MathSport Asia 2024

International Conference

Bringing Math Into Sports

9-11
December 2024

Conference Handbook

For more details, visit:
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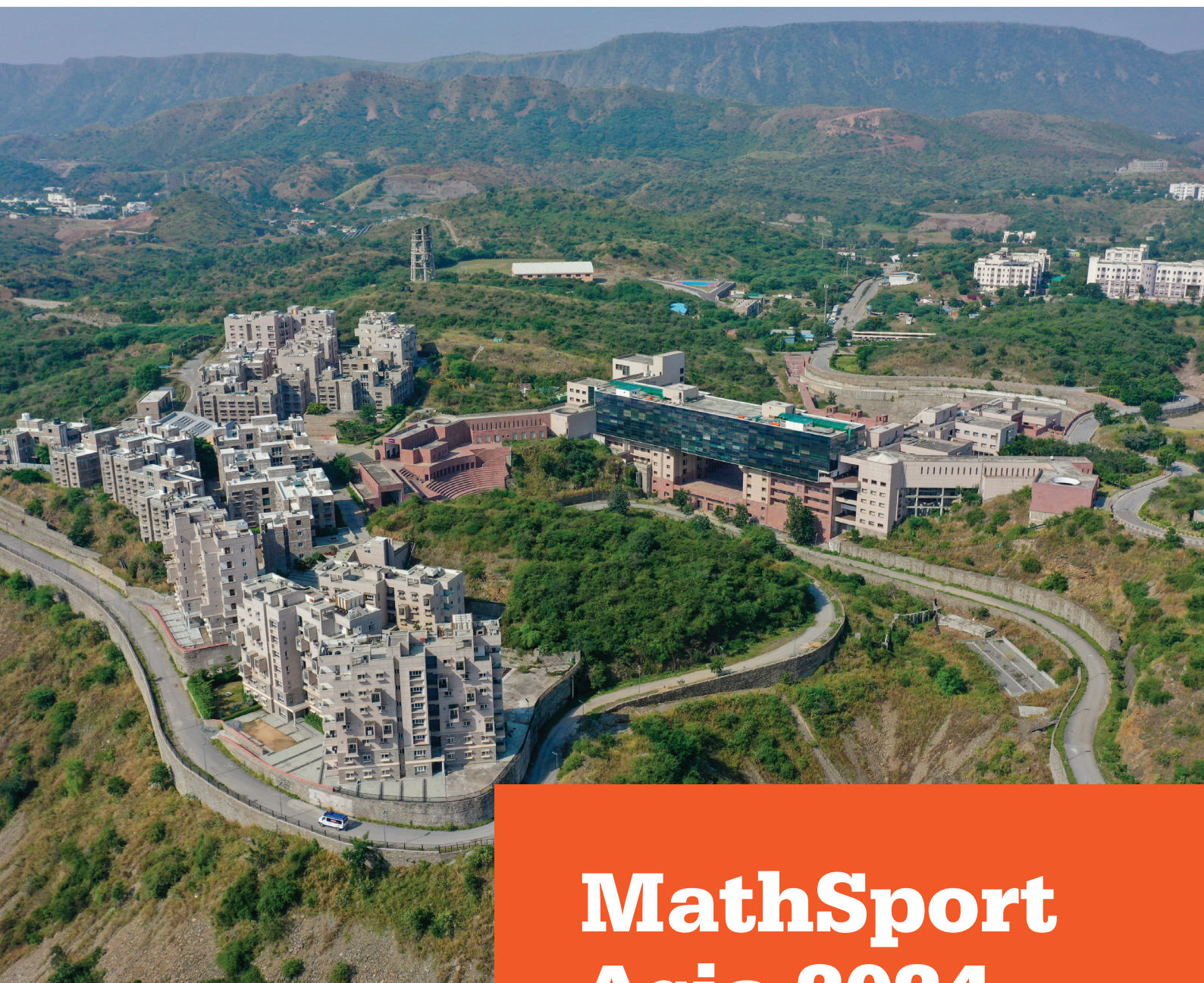भारतीय प्रबंध संस्थान उदयपुर
Indian Institute of Management Udaipur

MathSport
ASIA | 2024

SAMMAAN CAPITAL
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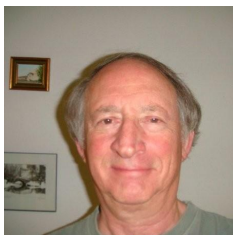Ghent University,
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MathSport Asia

Asia, the largest and most populous continent on Earth, has a long tradition of sports. Traditional Asian Sports like wrestling and archery survive even today in forms unchanged over centuries. The globalization of sport has brought new sports, coaching techniques and methods to the continent.

MathSport Asia is a group of academicians and sports professionals interested in the promotion and development of the application of mathematics, statistics and data analysis to sports management, sports performance analysis and management and sports coaching and training, in Asia.

MathSport Asia seeks to play the role of a catalyst in encouraging the use of Mathematical and Statistical Analysis in Sports in Asia by organizing Conferences and Workshops, by encouraging research in the area and facilitating its dissemination. MathSport Asia will also seek to promote the teaching of mathematics and statistics using sports.

In this endeavour, MathSport Asia will seek to bring together various stakeholders: academicians, sportspeople, sports bodies, industry, sports academies, sports leagues and the government.

MathSport Asia seeks to complement the work done by two related groups, MathSport International and ANZIAM MathSport. While MathSport International has been organizing biennial conferences in Europe since 2007, ANZIAM MathSport has been organizing biennial conferences in Australia/ New Zealand since 1992.

About the Conference: MathSport Asia, 2024

MathSport Asia 2024, the second edition of MathSport Asia Conferences, is being held from December 9 to 11, 2024, at the Indian Institute of Management Udaipur, India.

It is the second edition of a series of biennial conferences that will be held across Asia under the aegis of MathSport Asia, a group of academicians and practitioners interested in the promotion and development of the application of mathematics, statistics and computing in sports in Asia.

As in the first conference, the response to the Conference was overwhelming. More than 60 papers were received, out of which 42 papers will be presented at the Conference. More than 100 researchers had shown interest in presenting their work in the technical sessions.

Leading research in the field of sports analytics, namely, Prof. Young Hoon Lee of of Sogang University, South Korea; Prof. Phil Scarf of Cardiff Business School, UK; Prof. Dries Goossens of Ghent University, Belgium, Prof. Anthony Bedford of the University of the Sunshine Coast, Australia and Prof. Shubhabrata Das of the Indian Institute of Management Bangalore, India will be delivering the Plenary talks.

The conference shall also have practitioners from the field of sports analysis like Mr. Ramakrishnan, S from Sportsmechanics India Pvt Ltd, Mr. Anukool Bharadwaj of Olympic Gold Quest, Mr. Amit Purohit of Fantasy Akhada, Mr. Dhruv Kanal of Infosys, Mr. V Jayadevan of the VJD Method, and Mr. Mukul Choudhari of Jamshedpur Football Club.

About the Host Institution: IIM Udaipur

IIM Udaipur is well on its way to becoming a globally recognised B-School. It has broken new ground by focusing on world-class research and transforming students into tomorrow's managers and leaders. The Institute arrived on the global education stage by securing accreditation from the AACSB (Association to Advance Collegiate Schools of Business) in merely eight years of its establishment. With this accreditation, IIM Udaipur is counted in the same league of global institutes, such as Harvard Business School, Wharton School at the University of Pennsylvania, and the MIT Sloan School. IIMU has been listed on the Financial Times (FT) Global MIM Ranking 2024 for the 6th consecutive year, making it the only IIM to have achieved this feat. In the QS Global MIM Ranking 2025, IIM Udaipur stands as the 6th highest-ranked IIM and continues to maintain its listing for the 6th year in a row, reinforcing its global standing. Notably, it is also the youngest B-School in the world to be featured in both rankings. Additionally, IIM Udaipur ranks 4th in India for research in management, according to the UT Dallas methodology, which tracks publications in leading global journals, showcasing its excellence in academic research.

Guidelines for Session Chairs

The role of the chair is to coordinate and ensure the smooth conduct of the session. The session chair is expected to remain in the lecture room well before the beginning of the session and contact the speakers before the session begins. The chair shall verify the attendance of the scheduled speakers and their technical requirements, if any.

The chair shall see that the speakers stick to the timing, which is a maximum of 15 minutes for the presentation of each paper and a maximum of 5 minutes for discussion. The chair can change the timing depending on the attendance of the speakers, but in no case shall allow the session to continue beyond the completion.

The chair shall ensure that the presentations are made in the program's order and allow the delegates to switch between parallel sessions. The chair will also help evaluate the papers for the award of best paper awards.

Guidelines for Presenters

Each presentation in the technical session is allotted a maximum of 15 minutes, followed by a discussion for 5 minutes at the maximum. However, based on the attendance of presenters in a session, the chair of the session can adjust the time duration of the presentation. Each lecture hall shall have a Windows-based computer system and an LCD projector. The presenter shall ensure that the presentation is uploaded to the computer system during the break before the talk. Alternatively, the presenter can use his/her laptop.

