOMIC AND POLITICAL SPACE OF WATER TANKER SYSTEMS IN KARACHI: A CASE STUDY OF DEFENCE HOUSING AUTHORITY (DHA)

Principal Investigator: Esha Amin (SDP)
Supervisor: Farhan Anwar (Assistant Professor of Practice, SDP)

Abstract:
Access to safe and affordable drinking water is a basic human right as per United Nations Sustainable Development Goal (SDG)6.1. However, in Karachi there is a severe shortfall between the demand and supply of water. This shortage has allowed the private water tanker system's existence to become persistent in the city which exploits the vulnerability of citizen's by supplying water and extremely high rates. This research aims to analyze the socio-economic and political space of water tanker systems in Karachi, followed by a case study of DHA, which is unique due to its status as a cantonment. This research will employ qualitative and quantitative research methods and through engagements with relevant stakeholders such as residents, government officials, sector experts and NGOs. This research will aim to understand the historical presence of tankers in the city, their pricing patterns, and the implications of their existence on Karachi. In addition, surveys will be conducted with the residents of DHA to investigate and analyze trends in income levels, water consumption patterns, spending on and attitudes towards tankers. The findings of this research will be presented as a research paper and a policy brief. The scope of this study is crucially important as being breakthrough in terms of analyzing water supply, consumption, and spending patterns in a cantonment like DHA, which is known for housing the city's most affluent people. In addition, it will allow for a comparative analysis to be conducted on the wider impact of water tanker systems between Karachi's cantonment and non-cantonment areas, with the greater goal of informing the citizens of Karachi regarding the consequences of the existence of this system.

Key Words: Karachi, Tanker Systems, Cantonment, Income, Demand Elasticity, Pricing, Comparisons, Trends, Political Economy, Residents, Society

8. SPIRIT OF JUGAAD - EXPLORING THE INTERSECTION BETWEEN CLASS, RACE, CRAFTSMANSHIP AND GENDER

Principal Investigator: Soheba Shoaib (CND)
Supervisor: Dr. Behzad Khosravi Noori (Assistant Professor of Practice, CND, and Director of Academic Centers)

Abstract:
By investigating the social, economic, and political aspects of the practice of Jugaad, this research takes shape as an exploratory and practice-based artistic research. As this research unfolds, the intersection between class, ethnicity, gender, and indigenous craftsmanship in the everyday life of the underprivileged will be studied.

Jugaad is a Hindi word mostly used in the South Asian region, translated as an 'improvised solution' or an 'innovative fix' using the limited resources at hand. Historically, the South Asian region still has the consequences of its colonial past. These consequences can be seen in the region's structures upholding the values of capitalism, patriarchy, and classism. The question is: How does Jugaad steer away from these pillars and in practice, acknowledge the many layers of existence like social, political, and economic factors including class, ethnicity, and gender? We will also explore if the practice of Jugaad connects these layers.

Keywords: Jugaad, Innovative fix, Indigenous craftsmanship, Intersectionality, Practice-based Artistic Research

9. ANALYZING URBAN OVERHEATING THROUGH REMOTE SENSING AND GIS TECHNIQUES: A CASE STUDY OF KARACHI, PAKISTAN

Principal Investigator: Dua Mohtashim (SDP)
Supervisor: Zaineb Makati (Dean's Fellow, SDP)

Abstract:
Rapid urban densification has radically impacted the local climate and weather of Karachi. The replacement of vegetation cover with anthropogenic materials has led to urban overheating which has exacerbated climate change events within the city. In this research, the phenomenon of urban overheating has been analysed using Land Surface Temperature (LST) of three years (2015, 2019, 2023) over a time span of nine years. For this purpose, remote sensing data has been extracted from Landsat 8-9 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIR) to detect LST as well as to determine changes in land usage through two indices: Normalised Difference Vegetation Index (NDVI) and Normalised Difference Built-up Index (NDBI). The highest value of LST was recorded for the year 2015, the same year in which the city was struck by a deadly heatwave event. A correlation between LST and the two indices has also been established in this study.

