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Role Of Databases In Sport Science: Current Applications And Future Prospects: A Review

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Abstract
An influential aid in the realm of sports science could be databases that include all the features needed to record, organize, retrieve, integrate, analyse, interpret, report, and share data on all aspects of sports and games. Collecting, storing, accessing, retrieving, and integrating information is a must for the successful evaluation of the performance of players and making decisions. The majority of the other technologies employed in the field of sports science should have databases as their essential basis. This is due to the fact that databases provide the framework and accessibility to the data that drives most of the other uses. A database's worth grows and the role it plays in system design takes centre stage as a result of more integrated resource development. Some of these capabilities include the ability to access past data to compare it to current performance and the utilization of data to highlight important concerns that need to be addressed. On top of that, databases can be great places to keep all sorts of sports-related content. Human mobility is the defining feature of sport. One way to measure this is by using numerical data, photographs, or audio/video recordings. Here, multimedia resources really shine, especially when combined with innovative user interfaces that provide relevant, up-to-date information in a way that caters to each person's unique needs. The goal of this research is to provide a detailed description of databases and their roles in sports science, covering topics such as design considerations, integration difficulties, examples, and possible future uses.

Keywords- Sports Science, Databases, Information Resources, Sports Analyst.

INTRODUCTION

A database is an integrated set of related documents or files that are combined into a single pool to offer data and information for one or more purposes. Using Microsoft Excel to make a spreadsheet is all it takes to build a database. Developing a database in this manner is the most fundamental step. Complex and customized systems that can collect, store, retrieve, analyze, and distribute data are possible at higher levels of database administration. The bulk of the additional resources used in the realm of sports science are based on databases. Reason being, that databases facilitate a plethora of different applications by providing structure and accessibility to data. Thanks to this setup and accessibility, the user can access previous data to compare it with new performance metrics or use data that pinpoints problems to spark conversations. A part of sports is the quantification of human movement, which can be done with numerical data, pictures, and audio/video recordings. In such a setting, multimedia resources are invaluable, especially when combined with cutting-edge user interfaces that provide relevant, up-to-date information tailored to each person's needs (Secomb, Josh. 2023).

A database, in its most basic definition, is an organized set of related data files. To put it another way, a database is a container that holds information, and a database management system (DBMS) is a tool that helps to manage and organize the contents of that container to provide the information to its bonafide users. The use of databases for data storage and retrieval has dramatically increased in epidemiology, the field that studies the variables that influence population health and well-being. In the United States, for instance, the National Collegiate Athletic Association (NCAA) is a membership-driven organisation committed to college athletes' success throughout their lives. It maintains a database called the Injury Surveillance System (ISS) to record information about collegiate athletic injuries (Dick, Agel, & Marshall, 2007). This database has been gathering injury statistics from NCAA universities in a variety of sports since its start in 1982. Some examples of the data that is collected and kept include injuries that athletes have, the school they attend, and the sport they play. The data is grouped by institution, sport, or injury kind, and decision-makers can use this to their advantage. Data like this is gathered annually. I have used it to track injury rates in new sports, on different playing surfaces, and in existing sports, as well as to study the consequences of rule changes in other sports.

Planning of Databases

Many other kinds of data, such as continuous and categorical information, can be stored in databases. All sorts of information that a coach collects before, during, and after a season can be considered performance statistics when discussing a sport's overall success. Each athlete's unique biomechanical, physiological, or medical details may also be included in this data. A well-thought-out strategy, a database, and regular maintenance are all essential for creating and using a "active" tool that could benefit everyone involved. Typically, a database expert is needed for the creation and maintenance of sophisticated databases that have several users. The reliability of the results obtained from a database is proportionate to the accuracy of the data submitted into it. There needs to be a system in place to ensure the data is reliable and that all of the information is proper. This quality assurance is crucial because information usually comes