Conference Schedule

Day 1: December 9th, 2024

Time	Venue	Events & Sessions		
08:30 - 09:00	CR-6C-14	**Inauguration**		
09:00 - 09:45	CR-6C-14	**Plenary Session 1: "Scheduling Youth Competitions"** *Speaker:* Dries Goossens, Professor, Faculty of Economics and Business Administration, Ghent University, Belgium		
10:00 - 11:00	CR-6C-14	**Technical Session 1 - A1**	1. Satyam Mukherjee 2. Anand V 3. Rhitankar Bandyopadhyay	
10:00 - 11:00	CR-6C-13	**Technical Session 1 - A2**	1. Apurva Jha 2. Mohit Bhatnagar 3. Jimut Bahan Chakrabarty	
11:15 - 12:15	CR-6C-14	**Technical Session 1 - B1**	1. Tarun Abhichandani 2. Ganesh Katrapati 3. Shabana Chandrasekaran	
11:15 - 12:15	CR-6C-13	**Technical Session 1 - B2**	1. Gleb Vasiliev 2. Rehan Bhatia 3. Sadanand Venkataraman	
12:30 - 01:30	CR-6C-14	**Practitioner Talks 1** 1. Robert Younger: *Melbourne Football Club* 2. Amit Purohit, Founder: *Fantasy Akhada, VUSport & FanToPark*		
01:30 - 02:30	Executive Dining Hall	LUNCH		
02:30 - 03:15	CR-6C-14	**Plenary Session 2: "Measurement of Competitive Balance and Outcome Uncertainty"** *Speaker:* Young Hoon Lee, Professor of Economics, Sogang University, South Korea		
03:30 - 04:30	CR-6C-14	**Technical Session 1 - C1**	1. Abhishek Chakraborty 2. Lisa Garcia Tercero 3. Jayadevan V	
03:30 - 04:30	CR-6C-13	**Technical Session 1 - C2**	1. Kushagra Sharan 2. Ashish L Karnavat 3. David Van Bulck 4. Joonas Paakkonen	
05:00 - 06:00	Upper Plaza	**Kabaddi Demo Game**		
06:30 - 07:30	Auditorium	**"Pulling Strings": Social Event Hosted by EURO Working Group "OR in Sport"** 		
07:30 - 09:00	Lower Plaza	DINNER - Hosted by the Director, IIM Udaipur		

Conference Schedule

Day 2: December 10th, 2024

Time	Venue	Events & Sessions	
09:00 - 09:45	CR-6C-14	**Plenary Session 3:** **"Fifty years modelling soccer scores: what have we learned?"** *Speaker:* **Phil Scarf,** Professor of Management Mathematics, Cardiff Business School, United Kingdom	
10:00 - 11:00	CR-6C-14	**Technical Session 2 - A1**	1. Praveen D. Chougale 2. Mohit Bhatnagar 3. Bhaskar Basu
10:00 - 11:00	CR-6C-13	**Technical Session 2 - A2**	1. Priyanka Talukdar 2. Jayadevan V 3. Anthony Bedford
11:15 - 12:15	CR-6C-14	**Technical Session 2 - B1**	1. Jimut Bahan Chakrabarty 2. Kapil Gupta 3. Anirudh Srikanth
11:15 - 12:15	CR-6C-13	**Technical Session 2 - B2**	1. Nobuyoshi Hirotsu 2. Sweta Tiwari 3. Robert Younger
12:30 - 01:30	CR-6C-14	**Practitioner Talks 2** 1. **V Jayadevan**, *Creator of the VJD Method* 2. **Ramky S**, *Promoter, Sports Mechanics India Pvt Ltd: Formerly Performance Analyst, Indian Cricket Team*	
01:30 - 02:30	Executive Dining Hall	LUNCH	
02:30 - 03:15	CR-6C-14	**Plenary Session 4:** **Modern Solutions to Ancient Problems: AI and CV Technology in Horse Racing** *Speaker:* Anthony Bedford, Associate Professor, Data Science, University of the Sunshine Coast, Australia	
03:30 - 04:30	CR-6C-14	**Technical Session 2 - C1**	1. Karel Devriesere 2. Siddhartha K Rastogi 3. Subhasis Ray
04:30 - 05:00	CR-6C-14	**Practitioner Talks 3** 1. **Dhruv Kanal,** Senior Marketing Manager Infosys: *Global Marketing Head for Sports Sponsorships, Implementing New Cutting Edge Technology in Tennis and Formula E*	
05:30 - 07:30	Udaipur City	City visit	
07:30 - 09:00	Shikarbadi Hotel	DINNER - Hosted by Hosted by Plant Lipids Private Limited	

Conference Schedule

Day 3: December 11th, 2024

Day 3: December 11th, 2024

Time	Venue	Events & Sessions	
09:00 - 09:45	CR-6C-14	**Plenary Session 5:** **"On Balanced Scheduling and Dynamic Updates in Double Round-Robin Tournaments: Applications in the Indian Super League"** *Speaker:* Shubhabrata Das, Professor, Decision Sciences, Indian Institute of Management Bangalore	
10:00 - 11:30	CR-6C-14	**Technical Session 3 - A1**	1. Satyam Mukherjee 2. Chitresh Kumar 3. Apurva Jha 4. Soumya Sarkar
10:00 - 11:30	CR-6C-13	**Technical Session 3 - A2**	1. Subhasis Ray 2. Jimut Bahan Chakrabarty 3. Shobhit Aggarwal 4. Praveen D Chougale
12:00 - 01:00	CR-6C-14	**Practitioner Talks 4** 1. **Anukool Bharadwaj,** Chief Strategy Officer, OGQ: *Olympic Gold Quest: Earlier Roles at OGQ Head- Para Athlete Management, Head- Research & Analysis* 2. **Mukul Choudhari,** CEO, Jamshedpur Football Club and Chief of Sports Excellence Centres at Tata Steel	
01:00 - 01:30	CR-6C-14	**Concluding Sessions:** 1. Presentation of Sammaan Best Paper Awards 2. Presentation of Participation Certificates	
01:30 - 02:30	Executive Dining Hall	LUNCH	

Schedule of Technical Sessions

Day 1: December 9th, 2024 (Monday)

Technical Session 1A: 10:00 am to 11:00 am

Parallel Session: 1 - A1		
Time	**Venue**	**Session Chair**
10:00 - 11:00	CR-6C-14	Shubhabrata Das , IIM Bangalore

Title of the Work	Prior shared successes and mediation in team competitions	
Presenter (Author)	Satyam Mukherjee	Shiv Nadar University
Abstract	*Extant literature on the team vs team competition focuses predominantly on a team's talent in explaining the team's odds of winning. While some prior research has documented the link between managerial characteristics and organizational performance, research on the coach-player relationship and its effect on team performance has been limited. We overcome the limitation by leveraging historical data from the National Basketball Association (NBA), Major League Baseball (MLB), English Premier League (EPL), French League and Bundesliga. In sports, a coach-player relationship is estimated as the number of prior shared wins a coach and player have been part of. Using regression models, we observe that prior shared coach-player success has a moderate to negligible effect on a team's performance across all the sports. Our empirical analysis also reveals the mediating role of prior shared player-player success. We provide novel empirical insights to deepen our understanding of the ongoing research on team competitions.*	

Title of the Work	Applying the Malmquist Productivity Index to Evaluate IPL Players' Performance	
Presenter (Author)	Anand V	Institute of Rural Management Anand
Co-Author	Jimut Bahan Chakrabarty	Indian Institute of Management Kashipur
Co-Author	Shivam Kushwaha	Institute of Rural Management Anand
Co-Author	Prashant Premkumar	Indian Institute of Management Vishakapatnam
Abstract	*The Indian Premier League (IPL) has become one of the world's most lucrative sporting events over the past decade, drawing top global talent and serving as a breeding ground for emerging Indian players. Recently, sports researchers and analysts have increasingly focused on evaluating IPL players' performance and tracking their relative improvements. A common but simplistic approach to this evaluation involves comparing players' raw scores across different time periods. However, this method can be misleading, as it fails to account for changes in the overall IPL environment, such as variations in pitch conditions, boundary lengths, and seasonal factors. To address these limitations, a more comprehensive approach is required to assess players' performance over time. The Malmquist Productivity Index offers a promising solution by decomposing changes in average productivity into two key components: Efficiency Change and Technical Change. Efficiency Change measures how much closer a player has come to the production frontier of a given period, while Technical Change assesses shifts in the efficiency frontier itself over time. This distinction allows us to determine whether observed improvements in players are due to their individual advancement or changes in the overall playing conditions. This study employs the Malmquist variant of Data Envelopment Analysis (DEA) to analyze the performance of both batsmen and bowlers by considering appropriate input and output variables in the IPL over the past five years.*	

Title of the Work	Applications of higher order Markov models and Pressure Index to strategize controlled run chases in Twenty20 cricket	
Presenter (Author)	Rhitankar Bandyopadhyay	Indian Statistical Institute Kolkata
Co-Author	Dibyojyoti Bhattacharjee	Department of Statistics, Assam University
Abstract	*In limited overs cricket, the team batting first posts a target score for the team batting second to achieve in order to win the match. The team batting second is constrained by decreasing resources in terms of number of balls left and number of wickets in hand in the process of reaching the target as the second innings progresses. The Pressure Index, created by researchers in the past, serves as a tool for quantifying the level of pressure that a team batting second encounters in limited overs cricket. Through a ball-by-ball analysis of the second innings, it reveals how effectively the team batting second in a limited-over game is proceeding towards their target. This research employs higher order Markov chains to examine the strategies employed by successful teams during run chases in Twenty20 matches. By studying the trends in successful run chases spanning over 16 years and utilizing a significant dataset of 3378 Twenty20 matches, specific strategies are identified. Consequently, an efficient approach to successful run chases in Twenty20 cricket is formulated. The innovative methodology adopted in this research offers valuable insights for cricket teams looking to enhance their performance in run chases.*

Keywords: Pressure Index, Markov model, Transition matrix, Data mining in sports, Cricket analytics | |

Technical Session 1A: 10:00 am to 11:00 am

Parallel Session: 1 - A2		
Time	**Venue**	**Session Chair**
10:00 - 11:00	CR-6C-13	Dries Goossens, Ghent University

Title of the Work	Modeling Player Experience on Fantasy Sports Mobile Applications: Insights from Text Mining	
Presenter (Author)	Apurva Jha	Indian Institute of Technology Delhi
Abstract	*In this study, we identified factors influencing participant experience on fantasy sports mobile applications. We proposed a player experience model combining constructs from Information System theories and Player Experience models. We used machine learning-based sentiment classification and content analysis on player reviews for data preparation, model building, and exploratory analysis, followed by regression-based methods for model verification.*
The exploratory results indicate that players appreciate the app's usability, design, economic benefits, and positive experience of participating in contests with peers. However, contest bias, information risks, inadequate informational content, and financial loss were noted. Factors influencing player experience include enjoyability, relatedness, information quality, service quality, trust, perceived knowledge of sports, in-game autonomy, and competence.
The value of this study lies in combining constructs from various theories to propose a comprehensive model of player experience on fantasy sports mobile applications. Additionally, we used a novel research approach. Participant reviews were collected and analysed to determine factors influencing player experience instead of the usually employed techniques of surveys and other user-generated content, such as Twitter data.