Key Words: Land Surface Temperature, Built-Up Areas, NDVI, Remote Sensing, Urban Overheating

10. RECLAIMING THE STREETS AS PUBLIC SPACES OF KARACHI: A CASE STUDY OF LYARI'S JHATPAT MARKET

Principal Investigator: Munaza Fatima (SDP)
Supervisor: Farhan Anwar (Assistant Professor of Practice, SDP)

Abstract:
This research explores the reclamation of street life in the Jhatpat Market in Lyari, Karachi, focusing on its potential to create a more sustainable, inclusive, and pedestrian-friendly commercial space. As Karachi faces critical challenges such as inadequate infrastructure, social fragmentation, and environmental degradation, revitalizing public spaces like Jhatpat Market can contribute to the city's overall livability. This study employs a mixed-methods approach, combining interviews, observations, and surveys to assess resident experiences, challenges, and recommendations. A key component of the research is the development of a self-help model for community mobilization, empowering local community to take charge of market and area improvements. The study aims to develop actionable urban design recommendations that prioritize inclusivity, safety, and environmental sustainability. By examining the interconnected social, environmental, and economic benefits of reclaiming street life, this research contributes to broader urban development strategies, aligned with the United Nations' Sustainable Development Goal 11, aiming for inclusive and resilient cities by 2030.

Key Words: Public Streets, Community Mobilization, Pedestrian-Friendly Spaces, Sustainability, Urban Design

11. ENHANCED GAZE ESTIMATION

Principal Investigator: Samiya Ali Zaidi (CE)
Supervisor: Dr. Unaiza Ahsan (Assistant Professor, CS)

Abstract:
Eye tracking, and particularly gaze estimation, is crucial for various applications in HCI, AR, VR, and for detecting early symptoms of neurodevelopmental disorders. This research introduces an advanced method for 3D gaze estimation by integrating novel techniques with established models. We enhance the L2CS model by incorporating the DINOv2 transformer backbone and evaluate its performance against traditional CNN-based backbones. Additionally, we conducted a thorough ablation study on various loss functions, including Mean Squared Error and Cross-Entropy, to assess their effectiveness in gaze estimation. Notably, we explore the use of Pinball loss to address asymmetric error scenarios, aiming to improve model accuracy and generalization. Our results show that the DINOv2 backbone achieves more stable training and superior performance compared to the CNN backbone, with an average gaze angular error of 2.036○. Pinball loss further enhanced the accuracy, approaching the performance of DINOv2-Base with an error of 3.471○.

Key Words: Gaze Estimation, Eye Tracking, Vision-Transformers, DINOv2, Loss-Functions

12. A COMPARATIVE STUDY ON THE PERFORMANCE OF MODERN GRAPH DATABASES

Principal Investigator: Ali Muhammad Asad (CS), Asad Muhammad (CS)
Supervisor: Dr. Qasim Pasta (Assistant Professor, CS)

Abstract:
This research provides a comprehensive comparative analysis of modern graph databases, focusing on Neo4J, MemGraph, RedisGraph, and ApacheHugeGraph. Using the LDBC SNB Benchmark, the study evaluates the performance of these databases in terms of data loading times, and query execution times across varying dataset sizes. The study addresses a significant gap in literature by focusing only databases that provide a graph database model, and not a multi-model system, are not cloud-based,

installable on local machines, and support the Cypher query language. Our findings offer insights into the scalability, efficiency, and practical applicability of these systems for social network analysis tasks, such as shortest path detection. The results are intended to guide both researchers and practitioners in selecting the most suitable graph database for their specific needs, while also highlighting areas for future technological advancements in graph database performance.

