

Research Statement

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Introduction

As a passionate researcher in the field of Computer Science, my endeavors have always been directed towards leveraging computational technologies to address and solve real-world challenges. My academic foundation, culminating with a Ph.D. from LUMS, has equipped me with the skills to contribute significantly across various domains, including big data analytics, software reliability, and distributed systems.

Pioneering Contributions to Web Energy Optimization

In my pursuit of sustainable computing, I have dedicated a considerable part of my research to understanding and mitigating the energy consumption of web applications. My research, "Modeling Power Consumption of Web Apps using Static Design Features," underlines a novel approach to predict and thereby reduce the energy footprint of web applications. This work not only highlights the intersection of program analysis and environmental sustainability but also proposes actionable strategies for developers to create energy-efficient web solutions.

Advancements in Sports Analytics: Cricket Performance Metrics

My work in sports analytics, specifically within cricket, has led to the development of "CAMP: A Player Performance Metric for Data-Driven Man of the Match Prediction in Cricket," published in the *Journal of the Operational Research Society*. This study introduces a comprehensive metric that incorporates various game aspects to predict player performance more accurately. By applying machine learning algorithms to vast datasets, my research offers insights into player selection and strategy development, significantly impacting how teams and organizations approach the game.

Ensuring Software Reliability through MPI Java Program Verification

Another facet of my research focuses on improving software reliability, particularly through the verification of MPI Java programs. My work, "Verifying Non-Deterministic Behavior of MPI Java Programs using Software Model Checking," addresses the challenges in ensuring the correctness of parallel computing applications. This research is pivotal for developers and researchers working with high-performance computing applications in Java, providing them with tools and methodologies to verify the reliability and correctness of their software.

Optimizing MapReduce Programs for Efficient Failure Detection

The MapReduce programming model is fundamental to processing large data sets, and my publication, "Efficiently Finding Minimal Failing Input in MapReduce Programs," offers significant advancements in debugging MapReduce applications. By identifying minimal failing inputs, this work substantially reduces the debugging effort and enhances the overall efficiency of MapReduce program development. This contribution is particularly relevant in the context of big data analytics, where efficiency and reliability are paramount.

Future Research Directions

Looking forward, I aim to extend my research in data-driven methodologies to encompass broader applications, including fairness in AI and analysis of biological data. My ambition is to foster a collaborative research environment at LUMS, encouraging interdisciplinary projects that push the boundaries of current knowledge and technology.

Conclusion

My research journey is characterized by a continuous endeavor to contribute meaningfully across multiple domains of computer science. As I look forward to the opportunity to further my research at LUMS, I am committed to pushing the boundaries of what is possible through collaboration, innovation, and a deep-seated passion for discovery and learning.