Keywords: Machine Learning, Sentiment Classification, Player Reviews, Fantasy Sports Mobile Applications, Player Experience, Hedonic Systems, Text Mining | |

Title of the Work	Evaluating the Effectiveness of Crowd Wisdom in IPL Fantasy League Team Compositions	
Presenter (Author)	Mohit Bhatnagar	O.P. Jindal Global University
Abstract	*This study examines the wisdom of crowds (Surowiecki, 2005) in predicting effective team compositions in fantasy sports leagues. We analyse data from 14 million entries in a randomly chosen contest on Dream11, a fantasy league for IPL cricket matches, to evaluate the prediction accuracy of vast, non-expert crowds (Herzog & Hertwig, 2011). These predictions are compared with those from smaller expert groups (Olsson & Loveday, 2015). To broaden our findings, we validate our results using randomly sampled datasets from 20 additional IPL matches from the 2023 season.* *A literature review ties our findings to broader sports applications, highlighting the potential of crowd wisdom in fantasy league selections, as per Francis Galton's intriguing concept highlighted by Surowiecki (2005). Additionally, it reviews other applications of AI and machine learning in building fantasy league teams, focusing on cricket, demonstrating a growing intersection between analytics, technological advancements in AI, and the business of sports.* *The relevance of this exploration stems from ongoing scepticism regarding the practical utility of crowd wisdom in complex decision scenarios (Reia & Fontanari, 2021). Our research seeks to validate crowd-based forecasting in sports analytics and critically assess the biases inherent in such collective intelligence models. The study also explores the popularity of players from the wisdom of crowds teams, analysing performance, popularity, and team expenditures.*	

Title of the Work	Leveraging Dynamic Player Rankings for Predicting Optimal Fantasy Teams in T20 Cricket: A Factor Score Based Approach	
Presenter (Author)	Jimut Bahan Chakrabarty	Indian Institute of Management Kashipur
Co-Author	Kavya V Kannan	Indian Institute of Management Kashipur
Co-Author	Prashant Premkumar	Indian Institute of Management Vishakapatnam
Co-Author	Bhaskar Basu	Xavier Institute of Management, Bhubaneswar
Abstract	*Fantasy cricket has emerged as a global phenomenon, revolutionizing the way fans interact with the sport. Its widespread popularity underscores the shifting dynamics of sports fandom. By blending the thrill of cricket with strategic gameplay and leveraging technological innovations, fantasy cricket offers a distinct and captivating experience for enthusiasts. This paper focuses on predicting the optimal fantasy team for T20 cricket matches by employing a comprehensive T20 player ranking system that identifies key parameters indicative of players' current form. Using data from T20 international cricket matches played during 2023-24, this study adopts a factor score-based approach to rank players according to their performance in the specified period. To accurately reflect players' true performance, considering their roles at various stages of the game, performance variables are tailored to suit different game phases, including powerplay, middle overs, and slog overs. The paper employs a dynamic approach, rather than a static one, to generate factor scores through factor analysis on a match-by-match basis for different stages of the game. This methodology provides a thorough ranking of players who participated in T20 international cricket during 2023-24. By incorporating the fluctuating conditions and contexts of each match, this dynamic method allows for a more nuanced evaluation of player performance, offering a deeper and more precise assessment of individual contributions throughout the year. The player rankings are subsequently used to predict the ideal fantasy eleven. This analysis not only highlights the strategic dimensions of fantasy cricket but also illustrates how data-driven approaches can enhance the accuracy of fantasy sports predictions, contributing to a more engaging and informed fan experience.* *Keywords: T20 Cricket, Player Ranking, Fantasy Sport, Factor Analysis, Performance Evaluation*	

Schedule of Technical Sessions

Day 1: December 9th, 2024 (Monday)

Technical Session 1B: 11:15 am to 12:15 am

Parallel Session: 1 - B1		
Time	**Venue**	**Session Chair**
11:15 - 12:15	CR-6C-14	Bhaskar Basu, XIMB

Title of the Work	The influence of performance in domestic tournaments on longevity in Indian Premier League (IPL) and viability of representing India- Analytical Approach
Presenter (Author)	Tarun Abhichandani	K.J. Somaiya Institute of Management
Co-Author	Sanjiwani Kumar	K.J. Somaiya Institute of Management
Abstract	*Indian Premier League (IPL), administered by Board of Control for Cricket in India (BCCI), is the most popular cricket league in the world. Started in April 2008, the league attracts participation from 8-10 cricket teams comprising an average of 190-200 players. Administrators of Cricket in India have indicated explicitly that they do not consider IPL as a basis for selection of players. If the administrators of the game consider all-round performances (all formats), then it is extremely important to evaluate domestic performances and their effects on getting selected in IPL tournaments as well as representing the country in overseas competitions.* *Specific research questions that study addresses are:* *What is the threshold of performances in domestic cricket tournaments based on which the Indian players, specifically who have no overseas exposure, are selected to represent IPL Teams?* *Do the Indian players, after their recruitment in IPL, continue to play in the domestic tournaments? How do their performances differ?* *Are these factors influenced by any specific format of the matches they play in? Considering domestic tournaments in India are varied and support all the formats.* *The study is based on secondary data analysis from key resources in the sports arena using technological and non-technological approaches.* *Specific statistical analysis includes predictive analytics as well as regression analyses for determining causal relationship among variables. Further, advanced statistical tools for comparing means of 2 or more groups are also used.* *Based on the analysis, there is a threshold of performance based on which IPL teams recruit domestic players. Upon representing an IPL team, the performance in domestic cricket tournaments does show a change in a certain direction also it does not necessarily guarantee a domestic cricket player that they would represent India in overseas tournaments.* *Keywords: Sports Analytics; Indian Premier League; Player Performance*

Title of the Work	Sports data to stories- an AI-based framework for generating interesting content
Presenter (Author)	Ganesh Katrapati	International Institute of Information Technology Hyderabad
Co-Author	Kiron Shastry	Athlyte Inc
Co-Author	Manish Shrivastava	International Institute of Information Technology Hyderabad
Co-Author	Neil Jaiswal	Athlyte Inc
Abstract	*The US collegiate sports fans' passion for their favorite sports team results in a $50B+ annual business. Fans spend a significant amount of time and money following their team and have an almost insatiable appetite for relevant, interesting content. However, generating this content remains entrenched in practices which are manual, time consuming and strongly biased towards either highly templatized or celebrity-focused posts. Furthermore, the quality of this content is also not very consistent. In this paper, the authors present a framework for 'sports data to text to interesting content' generation that addresses these shortcomings.* *We present a framework to automatically generate interesting stories based on underlying sports data. We*

propose a three-fold approach, starting with the automatic extraction of story templates from corpora consisting of social media and text from published news articles. Story templates are partially filled patterns, such as player position, a particular statistic, sports event and so on. We next develop a measure of "interestingness", factoring in multiple inputs such as statistical significance, popularity, newsworthiness, expert evidence and choice-based evaluations. This measure is a ranking system which helps to choose the best templates given a particular context, which is then instantiated with specific sports data, yielding a sports fact. Finally, we group generated sports facts based on relatedness factors, such as player, game, season, record etc., and a story is generated as a combination of such related facts.
Our approach enables the automatic generation of sports content out of sports data. This includes the evaluation of various text mining and classification models such as the "overgenerate-and-prune" approach. Our approach also includes controlling the combinatorial expansion of the story space with our "interestingness" measure, which also allows for time-sensitive changes and expert evidence.

Title of the Work	Content Creator Personality and Fan Engagement: Twitter Analysis from FIFA 2022 World Cup	
Presenter (Author)	Shabana Chandrasekaran	Xavier Institute of Management, XIM University
Co-Author	Balamurugan Annamalai	Xavier Institute of Management, XIM University
Co-Author	Shabbir Husain R.V.	S.P. Jain Institute of Management & Research
Abstract	*The content creator's personality will influence social media engagement, based on Parasocial Interaction (PSI) theory. However, related research is limited by the challenge of assessing the content creator's personality. We capture linguistic cues of content creators on social media and identify their personality traits by text mining. To our knowledge, it is the first study incorporating social media text mining approaches into the sports media research stream that empirically inquires and extends PSI. The study investigates the content creator's personality impact on sports fan engagement by analysing 48,742 tweets and over 50 million impressions on 1000 active Twitter handles during the FIFA 2022 World Cup. Results show that content creators' Extraversion improve all engagement measures. Further, Conscientiousness improve replies and retweets, while Neuroticism reduces likes and retweets. The intended research contribution is twofold: (1). theoretically, we offer empirical support for PSI; (2). practically, our findings aid sports entities in assessing content creator choices based on personality.*	

Parallel Session: 1 - B2		
Time	**Venue**	**Session Chair**
11:15 - 12:15	CR-6C-13	Shubhabrata Das, IIMB