Key Words: Graph Databases, Performance Evaluation, Benchmarking, Comparative Study, Database Scalability

13. EDDY CURRENT METHOD FOR CRACK DETECTION: MATHEMATICAL MODELING AND SIMULATION FOR PREVENTIVE MAINTENANCE

Principal Investigator: Syed Muhammad Muslim Hussain (EE)
Supervisor: Dr. Tariq Mumtaz (Assistant Professor, ECE)

Abstract:
Maintaining the structural integrity of chemical storage tanks is essential for operational safety and environmental protection. This research explores the application of the Eddy Current Method (ECM) for detecting surface cracks in chemical tanks and enhancing preventive maintenance strategies. ECM's non-destructive nature allows for frequent inspections without interrupting operations. We present a comprehensive mathematical model for impedance measurements through eddy currents, forming the basis for accurate crack detection and characterization. Our methodology includes developing analytical and numerical models to predict impedance variations caused by cracks, supported by detailed simulations. The study found that the presence of a crack near eddy currents led to an increase in inductance and a decrease in resistance. Consequently, the overall impedance rose. This effect was more pronounced at shorter lift-off distances. Conversely, increasing the lift-off distance diminished the sensitivity of the method, making it challenging to differentiate between cracked and uncracked conditions at greater distances.

Key Words: Crack Detection, Preventive Maintenance, Eddy Current Method, Impedance Analysis

14. DESIGNING TOWARDS AN INFORMED CRISPR CAS13 BASED DRUG DESIGN FOR DENGUE VIRUS

Principal Investigator: Syed Muhammad Ali Naqvi (CS)
Supervisor: Dr. Farhan Khan (Assistant Professor, CS)

Abstract:
CRISPR-based therapies are at the forefront of genetic medicine, having the potential of offering precise and effective solutions for targeting viral RNA. Research shows that Cas13b system can be crucial for making antiviral drugs. However, designing guide crRNA is a crucial and experimentally intensive step for designing such drugs. The vast number of possibilities of a potential guide crRNA makes it impossible to test every single sequence in the laboratory. Hence, an alternative approach is needed to assist the process. This study introduces a machine learning (ML) framework designed to enhance the identification of guide CRISPR RNAs (crRNAs) for the Dengue virus, specifically leveraging the CRISPR-Cas13b system. Our approach combines Long Short-Term Memory (LSTM) networks, Convolutional Neural Networks (CNNs), and Deep Neural Networks (DNNs) into an ensemble model trained on a dataset experimentally validated Cas13b crRNA sequences. The model is then applied to Dengue virus genome sequences, identifying crRNAs with potential high efficacy. This framework provides a scalable and efficient method for crRNA design, potentially applicable to a wide range of viral targets, and can significantly accelerate the development of CRISPR-based antiviral therapies.

Key Words: CRISPR Cas13b, Machine Learning, Dengue Virus, Nucleotides, crRNA

15. CUTTING THE REEL: CENSORSHIP'S ROLE IN CRAFTING PAKISTAN'S FILM NARRATIVE

Principal Investigator: Alaina Asim (SDP)
Supervisor: Tajreen Midhat (Lecturer II, SDP)

Abstract:
This research investigates the lasting impact of colonial-era censorship laws on contemporary Pakistani cinema. Employing a qualitative approach, semi-structured interviews with key stakeholders were conducted to gather diverse perspectives on the issue. Through thematic analysis, the study found that historical and contemporary forces continue to shape film narratives in Pakistan. While the industry has evolved, colonial control persists, limiting artistic expression and reflecting broader societal concerns. The research reveals that censorship is influenced not only by colonial remnants but also by economic pressures, sociopolitical sensitivities, and public attitudes. The study calls for a revaluation of censorship laws and practices to foster creativity, diversity, and a vibrant film industry while respecting societal values. By understanding the historical roots and contemporary manifestations of censorship, policymakers, industry stakeholders, and civil society can work together to create a more inclusive and expressive cinematic landscape in Pakistan.