from a lot of different places. You can choose between manually entering data or using an automated system. Although it may take more time initially, with the right checks and balances in place, manual entry ultimately gives a degree of comfort that the data is more accurate. A computer programmer can enable the capacity to automatically read data, for example from a website that offers performance data, by creating scripts, which are programmes. Using the Injury Surveillance System (ISS) as an example, the following could be the most effective way to demonstrate this notion. There is no duplication of data for any of the 1.4 million injuries recorded in the database, including the name, abbreviation, and location of any establishment. A "referential integrity constraint" is applied to each injury after the institution's information has been saved once so that it can be linked to the institution's information. The continuous maintenance of the institution's information ensures the successful retrieval and aggregation of injuries across all institutions. One way this is achieved is by keeping all of the institution's data unique. Any updates to the institution's data must be made in one centralised location. An additional element that dictates database design is the need for data uniqueness. For example, in the International Space Station (ISS), it is mandatory to report each injury a single time. (Uma Maheshwari 2009).

Systems for the Management of Databases

A DBMS is a suite of applications that manages the creation, upkeep, and access to a database; this definition is taken from Wikipedia (2024a). Simply put, it allows the designer to create tables with specific data types and sizes for the columns, establish relationships between those tables, insert, update, and delete rows from those tables, and then use Structured Query Language (SQL) to retrieve data from those tables. Data management was the original motivation for the creation of SQL, a database computer language. Many major organisations and data warehousing applications choose Oracle Database Management System (DBMS) as their database management system of choice. The open-source database management system MySQL is another popular choice among database developers.

Systems for the Management of Content

Content management systems (CMSs) are computer applications that help manage workflow for creating, editing, reviewing, indexing, searching, publishing, and archiving digital media and electronic text in a collaborative effort (Wikipedia, 2024b). The majority of systems employ databases to store the content, metadata, and artifacts that are used by the system. In many instances, the database will be in charge of content security, letting users see, add, edit, or remove content as they see fit. The vast majority of content management systems are web-based, and their primary function is to oversee the publication and editing of web content. Thanks to the given writing tools, even users without experience with website design will be able to control certain areas of the website. Internet Consulting Services (2009) lists SideArm as one of the web-based content management systems (CMS) used by university athletic departments across North America. Use it to keep track of your university's varsity sports teams and their stats; that way, your coach can easily add or edit data as the season progresses.

Databases for Sports

Databases are an integral part of several fields within the realm of sports science, including sports epidemiology, sports science sub-disciplines, and sports administration. There are some highly recommended databases in sports sciences are as follows.

1. PubMed
2. Scopus
3. SPORTDiscus with Full Text (EBSCO)
4. Academic Video Online
5. AUSPORT (Informit)
6. Health & Medicine (ProQuest)
7. Rehabilitation & Sports Medicine Source Full text
8. APA PsycARTICLES
9. APA PsycINFO
10. SBRnet (Sports Business Research Network)
11. Sports Medicine and Exercise Science in Video
12. ERIC (EBSCOhost)
13. Sports Videos in the Wild (SVW): A video dataset for sports analysis
14. Data.world
15. Datarade.ai
16. SoccerDB

The Administration of Sports

The scoring of athletes participating in judged sports is an intriguing idea, according to databases within the sports administration stream. A scoring system for gymnastics was recently detailed in a paper by Ozawa and Jeongeun Shin (2008). Athletes' video performances are dissected into their individual skills using this method. Then, each skill is compared to a database of skills and scored according to the regulations established in the rule book. The gymnastics horizontal bar discipline has 141 talents listed in the regulation. The rulebook not only lists the necessary places for each skill but also provides instructions on how to categorise them according to their difficulty level. Along with the addition

of the three-dimensional human silhouette to the skills database, the attributes of the essential postures are reinforced. Next, the database's three-dimensional key positions are compared against the athlete's performance to generate scores for both the individual skills and the full routine. Data science will be crucial in determining how sports are shaped in the future. It will spur innovation, help players and fans connect more deeply, and ultimately improve the sports ecosystem as a whole. Professional athletes, data scientists, and tech innovators must work together as we move toward this data-driven future(Obi, O. C., et.al (2024).