Title of the Work	The Heat of the House: Analyzing Late-Game Performance in Curling	
Presenter (Author)	Gleb Vasiliev	HSE University, Moscow
Abstract	*Curling is a popular Olympic winter sport where two teams of two or four players alternately slide stones on an ice rink towards a target of concentric circles (the house) at the opposite end. One player makes the shot, while teammates use brushes to alter the ice properties in front of the stone and manipulate its trajectory to improve shot accuracy.*
Games typically involve multiple stone throws, but certain shots, especially those in the endgame, are crucial for the outcome. In my paper, I test whether athletes making these crucial shots experience the psychological effect of choking under pressure. This phenomenon of underperforming is well-documented across various sports; however, some studies suggest a potential facilitative effect instead (Deutscher et al., 2018; Otten, 2009; Ötting et al., 2020). To the best of my knowledge, there is limited research on this and other behavioral phenomena in curling. Curling offers a unique setting as a team sport where outcomes of each shot are largely determined by the initial shot execution, yet each shot is additionally influenced by sequential team efforts through sweeping.
I collected an extensive dataset of over 1 million curling shots and employed several fixed effects models to assess the influence of decisive moments on shot execution grades (points) from game protocols assigned by human experts. Preliminary findings indicate that performance declines when the game score is close, but surprisingly improves in the endgames.
Although the current project is still in its early stages and subject to various limitations, the results appear	

promising and significant for understanding curling performance, as well as general human behaviour under stress.
Keywords: curling, choking under pressure, clutch performance

Title of the Work	Does scheduling and related travel impact the team and individual performances in NBA? Evidences from multiple seasons	
Author	Soudeep Deb	Indian Institute of Management Bangalore
Co-Author	Akshay Singh	Indian Institute of Management Bangalore
Co-Author	Mayur Selukar	Indian Institute of Management Bangalore
Co-Author	Prathamesh Santosh Bhandari	Indian Institute of Management Bangalore
Presenter Co-Author	Rehan Bhatia	Indian Institute of Management Bangalore
Abstract	*In professional basketball, the grueling demands of travel and relentless scheduling can be as decisive as skills displayed on-court. Picture an NBA team, fresh off a hard-fought game, boarding a plane for a cross-country journey, only to face another formidable opponent the next day. In that context, we ask a critical question: can fatigue from back-to-back games, the toll of shifting time zones, and the challenge of minimal rest days significantly impact a team's performance? This study examines how scheduling affects NBA match outcomes, analysing factors such as season phase, team details, location, travel distance, flight time, rest days, and time zone shifts. It extends existing research by capturing team-specific and individual performance nuances related to scheduling.* *Our team-wise analysis reveals significant variations in travel times and distances, highlighting diverse travel demands and their effects on performance. Certain conferences or divisions experience more extensive travel, potentially affecting their competitive edge. Time zone shifts have a small but measurable impact on outcomes. Regression models, including penalization and shrinkage techniques, are employed to ascertain the significance of these variables. In-depth examination of individual performances shows strong correlations with travel-related factors, such as time zone shifts for the Charlotte Hornets and Dallas Mavericks, and travel hours for the Atlanta Hawks and Washington Wizards. Additionally, a demanding schedule increases the risk of player injuries, further affecting performance.* *Overall, our analyses pinpoint specific schedule-related factors impacting team and player performance. We discuss how optimizing factors within a team's control, such as maximizing rest days and minimizing adverse time zone effects, can improve performance. This study extends existing research by capturing the finer nuances of team-specific and individual performances as a function of scheduling.*	

Title of the Work	Redefining Talent Identification in Football: The YUVA-SQ Model	
Presenter (Author)	Sadanand V	Shiv Nadar University Chennai
Co-Author	Sundharakumar KB	Shiv Nadar University Chennai
Co-Author	Bharathi M	Shiv Nadar University Chennai
Co-Author	Santhi Natarajan	Shiv Nadar University Chennai
Abstract	*In the evolving landscape of football scouting and player development, traditional metrics focusing on physical and tactical skills are no longer sufficient to identify and nurture talent effectively. YUVA-SQ (Youth Understanding and Visionary Assessment for Scouting and Qualification) is a framework designed to integrate continuous mental and physical evaluation into the scouting process. This model builds upon the YODA (Your Offence and Defence Analytics) psychometric tool, which evaluates players through 48 football-specific scenarios, mapping their psychological responses to 14 primary traits and 60 sub-traits. YUVA-SQ functions as a comprehensive Decision Support System (DSS), providing a holistic approach to player assessment by combining YODA's psychometric insights with AI-driven modules. This dynamic structure allows for a nuanced understanding of a player's mental and cognitive profile, enhancing traditional scouting methods. The integration of YODA within YUVA-SQ offers a complete evaluation system that supports the continuous development of footballers from youth levels to professional stages. This includes various modules that can be used separately, or in tandem with one another. These modules provide further insights into the player's role in the field using the data collected from YODA, contributing to the overall understanding and development of players by aiding coaches.* *This paper will detail the structure and methodology of YUVA-SQ, showcase its application, and discuss its potential impact on the future of sports analytics and player development. By leveraging AI and psychometric*	

analysis, YUVA-SQ provides decision-makers with actionable insights to optimize player selection, training, and development strategies.
Keywords: Decision Support System, Cognitive Scouting, Football Analytics, Psychometrics, AI-driven Assessment

Day 1: December 9th, 2024 (Monday)

Technical Session 1C: 03:30 pm to 04:30 pm

Parallel Session: 1 - C1		
Time	**Venue**	**Session Chair**
03:30 - 04:30	CR-6C-14	Ranojoy Basu, IIM Udaipur

Title of the Work	Analyzing the competitiveness of European Football Leagues through Network Analysis	
Presenter (Author)	Abhishek Chakraborty	XLRI Jamshedpur
Abstract	*Competitiveness in football leagues is an essential element for attracting more spectators. The prevailing uncertainty regarding both the top-four finish (or may be top-three finish) in the top European football leagues and the relegation battle, has the capacity of making the spectators glued either to their TV sets or in the stadium. With the commercializing of most of the leagues across sports, competitiveness or competitive balance creates uncertainties that both attract spectators as well as provide incentives for betting markets. If a few teams keep on dominating the top spot battle year after year, it affects the competitive balance of leagues and could dissuade spectators away either to some other leagues or even to some other sports. To ensure the competitive balance remains intact, UEFA introduced the Financial Fair Play (FFP) to prevent teams from spending more than their income, and it was implemented in the 2011-12 season onward. In our work, we propose a network-based approach that will look into a pairwise comparison of the team's performance both on home-away format across the top five European leagues over a period of 18 years to provide a metric of competitive balance. We will further show how the competitive balance has changed over the years across leagues and also whether the introduction of financial fair play has helped to boost the competitive balance of the leagues.*	

Title of the Work	Minimal and fair waiting times for single-day sports tournaments with multiple fields	
Presenter (Author)	Lisa Garcia Tercero,	Ghent University
Co-Author	Dries Goossens	Ghent University
Co-Author	David Van Bulck	Ghent University
Abstract	*In this work, we study an amateur single round-robin tournament where all games take place at the same venue and a limited number of fields is available. Moreover, each team needs a resting time of at least one time slot between every two games it plays. This setting regularly occurs in practice, and fairness regarding the resting times is a frequently studied topic since differences in resting times may affect the outcome of the games. Sometimes having more resting time is perceived as desirable, yet in amateur tournament environments teams prefer to play their games in quick succession so they can return home without delay. The inspiration for this work is the regional championship of the West-Flemish Badminton Federation (WVBF), where participants want to play as many games as possible (hence the round-robin format) without having to wait a long time between their games. Therefore, we generate timetables minimizing waiting times, defined for each team as the number of time slots they have to be present in addition to their games and resting times. We focus on creating timetables that are both efficient (by minimizing the total waiting time) and fair (by minimizing the maximum waiting time). Besides showing our theoretical results regarding lower bounds on the total waiting time, we also provide two heuristics to create timetables minimizing waiting times, depending on whether the number of participating teams is even or odd. The provided heuristics have an absolute performance guarantee of 1 when the number of teams is odd, and are optimal when the number of teams is divisible by 8.*	

Title of the Work	The DLJ version, a new variant that eliminates all anomalies of the Duckworth and Lewis method
Presenter (Author)	Jayadevan V

| Abstract | *The Duckworth and Lewis method used by the ICC to set target scores in interrupted limited over cricket matches has completed 25 years of its tenure in the international cricket. Though the method is based on valid mathematical concepts, right from its original version in 1998 to the latest version DLS-5.0 (2022), all the versions invariably produced unacceptable results. The VJD system developed by the author was the closest competitor of the D/L system for all these years. In 2012, the ICC reviewer rated VJD system as equal to the D/L system but was reluctant to accept that it is better than the D/L system and hence the D/L system continued. The VJD method is based on a different concept and during its tenure of 17 years in the Indian domestic cricket; it never produced an embarrassing result. While the D/L method considers T20 as just a special case of 50 over matches, the VJD method considers it as a different ball game. Hence it uses different data for 50 and 20 over formats. The author had the impression that the D/L, DLS systems are giving unsatisfactory results mainly because they use only one set of data for both the formats. But recently, the studies conducted by the author based on the D/L theory and VJD data revealed that this impression was wrong. It is the lack of understanding of the dynamics of game that stands as the root cause for the major flaws in D/L systems. The proposed DLJ method is the creation of that experimentation. However, to establish the need for an improved version, it is necessary to bring out the serious anomalies in the D/L systems. In this paper, some glaring anomalies of Wincoda 2.0, Wincoda 3.0, DLS 1.0 and DLS 5.0 are brought out. The principles based on which the proposed DLJ method works is explained and a detailed comparison of the DLS 5.0-2022 version and the proposed DLJ-1-2024 version is done to establish the clear supremacy of the latter. Key words: DLJ, D/L, DLS, VJD* |

Parallel Session: 1 - C2

Time	Venue	Session Chair
03:30 - 04:30	CR-6C-13	Phil Scarf, Cardiff Business School