Key Words: Film Censorship, Artistic Freedom, Pakistani Cinema, Colonial Legacies, Policy

16. CHALLENGING THE MYTH OF THE SECULAR: THE ROLE OF ONTOTHEOLOGY AND BIOPOLITICS IN THE SECULAR STATE

Principal Investigator: Soha Sajjad (CH)
Supervisor: Sumbul Usman Yusuf (Dean's Fellow, CH)

Abstract:
This paper critically examines secularism through the lenses of biopolitics, ontotheology, and sovereign power, presenting a perspective that challenges the oft-touted narrative of secularism as a neutral and liberating force. Contrary to traditional arguments that utilize these frameworks to support secular governance, or rather criticize theologically driven forms of governance, this research argues that secularism often enables the state to practice mechanisms of ontotheological authority and biopolitical control, thereby undermining secularism's own claims to neutrality and non-preference. Employing a literature review and thematic analysis, this research highlights how secularism grants the state significant power to define and regulate moral and ethical standards, effectively assuming an ontotheological role, a concept borrowed from Heidegger and used here in combination with Michel Foucault's discourse on biopolitics. Giorgio Agamben's concept of the 'state of exception' is also used to illustrate how modern secular states can suspend legal norms during crises, reinforcing their authority in ways that are reminiscent of divine sovereignty. The concept of Ideological State Apparatus and Repressive State Apparatus is also borrowed from Louis Althusser to present a synthesis in this research. Furthermore, the paper explores the historical and contemporary implications of secularism's biopolitical practices, from colonial contexts to modern governance, revealing how secular states employ biopolitical tools to manage and control religious practices and identities. The study finds that secularism, under the guise of promoting pluralism and individual freedoms, frequently reinforces power dynamics that marginalize minority groups and enforce conformity to secular norms, a level of involvement that necessarily contradicts the common perception of secularism as a non-interventionist ideology. This research fills a critical gap by exposing the paradoxes within secularism and offering a fresh critique of its role in contemporary governance by drawing from philosophical frameworks oof Heidegger Foucault, and Agamben. Despite reliance on theoretical analysis and secondary sources, the findings provide valuable insights into the ways secularism operates as a form of ontotheological and biopolitical control, urging a re-evaluation of its impact on societal values and individual rights.

Key Words: Secularism, Biopolitics, Ontotheology, Foucault, Heidegger

17. QUESTIONING SURVIVAL IN THE AGE OF THE ANTHROPOCENE

Principal Investigator: Daniyal Ahmed (SDP)
Supervisor: Dr. Muhammad Haris (Assistant Professor and Program Director, CH)

Abstract:
The Anthropocene hypothesis has made it exceedingly clear that the current trajectory of modern industrial activity will make life on earth unsustainable by the next century. Despite these damning consequences, industrial activity under capitalism shows no apparent signs of reforming or slowing down. Having generated more wealth than any point in human history, Capitalism still insists on ever-increasing productivity and accumulation. Why is that? The need to generate wealth seems to indicate a collective desire to survive, but what is survival in the face mass extinction under climate crisis? Is this the only way to survive? If not, how did we arrive at this point where people living under capitalism conceive it as the only real way to survive? Most importantly, what are we surviving for?

Key Words: Anthropocene, Survival, Affect, Capitalism, Accumulation

18. SPECTERS OF BHUTTO

Principal Investigator: Fatima Javaid (CH)
Supervisor: Dr. Behzad Khosravi Noori (Assistant Professor of Practice, CND, and Director of Academic Centers)

Abstract:
Jacques Derrida states in Specters of Marx that learning to live with ghosts is learning to live finally by understanding transience. I return to death, to the assassination of Benazir Bhutto on footage, to the absence of Zulfiqar Ali Bhutto echoing in the material tragedy of self-immolation as protest, or public beatings for any association with the Bhutto family. I return to the memory of my mother's migration in 1971. A body provides clarity in mourning those conditions the specters, which appear to have been there originally. The death rituals we contrive as a response to what we owe the dead is ancient and is very close to us in the messianic forces of the Abrahamic traditions, the presence and absence of bodies juxtaposed across the spectrum of beliefs. How do we approach their outward renewed-ness in the discontinuity of history arising from everyday speculation?