Title of the Work	Allocation of Resources and its Adaptation to Competition	
Presenter (Author)	Kushagra Sharan	Indian Institute of Management Kozhikode
Co-Author	Deepak Dhayanithy	Indian Institute of Management Kozhikode

| Abstract | *The allocation of resources has been a significant concern for the firms. The paper develops linkages between the internal and external allocation of resources and its impact on the firm's performance. This research defines the internal and external resources in a location-specific context. The paper also develops linkages between leadership resource allocation and firm performance. Finally, it develops the linkages between how experiential knowledge of the internal resources aids the adaptation to the competition, consequently impacting the firm's performance. The study is analyzed through an empirical sports setting, where the data is collected from the Indian premier league, a cricketing league. The data is collected from 2008 to 2021 from the oldest and the largest cricketing database, ESPN Cricinfo. The findings support that the internal allocation of resources positively impacts the firm performance. It also provides partial support that if the leadership resource is internal, it positively affects the firm's performance.* | |

Title of the Work	Rank-based Model for Price-Differential for Exports of Media Broadcast Rights: Premier Badminton League, India	
Author	Ashish Karnavat	Novexa Consulting, Pune

| Abstract | *The purpose of this study is to measure the export-potential of the digital and television-broadcasting rights of a sporting-league-event using a simplified rank-based index. We will scrutinize data from selected 20 countries for Premier Badminton League (PBL) for this paper. The important objective is to provide a structured base in understanding the demand-side economics for the television-broadcasters, thus helping them create appropriate export-strategies for different countries. A factor-scale has been developed to measure each of the export-relevant factors for each country and the overall result is categorized into grades. These grades can be used by broadcasters to improve their export-focus on the high-potential countries,* | |

Title of the Work	How to organize a fair rogaining competition?	
Presenter (Author)	David Van Bulck	Ghent University, Belgium
Co-Author	Dries Goossens	Ghent University, Belgium
Co-Author	Joonas Pääkkönen	Dalarna University, Sweden
Co-Author	Benjamin Jacquet	
Abstract	*Orienteering is a group of cross-country running sports where participants use a map and compass to navigate through unfamiliar terrain to find locations marked on the map, known as control points. In this talk, we discuss a variant of orienteering called rogaining, where each control point is assigned a score, and competitive performance is measured by the cumulative score the competitor gathers by visiting as many control points as possible within a given time limit. Hence, it is important for the competitors to carefully plan which controls they are going to visit and in which order. Winning a rogaining competition thus not only requires physical but also cognitive (planning and navigational) skills.* *Unlike most operations research literature, we approach the rogaining problem from an organizers' perspective: how to assign scores fairly, balancing physical and cognitive skills? In practice, this typically translates to designing rogaining competitions such that brute physical skills are not overly favoured. We follow a bi-level optimization approach where the outer-layer assigns scores to control points and the inner-layer simulates a portfolio of pre-defined competitors. The result is a provisional ranking that enables organizers to evaluate how well the necessary skills for winning a rogaine are balanced and to make modifications to the score assignment when deemed necessary. Our method's efficacy is shown in its application to the 2023 Rogaining World Championships.* *Keywords: orienteering problem, rogaining, score assignment, bilevel optimization*	

Title of the Work	Cross-Country Skiing Training Data Predict the Competition Results of an Olympic Gold Medalist	
Presenter (Author)	Joonas Pääkkönen	Dalarna University, Sweden
Abstract	*We visualize, quantify and analyze the training diary dataset of a former elite female cross-country skier who won a gold medal at the 2014 Olympic Games. The dataset spans from spring 2012 through spring 2018 with a yearly average of 708.95 training hours. These 6 years cover 119 competitions with more than 2,600 training sessions, and more than 4,200 training hours with an average weekly load of 13.60 hours of which 90.33% is low intensity training (training zones A1–A2, 60–84% of maximum heart rate), while the rest, 9.67%, is high intensity training (training zones A3–A3+, ≥85% of maximum heart rate).* *While it is challenging to compare cross-country skiing competition results due to non-standardized competition courses, FIS points can be used to measure and compare the performance of an athlete over various races. The dataset includes 119 FIS ranking point competitions with 68 interval starts, 23 mass starts, 17 pursuits and 11 skiathlons.* *A specific focus of our analysis is on daily loads, i.e., the total daily training time durations. We also present taper load sequences that correspond to select realized and predicted FIS point minima. Roughly speaking, the data suggest that both the predicted and the realized 28-day trailing average weekly loads usually halved from approximately 16 to 8 hours over two consecutive 28-day periods prior to low FIS point competitions.* *To find a more precise mathematical model for FIS point prediction, we show that a multilayer perceptron with rectified linear units and compressed 28-day daily load sequences of taper periods appear to predict FIS ranking points. The timing error between the predicted minimum and the realized interval start minimum is only 3 days over a time span of more than 4.5 years. According to our results, the problem of FIS point prediction appears complex, yet tractable through a simple neural network.* *Keywords: cross-country skiing, elite athlete, training intensity, volume and recovery distribution.*	

Schedule of Technical Sessions

Day 2: December 10th, 2024 (Tuesday)

Technical Session 2A: 10:00 am to 11:00 am

Parallel Session: 2 - A1		
Time	**Venue**	**Session Chair**
10:00 - 11:00	CR-6C-14	Shobhit Aggarwal, IIM Udaipur

Title of the Work	Athlete ACWR Monitoring Tool: A Comprehensive Approach to Workload Management	
Presenter (Author)	Praveen D. Chougale	Indian Institute of Technology Bombay
Co-Author	Usha Ananthakumar	Indian Institute of Technology Bombay
Abstract	*This study introduces the Athlete ACWR (Acute Workload Ratio) Monitoring Tool, designed to evaluate and manage athletes' workloads, helping to prevent injuries and enhance performance. The tool uses Gradio for an interactive interface, integrating data processing, visualization, and report generation capabilities.The ACWR Monitoring Tool calculates workloads using session RPE (Rate of Perceived Exertion) and session duration across three sessions per week. Users can choose between the Rolling Average model and the Exponentially Weighted Moving Average (EWMA) model. The tool computes weekly total workloads, chronic workloads, acute workloads, and ACWR values, providing a comprehensive view of training load dynamics.* *Statistical analysis compares workloads across different weeks, highlighting trends and patterns. Repeated measures ANOVA identifies significant changes in workload metrics over time. Additionally, the tool calculates effect sizes to quantify the magnitude of observed changes. By visualizing ACWR trends, it enables the identification of critical periods where athletes are at increased risk of injury due to high ACWR values.Preliminary results demonstrate the tool's effectiveness in monitoring workload trends and identifying periods of heightened injury risk. Its interactive nature and comprehensive reporting make it invaluable for coaches, sports scientists, and performance analysts, aiming to optimize training loads and reduce injury risks. The analysis aids immediate decision-making and contributes to understanding workload management in sports science.* *Keywords: ACWR, sports performance, injury prevention, repeated ANOVA, effect size*	

Title of the Work	Analyzing Key Factors Influencing IPL Cricket Scores Using Explainable AI and Multi-Modal Data Integration	
Presenter (Author)	Mohit Bhatnagar	O.P. Jindal Global University
Co-Author	Manya Bhatnagar	Ashoka University
Abstract	*In this paper, we investigate data from the Indian Premier League (IPL) spanning from 2008, the inception year, to the last season in 2024 to identify and analyze key factors influencing the total scores of IPL cricket games. We build a post-facto predictive model for classifying high and low scoring games. The model is built using the H2O AutoML framework and includes data on the location, weather conditions, teams, and players. For a subset of games, we utilize GPT-4, an LLM with multi-modal capabilities (Yin et al., 2023), to analyze pitch report videos and incorporate audio and image features to evaluate if these can increase classification accuracy. We focus on Explainable AI (XAI) to quantify the influence of different match features on the scores, offering transparency and insights into the model's individual predictions (Arrieta et al., 2020).* *Through a literature review, we connect our findings to broader sports applications, highlighting the potential of AI in cricket analytics. We examine existing research on machine learning and AI in predicting cricket outcomes and scores (Kapadia et al., 2022) and emerging knowledge on evaluating pitch quality (Kumar & Balasubramanian, 2023).* *The findings of this study can be valuable for teams, coaches, and analysts, aiding in strategy alignment based on pitch conditions and other influential factors. Tournament organizers can also benefit by creating more balanced and competitive games, ultimately attracting larger crowds and increasing revenue and viewership.*	

Title of the Work	T20 Team Selection: From Analytics to Action	
Presenter (Author)	Bhaskar Basu	Xavier Institute of Management, Bhubaneswar
Co-Author	Sail Morye	Atharva College of Engineering, Mumbai
Abstract	*In the dynamic world of T20 cricket where matches are often decided by fine margins, advanced analytics have become increasingly important in player selection and team strategy. Essential statistics like batting averages, strike rates, and bowling economies provide useful insights but fail to address the intricacies of a complex team sport like cricket, especially in modern times when ICC is making all efforts to attract more fans to the ground or the broadcaster. Unlike traditional formats T20 cricket is centred on aggressive play; every ball matters and whichever team utilizes the available balls better comes out as the winner.* *Our proposed model is based on a hybrid of hard skills attributed to an individual player (like strike rate and economy for a bowler) and soft skills that have relevance in a team sport like cricket. While the metrics for batsmen, bowlers, and wicketkeepers have been applied extensively in past literature, the incorporation of the indicators manifesting soft skills associated with the game is novel and is our contribution to the body of literature. The soft skill metrics include the agility index (dexterity in multiple field positions), pressure index (ability to perform under stress), and flexibility index (ability to bat or bowl in multiple positions).* *The innovative hybrid model will enable the coach/captain of the team to formulate a team by entrusting a role for each player to maximize the team's impact in a competitive match with a rival. The model can also be used by franchisee administrators and team managers to pick players in the IPL mega-auction slated later this year.* *Keywords: T20 cricket, strike rate, dismissal rate, agility index, pressure index, flexibility index*	

Technical Session 2A: 10:00 am to 11:00 am

Parallel Session: 2 - A2		
Time	**Venue**	**Session Chair**
10:00 - 11:00	CR-6C-13	

Title of the Work	Importance of Setting a Target in case of a Limited Overs Cricket Match	
Presenter (Author)	Priyanka Talukdar	St. Xavier's University, Kolkata
Abstract	*Cricket is a sport that is extremely popular in the Indian subcontinent and is only next to soccer in popularity across the world. The game has undergone tremendous changes, starting with the earliest test cricket, which continues for five days, and then one-day international cricket with 50 overs per side, which restricts the span of a cricket match to a single day or night. The latest addition is Twenty20 cricket, where the game is reduced to only twenty overs per side. Due to stiff competition, tremendous popularity, vast media coverage, and the invention of franchise-based cricket leagues like the Indian Premier League, the Big Bash League, etc., analytical studies based on this limited format are important not only for academic interests but also for all stakeholders in the game. The present study is an endeavour to explore the problem of deciding an adequate 'target' to be put forward by the team batting first, which would eventually lead the team to victory (i.e., for a team chasing the said target while batting second would not be easy to achieve). The study is conducted in a limited-overs cricket match with the help of a composite indicator called the 'Pressure Index'.* *Key words: Cricket analytics, limited overs cricket, Target, Pressure Index.*	

Title of the Work	The net relative run rate method (NRRR), a foolproof technique to replace the net run rate (NRR) method in evaluating the authority of match-wins	
Presenter (Author)	Jayadevan V	
Co-Author	Keshav Kolle	Sportec India, Bangalore
Abstract	*When a number of teams participate in a league match and play each other, often many teams end up with the same points and will be difficult to rank them for the process of deciding which teams should go through to the next round. The authority with which the teams win their individual matches is considered under such situations for the selection process. Currently the net run rate rule (NRR) which is just a mediocre method*	

with several flaws is used for the purpose. While all the methods used to set target scores in interrupted matches for the last 25 years or more consider wickets also as a major parameter in their calculations, surprisingly this parameter is yet to find a place in NRR calculation. Suppose in a 50 over match, team-1 is all out for 150 runs. In reply, team-2 makes 151/9 in 25 overs and wins the match. NRR for team-1 is -3.04 and the same for team-2 is +3.04. Here, though the victory of team-2 is marginal, NRR projects it as massive. If team-2 wins by say scoring 151/2 in 40 overs (a more convincing win), the respective NRR values are -0.775 and +0.775 which makes no sense. Substituting overs with resources in the NRR equation is the best way to bring in the wickets factor into the calculation and eliminate such anomalies. Since par scores are proportional to the resources used, substituting the resources with par-scores, which are readily available for any match, is an easier way. One can thus derive a new parameter RRR (Relative Run Rate) which is exceptionally superior to the NRR. If VJD par-scores are used, the RRR values when team-2 scores 151/9 in 25 overs will be -0.106 and +0.106. For 151/2 in 40 overs, the values will be -0.901 and +0.901. NRRR will be the sum of individual RRR values of each match of a team. This paper explains how RRR and NRRR values are computed and analyses the IPL 2024 situation using this method and brings out the new point table.

Key words: NRR, RRR, NRRR, Resources, Par-score

Title of the Work	Technology and Decision Making in Sports	
Presenter (Author)	Anthony Bedford	University of the Sunshine Coast, Australia
Co-Author	Erica Mealy	University of the Sunshine Coast, Australia
Abstract	*Technology, sport and mathematics are long term companions. Since its known beginnings, measurement, aids and equipment have been entwined in sport. The ancient Olympics featured the discus throw, jumping and chariot races, marrying the human aim for perfection with equipment, measurement, and even other species (Christesen 2024). As sport moved toward the modern Olympic era, more sports involved more use of equipment, and associated technologies to enhance performance. In more recent times, the utility of technology to assist in both winning and deciding a winner are converging.* *In this work, we uncover the leading edges of visual technology, artificial intelligence (AI) and computer vision (CV) that are utilised in sport. We consider their impact and power on decision making specifically in the context of adjudication. We uncover sports utilising technology and propose ways and means to improve this space with CV and AI solutions. We develop a criteria assessing the levels technology is used in decision making and propose some scenarios for development in this area.* *Keywords: Computer Vision, Artificial Intelligence, sport, framework*	

Schedule of Technical Sessions

Day 2: December 10th, 2024 (Tuesday)

Technical Session 2B: 11:15 am to 12:15 am

Parallel Session: 2 - B1		
Time	**Venue**	**Session Chair**
11:15 - 12:15	CR-6C-14	Bhaskar Basu, XIMB

Title of the Work	Critical Metrics for Assessing Test Cricket Performance: A Factor Analysis Approach	
Presenter (Author)	Jimut Bahan Chakrabarty	Indian Institute of Management Kashipur
Co-Author	Kartheeswaran N	Indian Institute of Management Kashipur
Co-Author	Prashant Premkumar	Indian Institute of Management Kashipur
Abstract	*Assessing player performance in Test cricket has long been a complex challenge due to the intricate and multifaceted nature of the game. Traditional ranking systems often rely on cumulative statistics, which may not fully capture the subtleties of individual contributions. This paper presents a novel approach to evaluating Test cricket performance by identifying and analyzing critical metrics impacting player performance. A number of these metrics have been ignored by earlier ranking systems, even those employed by the International Cricket Council (ICC), which is the most popular system. The metrics proposed capture consistency, adaptability to different playing conditions, responsiveness to match requirements, and impact on match outcomes among other performance indicators. By incorporating these metrics, the analysis offers a holistic view of a player's value, moving beyond conventional statistics. Leveraging data from Test matches throughout the 2022-23 season, this study employs a factor analysis method to evaluate and rank players based on their performance during this timeframe. This study addresses the limitations of existing ranking systems and proposes a more comprehensive framework for player evaluation. This paper aims to redefine how Test cricket performance is assessed, setting a new standard for player evaluation in the sport. By employing the aforementioned approach, it delivers a comprehensive, data-driven perspective that aligns with the evolving demands of modern cricket. The methodology promises to enhance the understanding of player performance, contributing to the advancement of the sport.* *Keywords: Test Cricket, Player Ranking, Factor Analysis, Performance Metrics*	

Title of the Work	A Robust Multilevel Modeling Approach to Ranking Women's Batting Performances in Cricket	
Presenter (Author)	Kapil Gupta	Indian Institute of Management Bangalore
Abstract	*Women's cricket has historically received less analytical attention compared to men's cricket. This study addresses this gap by developing a robust all-time ranking system for women batters based on their One Day International (ODI) performances, focusing on players with a significant number of matches for meaningful comparisons.* *Our study models both runs scored and strike rates, incorporating the impact of other relevant variables. Exploratory analysis revealed overdispersion in these variables, prompting the use of a two-level negative binomial random intercept model. This model effectively handles overdispersed data and accounts for individual variability and the hierarchical structure of cricket data.* *The random intercept model includes fixed effects for factors such as not-out status, innings number, and opposition tier. By incorporating random effects, the model provides a nuanced understanding of player performance, capturing both the quantity of runs and scoring efficiency.* *We also compared the two-level model with a single-level negative binomial random intercept model and a negative binomial model without any random intercept using the same fixed effects to highlight the improved fit and accuracy provided by the multilevel approach. The results demonstrated that the two-level structure offers a superior fit, thereby enhancing the reliability of the rankings.* *Our proposed ranking method represents a significant advancement over traditional metrics, offering a comprehensive evaluation of batting performance. This approach not only improves the accuracy of rankings but also contributes to a more equitable understanding of women's cricket. Through advanced statistical*	

modeling, our study offers valuable insights for coaches, analysts, and fans, fostering a deeper appreciation of women's contributions to the sport.

Title of the Work	Extreme Heat and Productivity: Evidence from Elite Level Professional League Football	
Presenter (Author)	Anirudh Srikanth	Azim Premji University
Abstract	*As societies adapt to rising temperatures and longer summers, a pressing question arises: How does extreme heat impact productivity?* *In this study, we investigate how temperature affects the performance of professional male football players. We use data from top football leagues in England and Spain. The difference in temperature between the two countries and the wealth of data available allows us to study this relationship. We will try to estimate the financial costs associated with decreased productivity due to heat stress in professional football, including impacts on team performance, revenue generation, and healthcare expenditures. This research also aims to evaluate the generalizability of findings to broader populations beyond elite athletes, recognizing that if extreme heat affects top-tier football players who receive optimal care and resources, it may affect productivity in other occupations and industries. We will conduct on extensive empirical analysis by merging different data sources.*	

Parallel Session: 2 - B2		
Time	**Venue**	**Session Chair**
11:15 - 12:15	CR-6C-13	Phil Scarf, Cardiff Business School

Title of the Work	Evaluation of Rugby Teams Using Data Envelopment Analysis	
Presenter (Author)	Nobuyoshi Hirotsu	Juntendo University, Japan
Co-Author	Makoto Kiuchi	Sayama Secom Ruggut's
Co-Author	Keita Inoue	Kurita Water Gush Akishima
Co-Author	Kazuyuki Sekitani	Seikei University
Abstract	*This study aims to evaluate and analyze the characteristics of rugby teams using comprehensive data statistics, and to propose specific improvement plans for the teams identified as inefficient. The dataset includes detailed statistics from five teams in the Japan Rugby League One Division 3. A total of 29 play items were analyzed using Principal Component Analysis (PCA) and Data Envelopment Analysis (DEA). PCA reduced the 29 play items to 9 principal components, simplifying the dataset while retaining essential information. Two DEA models, maxRAM and minRAM, were used to evaluate the teams, addressing short-term and long-term improvements respectively. The maxRAM model aims at immediate performance enhancements, while the minRAM model is oriented towards sustainable long-term development. By applying these models, the study identified specific inefficiencies within each team. Detailed short-term and long-term improvement plans were then proposed for the identified inefficient teams. Short-term plans include tactical adjustments, training modifications, and short-term player recruitment strategies. Long-term plans involve developing robust training regimens, strategic player development, and long-term player reinforcement to enhance overall performance. The results provide valuable insights for coaches and team managers, offering a structured approach to diagnose inefficiencies and implement targeted improvements. The dual-model approach addresses both immediate and future needs, fostering balanced development.*	

Title of the Work	Exploring the Determinants of Football Performance in India: Economic, Physical, and Strategic Factors	
Author	Sayantani Roy Choudhury	Praxis Business School
Co-Author	Sweta Tiwari	Praxis Business School
Abstract	*Football has a rich and varied history in India, from its early days during the British colonial period to its*	

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current status as a growing sport with a burgeoning domestic league. Despite its potential, an ARIMA model predicts that India is unlikely to break into the top 100 FIFA rankings in the near future. This paper aims to uncover the reasons behind this continuous downturn and proposes potential solutions.