Key Words: Image, Language, Martyrdom, Materialism, Necropolitics

19. WOMEN FARMERS' AWARENESS, CHALLENGES, AND ADAPTATION NEEDS TO CLIMATE CHANGE: INSIGHTS FROM A REMOTE VILLAGE IN NEELUM VALLEY, AJ&K

Principal Investigator: Asiya Azad (SDP)
Supervisor: Uswa Ali Memon (Dean's Fellow, SDP)

Abstract:
This study, in collaboration with the National Rural Support Program (NRSP), investigates the awareness, impacts, and adaptive responses of women farmers to climate change in Kel village, Neelum Valley, Azad Jammu and Kashmir (AJ&K). Through qualitative interviews with 12 women, the research reveals significant disparities in climate change awareness between educated and uneducated groups. Collectively, they reported severe agricultural challenges, including erratic weather patterns, reduced crop yields insufficient for self-consumption, and increased livestock diseases, all exacerbated by a lack of institutional support and modern agricultural knowledge. Despite these difficulties, women showed strong willingness to learn and adapt if provided with appropriate resources and education. The study highlights critical gaps in the AJ&K Climate Change Policy 2017, particularly its failure to address rural women's

specific needs. The findings advocate for gender-sensitive policy revisions and targeted support to enable effective climate adaptation for women farmers in remote rural areas.

Key Words: Climate Change Awareness, Women Farmers, Adaptation Strategies, Rural Vulnerability, AJ&K Policy 2017

20. A COMPARATIVE ANALYSIS OF MATERNAL HEALTH CARE ACROSS DISTRICTS IN PAKISTAN: A CASE STUDY OF THE 2015 HEATWAVES

Principal Investigator: Sahar Makhani (SDP)
Supervisor: Zaineb Makati (Dean's Fellow, SDP)

Abstract:
This research explores the impact of the 2015 heatwaves on maternal healthcare services in Pakistan, with a focus on geographic disparities across districts. The study investigates how pregnant women, a particularly vulnerable group during natural disasters, were affected by the severe heat events, with particular emphasis on access to pre- and post-natal care. Through a combination of spatial analysis using QGIS and quantitative regression modeling in Stata, the study utilizes data from Pakistan Social and Living Standards Measurement (PSLM) and climate data from Copernicus Climate Data Store to examine the correlation between extreme temperatures and maternal health outcomes. Findings suggest that the intensity of heatwaves, population density, healthcare infrastructure, and regional differences significantly influence maternal healthcare access. This research provides insights for policymakers to enhance maternal healthcare resilience in disaster-prone regions of Pakistan.

Keywords: Maternal healthcare, heatwaves, climate change, natural disasters, Pakistan, spatial analysis, regression modeling, vulnerability, prenatal care, postnatal care.

21. ANALYSING TRENDS IN FUNDING ALLOCATION AMONG SPORTS FEDERATIONS: A STUDY OF HIGH AND LOW PERFORMERS OVER THE PAST FIVE YEARS

Principal Investigator: Mayam Raza (SDP)
Supervisor: Dr. Qasim Pasta (Assistant Professor, CS)

Abstract:
The essence of path dependence is that later (policy) possibilities are constrained by earlier choices or events, foreclosing otherwise superior policy options. The analysis explores whether a path dependency approach can help towards a better understanding of sport development activity in the country. This research paper explores if the Pakistan Sports Board distributes grants amongst the affiliated National Sports Federations based purely on their recent performances or their cultural & national significance in the previous years

Keywords: Path Dependency Approach, Data Analysis