Quantitative research was conducted to identify the contributing factors. Data from the top 50 countries in the current FIFA rankings revealed that GDP is the only significant variable, with a positive impact on rankings. A decision tree algorithm showed some non-linear associations with a few other variables, suggesting that football success does not depend solely on characteristics that India might lack. Additionally, we examined specific characteristics of top players, analyzing data on the top 50 players in the current world rankings. Regression analysis identified three significant variables: height, weight, and geographic location. Players with lesser height and slightly heavier weight ranked better. While European and Caucasian players are more prevalent, other ethnicities are also represented.

To further explore the factors contributing to better football performance, we analyzed data from Indian states and union territories, focusing on the number of players participating in national-level sports, especially in football. Among the relevant variables, only the sports budget emerged as highly significant. This finding suggests that adequate financial investment can bridge performance gaps between top countries and others, provided funds are used effectively. Concurrent advancements in skill development, technology, infrastructure, and training can elevate Indian football. Tournaments such as the Indian Super League can play a pivotal role in achieving this goal.

Key words- Football performance of India, Sports budget, ARIMA, Decision Tree, Regression

Title of the Work	Objectifying the Subjective: Turning Expert Recruiter Insight into Machine Analysable Data in Australian Football	
Presenter (Author)	Robert Younger	Melbourne Football Club

Abstract	*Every player to make the top level of Australian Football, the AFL, is recruited from a lower competition, be it a state, regional, U18 development or high school league. Clubs employ a team of recruiters (also known as "scouts") to follow players in these leagues and make decisions about which players to select to join their club via the National Draft.*
	Clubs also pay data providers to capture key statistics for these leagues. These stats have some predictive use, but are an incomplete picture of a players performance and vary in which data is collected and accuracy of collection across different leagues.
	Since 2019, Melbourne Football Club recruiters have rated potential draftees (on a scale from 1-7) in a range of different attributes, from closed-skill traits like Kicking Ability or Ball-Handling, to more subjective measures like Footy-IQ and AFL Talent. This data has allowed a range of insight and analysis, such as which patterns of attributes lead to better future outcomes for different roles, or which attributes have been overvalued historically. I will show how a predictive model built on these attribute ratings along with game stats outperforms both the recruiters or the statistics alone.
	In addition to attribute ratings, recruiters also submit a written report on each player after watching them in each match they play. Records of these reports pre-date attribute ratings. In this presentation we will explore the use of natural language processing (NLP) within the framework of attribute ratings to see whether sentiment analysis may allow us to expand our sample of ratings to earlier years and hence get a much better idea of how different skills at lower levels may transfer into the AFL
	Keywords: AFL, Drafting, Machine Learning, Career Forecasting, Sentiment Analysis

Parallel Session: 2 - C1		
Time	**Venue**	**Session Chair**
03:30 - 04:30	CR-6C-14	Govind Kumawat, IIM Udaipur

Title of the Work	Reforming Belgian youth field hockey competitions with an incomplete round robin tournament	
Presenter (Author)	Karel Devriesere	Ghent University, Belgium
Co-Author	Dries Goossens	Ghent University, Belgium
Abstract	*The organization of youth sports competitions often involves considerable efforts. In contrast to professional sports competitions, that usually involve only a selected number of elite teams, there are often up to a hundred teams in the same competition. The main objectives of the competition organizer are to adhere to the venue capacity (i.e., number of teams a certain club can accommodate in its home venue on the same day), but also to minimize the total travel times the teams face when visiting their opponents.* *Traditionally, the organization of youth sports competitions involves partitioning the teams into leagues, where each league is scheduled as a double round robin tournament (each team faces each opponent in its league twice: once at home and once away). Although widely used in practice, this approach has some serious limitations. By first partitioning the teams, travel time is prioritized over limiting capacity violations. Secondly, the restriction that each team must face each opponent in the same league exactly twice limits the potential opponents of each team.* *Here, we present an alternative way to tackle this problem. Instead of partitioning teams into leagues, we consider the whole competition as one big league, where each team plays a fixed number of games. Teams can face any subset of opponents but see the same opponent at most twice. The format is called an incomplete round robin since not every opponent is necessarily seen the same number of times. The advantage of this format is that we extend the solution space, such that we can further minimize the travel times of the teams. An integer program and an accompanying fix-and-optimize heuristic to solve this problem is proposed and discussed. The effectivity of both the algorithm and proposed format are presented based on data from scheduling the Belgian hockey youth leagues in seasons 23/24 and 24/25. The proposed format is shown to improve the travel times considerably.*	

Title of the Work	Sporting Leagues of India: Insights for Economics, Management, and Sports	
Presenter (Author)	Siddhartha K Rastogi	Indian Institute of Management Indore
Abstract	*While the professional sporting leagues ran successfully in the west since 1950s, the phenomenon of sporting leagues is relatively new in India. The first successful professional league debuted in India in 2008. While the Indian Premier League cashed on the popularity of cricket in India, it also gave a window of inspiration to several other such leagues. At the last count, there are more than 30 such professional sports leagues operating in India.* *Understandably, each sporting league follows a different design of competition, model of franchisee auction, revenue model, durations, and methods of promotion. Some leagues have innovated and modified heavily over time, whereas some have continued a conventional structure with little reforms. Most importantly, some leagues have been immensely successful while others have bowed out soon. The obvious questions arise regarding the factors behind success, stagnation, or failure of any league. We try to understand such factors at three levels of league's design – one, economics of the league; two, management of the league; and three, the peculiarities of the sport itself. To keep the analysis focused, manageable, and comparable, we selectively analyze the professional leagues of four team sports only. These include Indian Premier League (Cricket, started in 2008), Hockey India League (Hockey, 2013), Pro Kabaddi League (Kabaddi, 2014), and Indian Super League (Football, 2014). Notably, 3 of these 4 leagues are running successfully, whereas the Hockey India League was organized between 2013 to 2017 only.* *To explore these four leagues across three contours of analysis, we seek factual and numerical information from popular sources as well as leagues' own websites. More importantly, we draw insights from the existing literature on professional league sports' economics and management. Among the major studies that we draw insights from include Bradbury (2021), Szymanski (2003), Vrooman (2000), and Neale (1964).*	

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Title of the Work	Best congregation of skill may not be enough for success in a team game- a provocative study around IPL 2024	
Presenter (Author)	Subhasis Ray	IISWBM, Kolkata
Co-Author	Pragnadip Chakrabarty	Presidency University, Kolkata
Abstract	*Can a collection of best players at every position yield the best possible result in a team game? – is the research question under consideration here. Cricket is one game where official rating scores and rankings are published on a regular basis for players in various formats (e.g. Test, ODI, T20I) as well as roles (i.e. batsman, bowler, all-rounder) according to their performance in international matches. These ratings are nothing but metrics that are supposed to quantify their skill level. It is pertinent to see how and whether these rating scores translate into performance in a team game, for example, franchise based cricket, specifically Indian Premier League (IPL). Collectively also, does a franchise taste success simply by having an assortment of players with highest aggregate rating points? Within a limited purview of IPL 2024, it is seen that neither international performance based rating points guarantee a robust individual performance nor a team with highest aggregate rating points comes out the winner. This raises an even more intriguing question – in a team game what are the other factors that possibly interplay with the skill factor to make a winning combination? This research work seeks to explore options and opinions on the same.*	

Schedule of Technical Sessions

Day 3: December 11th, 2024 (Wednesday)

Technical Session 3A: 10:00 am to 11:30 am

Parallel Session: 3 - A1		
Time	**Venue**	**Session Chair**
10:00 - 11:30	CR-6C-14	Dries Goossens, Ghent University

Title of the Work	Competing Against Former Teammates Predicts Team Victory	
Presenter (Author)	Satyam Mukherjee	Shiv Nadar University
Co-Author	Yun Huang	Northwestern University Evanston
Co-Author	Brian Uzzi	Kellogg School of Management, Northwestern University
Co-Author	Noshir Contractor	Northwestern University Evanston
Abstract	*The small but growing body of research on team vs. team competition focuses on predicting the winner based on multilevel factors, including the team's strength and prior relations among team members within a team. Our research demonstrates the significance and power of prior relations among members between competing teams in predicting the outcome of a contest. Leveraging data over 8 seasons of the Indian Premier League (IPL), we demonstrate the effects of competing against former teammates on a team's victory in IPL matches. If two teams, A and B, are competing in a match, and nA players from A are former teammates of players on B and nB players from B are former teammates of players on A, then if team A has smaller values of nA, it will have a competitive advantage over Team B with a higher value of nB. We call the magnitude of the difference of nA and nB the "ecosystem" factor in predicting performance. Using regression and stochastic network models, we find that the ecosystem factor significantly impacts the outcome of a match. Our findings have implications for franchise owners. While recruiting a player, franchise owners should not rely solely on the player's ability but also leverage the rivalry between former teammates.* *Keywords: Team performance, Former teammates, Ecosystem factor, Indian Premier League*

Title of the Work	My country, my pitches! Assessing the impact of pitches, venue, and toss on Test Cricket outcomes	
Presenter (Author)	Chitresh Kumar	O.P. Jindal Global University
Co-Author	Sakshi Malik	O.P. Jindal Global University
Co-Author	Girish Balasubramanian	Indian Institute of Management Lucknow
Abstract	*This paper investigates whether pre-match covariates like pitch, outfield and toss lead to any possible advantage to the home team in men's international cricket test match. Logit regression was used upon test matches played for two seasons between 2021and 2023, whose pitch ratings were available on International Cricket Council's website. Past performance, team ranking, pitch and outfield ratings were regressed against the match outcome. The logit regression model found support for competitive balance only for 'Good' or above-rated pitches, meaning an added advantage exists if the pitch was rated 'Average' or below. Toss does not have any impact on the longest format, while past performance plays a significant role among test-playing nations. The research work establishes that pitches can be doctored to influence the outcome, hence, making the role of the referee extremely important in providing the pitch ratings while looking into the competitive balance of the playing condition. Good outfield ratings support the home team, establishing the psychological impact of familiarity. Higher-ranked teams have a higher probability of winning, providing evidence for the entry barrier for becoming a test-playing nation for international men's cricket. The research work is one of the few works that introduces pitch and outfield ratings to understand the home-team based competitive advantage. The research work is also among the first one to emphasize upon the critical importance of match referees while*

giving pitch and outfield ratings. Research work is among the first one to introduce the Game Location Research Framework for cricket related research works.

Title of the Work	Determinants of Online Fantasy Contest Choices: A Multinomial Logit Estimation	
Presenter (Author)	Apurva Jha	Indian Institute of Technology Delhi
Co-Author	Arpan Kar	Indian Institute of Technology Delhi
Co-Author	Agam Gupta	Indian Institute of Technology Delhi
Abstract	*This study explores the factors influencing contest selection behaviour in fantasy sports, a popular form of entertainment in the sports industry. By drawing on existing theories, we developed a model to examine how factors such as aggregate outcomes, recent outcomes, and participation frequency affect contest selection behaviour differently.* *We empirically tested the model using panel data from a simulated fantasy contest experiment during the ICC T20 World Cup 2022. Sixty-six participants chose among three contest types: Head-to-Head, Small League, and Grand League. The design of the contests made Head-to-Head contests appear the riskiest, followed by Small league contests, with the Grand League perceived as the least risky. A multinomial regression analysis of the dataset revealed three key insights: First, an increase in aggregate gain and loss was associated with a higher likelihood of choosing Head-to-Head contests. However, increased aggregate gain reduced the likelihood of selecting Grand Leagues. Second, an increase in recent gain and loss increased the propensity to choose Head-to-Head contests and Grand Leagues, with a stronger inclination towards Head-to-Head contests. Finally, increased participation frequency led to a higher propensity for choosing Head-to-Head contests and a reduced propensity for choosing Grand Leagues. Overall, this study sheds light on how participants react to immediate and cumulative outcomes and how regular use influences behavior in fantasy sports. These findings offer valuable insights into other types of online games that involve risking real or virtual money, such as online gambling and online virtual worlds.* *Keywords: User behaviour, Fantasy sports, Contest selection, Decision making, Regression analysis*	

Title of the Work	Pep or PowerBI for Football Lineup Prediction?	
Presenter (Author)	Soumya Sarkar	Xavier Institute of Management, Bhubaneswar
Co-Author	Shubh Darji	Atharva College of Engineering, Mumbai
Co-Author	Bhaskar Basu	Xavier Institute of Management, Bhubaneswar
Abstract	*It is hard to find a club at the top level that is not using data analytics in tactics, recruitment, and training to boost their chances of success. This study aims to develop a robust performance scoring model to evaluate and predict the best playing eleven football players in a team. The objective is to formulate a model reflecting each player's contribution based on various performance parameters, enabling the selection of an optimal line-up from an initial pool of players.* *Detailed player data was collected from FBref.com, a comprehensive resource for football statistics, cleaned and formatted to ensure consistency and accuracy. Specific and appropriate parameters were chosen for each player category – goalkeeper, defender, midfielder, and forward. Using Power BI, a detailed analysis was conducted to visualize and extract player performance scores. This phase involved creating various visualizations to understand the impact of different parameters on overall performance. A significant challenge encountered was determining the appropriate weightage for each parameter to reflect its importance accurately. Experts rated the importance of each parameter on a Likert scale and provided qualitative feedback. The average ratings from this feedback were then applied to the model to assign weights appropriately.* *Moreover, we must be wary of using individual data in a team sport like football. Only a small amount of what a player does can be measured or modelled. The interaction with the teammates is more important than individual actions. This is where the coach's skills come to the fore by assessing qualities that a computer is unable to detect.* *Keywords: Indicators, team composition, team formation, player role*	

Technical Session 3A: 10:00 am to 11:30 am

Parallel Session: 3 - A2		
Time	**Venue**	**Session Chair**
10:00 - 11:30	CR-6C-13	Avijit Raychaudhuri, IIM Udaipur

Title of the Work	In search of the winning formula and patterns in five major European soccer leagues	
Presenter (Author)	Subhasis Ray	IISWBM, Kolkata
Co-Author	Shreyan Sarkar	IISWBM, Kolkata
Abstract	*With the advent of use of analytics in soccer, lots of discrete data are collected for all five major soccer leagues in Europe; England, Spain, and Italy are having twenty teams and Germany and France have eighteen teams competing at the premier level. These data include Ball possession percentage, Number of yellow and red cards, Number of Shots and shots on target, Number of fouls, offside traps, number of passes and its accuracy percentage, penalty conversions, corners along with goals scored for both the teams in a match. This study endeavors to study the dependency of total points earned by each team in the league on all these variables accumulated over all the matches in the league. The EPL data for 2023-24 session reveals that the major determinant for total points is the goal difference and the number of cards seen by a team is a distant second best regressor; most of the other variables showing linearity with the goal difference are discarded. The Hierarchical cluster analysis using these two variables exposes the pattern of EPL teams in four tiers. The rest of the analysis is centered on finding out how good this regression equation fits for the other leagues and whether similar patterns can be eked out for the other leagues. Since the answer to both these questions is encouraging, universalization of strategy may be attempted to an extent by the coaches across countries.*	

Title of the Work	Insights from Game Chatter: Commentary and Number driven T20 Match Predictions	
Presenter (Author)	Prashant Premkumar	Indian Institute of Management Visakhapatnam
Co-Author	Jimut Bahan Chakrabarty	Indian Institute of Management Kashipur
Abstract	*Cricket in particular and Indian Premier League (IPL) in general, is a sport rich in both quantitative and qualitative data. Game result prediction holds significant importance for multiple stakeholders of the game including team, coaches, analysts, broadcasters and fans. While most existing prediction models rely on quantitative data to predict the outcome of a cricket match, our work provides a novel approach to harness the diverse data streams to predict the probability of a team winning at any stage of the game. In this paper, we integrate the qualitative insights gathered from the ball-by-ball commentary with quantitative match statistics to develop robust predictive models using Random Forests. Our study spans a time period of ten years of IPL matches which includes detailed ball-by-ball commentary and other quantitative data including runs scored, wickets taken etc. Our work aims to improve the prediction accuracy of the match results. Real time predictions can help captains and coaches formulate crucial game strategies. At the same time Predictive insights can enrich live commentary, providing viewers with deeper analytical perspectives and making the broadcast more engaging. By employing the above approach, our paper provides a detailed, data-driven perspective that derives insights from the experts' opinion by integrating it with match statistics. aligns with the evolving demands of modern cricket. The methodology promises to enhance the understanding of game strategies, in-game decision making and player performance, all of which contribute to the advancement of the sport.*	

Title of the Work	Does team composition affect team performance in cricket?	
Presenter (Author)	Shobhit Aggarwal	Indian Institute of Management Udaiipur
Co-Author	Amish Dugar	Indian Institute of Management Udaipur
Abstract	*This paper examines the contributions of all-rounders in ensuring better team performance in cricket World Cups. Specifically, we compare the contributions "batting all-rounders" against "bowling all-rounders" to examine which contributes more towards a team doing well in the World Cups. This is an empirical study which covers both One Day International And T20 World Cups.* *Keywords: Team Composition; All-rounder performance; Cricket*	

Title of the Work	Pre- and Post-Season Analysis of Physical and Performance Metrics in Thane City Football Club Youth Players	
Presenter (Author)	Praveen D Chougale	Indian Institute of Technology Bombay
Co-Author	Usha Ananthakumar	Indian Institute of Technology Bombay
Abstract	*The development of young athletes is critical for nurturing future sports talent. This study analyzes pre- and post-season changes in physical and performance variables among youth football players of Thane City Football Club during the 2023-2024 season, providing insights into the effectiveness of training methods and identifying areas for improvement. Data collected at the beginning (pre-season) and end (post-season) include Resting Heart Rate (RHR), Height, Weight, Body Fat Percentage, Resting Metabolic Rate, Body Mass Index, Skeletal Muscle Mass, T-Test time, 10-meter sprint time, Horizontal Jump (HJ), Right and Left Horizontal Jump, Right and Left Lateral Bound, Right and Left Triple Jump, 1-minute max Squats, 1-minute Push-Ups, 1-minute Hip-Bridge, 8-stage Core, and Yo-Yo Intermittent Recovery Test Level 1 (Yo-Yo L1). Repeated measures MANOVA determined significant differences between the two time points, focusing on fitness and performance metrics. This method allows for a comprehensive analysis of interrelated changes in multiple variables. Preliminary results indicate notable improvements in endurance (Yo-Yo L1), explosive power (HJ, RHJ, LHJ, RTJ, LTJ), and muscular endurance and strength (Squats, Push-Ups). Significant reductions in RHR and body fat percentage suggest enhanced cardiovascular fitness and overall conditioning. The findings highlight the effectiveness of the training regimen and provide insights for future programs tailored to youth football players. These results contribute to the knowledge on youth sports performance and offer a framework for other football clubs aiming to enhance player development.* *Keywords: Strength & Conditioning, physical fitness, performance metrics, statistical analysis, repeated MANOVA*	

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