Databases in Performance Analysis

Performance Analysis aims to increase athletic performance through player, coach, and analyst participation. Performance evaluations are conducted either in real-time during competition or afterwards using recorded video and collected data. Performance Indicators for Database Use One form of performance indicator that can be seen by the largest potential audience is data on the outcomes of athletic events. More contemporary databases that deal with performance contest information include the National Performance Database. In order to ensure that Canadian winter athletes bring home the most medals at the 2010 Olympic Winter Games in Vancouver and finish in the top three nations in terms of gold medal count at the 2010 Paralympic Winter Games, the Sport Technology Research Laboratory at the University of Calgary developed a database for an organisation called Own The Podium 2010 (OTP) (Own Podium, 2009). The official description of the Over the Podium programme from 2009 states that this is really the case. If you want to see how each of the 152 sports that were part of the 2010 Winter Olympics and Paralympics fared, you can find that information in the National Performance Database. This database includes the outcomes of every competition that has occurred since 1997, for example, the Olympic Winter Games, World Cups, and World Championships (Vincent and Childs, 2009). Results can be searched for by various competitions or by an athlete's name using a web-based interface, which is accessible to both administrators and the general public. In addition to recording the total number of medals won by Canada, the National Performance Database also includes a schedule of forthcoming events. The decision-makers at OTP can assess the Canadian athletes' performances, compare their accomplishments, and even see the medal tally of the top ten nations thanks to a number of different interfaces at their disposal. On top of that, the database gives the OTP decision-makers statistics on the top performing nations across different sports and disciplines, and it also allows them to compare the results of individual athletes to their own standards. New contests are added every week, and all the information is updated in real time.

Nine gold, ten silver, and nineteen bronze medals were among the 38 medals earned by Canadian competitors at the 2008–2009 Olympic Games. To access more information about "Short Track Speed Skating," users can click on the plus sign next to the term. The gender and sport categories in which Canadian athletes won medals can be viewed in this way. Performance analysis databases are also very helpful when dealing with data related to biomechanical and physiological processes. Data can be collected, managed, monitored, and analysed using online database systems like SSENTIF Sport (http://www.ssentif.co.uk). As an added bonus, these tools include an intuitive interface that even those without a background in database administration may utilise to boost their athletes' performance. These technologies can be used if the data is well structured. Building tables and graphs to track athletes' progress is well within the realm of possibility. An athlete's biomechanical statistics pertaining to their ball-throwing speed can be seen in the following illustration. Information gathered covers both the ball's velocity and the athlete's body language as they performed the feat. We entered all of the data into the database and made graphs to show how the contestants finished the competitions. Two athletes, one with greater experience than the other, each made their own graph.

Databases Videos

A Video is a crucial component for the successful evaluation of athletic performance. Athletes and coaches alike use video analysis to improve skill development, decrease injury risk, learn more about techniques, and back up notational analysis. There is now ongoing study into the best ways to automatically index and retrieve specific video footage from complete competition films. The SportsBR system can automatically select event-based clips from a video, index them, and store them in a database so they can be retrieved and viewed at a later time. It takes a video from the current abundance of athletic competition recordings and processes them (Hua-Yong Liu, 2005).

The algorithm applies attention to audio, visual, and caption text information to automatically choose events. The next step is to index the clips using the recovered text from the captions and speech recognition technology. One of the most talked-about areas of research in video analysis is multimodal analysis, which involves combining different methods to extract specific video portions. The researchers opted to use football games as their data source, and they zeroed in on three specific events: corner kicks, penalty kicks, and free kicks near the goal. After testing their system on a library of FIFA World Cup matches, they achieved a 91.3% clip selection accuracy rate and a 97.5% recall rate for the same clip. It was possible to infer the database query keywords from the broadcast commentary, speech recognition software, and subtitle portions that were present during the footage. Researchers built a sport video vocabulary library using match observations and then normalized this data against it to improve film retrieval. Furthermore, it offers a certain level of domain integrity. Studies in multimodal video retrieval are helping to build data warehouses for athletic performance in addition to databases of video clips with keywords. For example, the GNAVI system tracks golfers' whereabouts and scores them based on each hole (Cheolkon Jung &Joongkyu Kim, 2008). Sports Videos in the Wild (SVW): A video dataset for sports analysis is another example of a video dataset for sports. It is made up of clips that users of Coach's

Eye, the top sports training app on mobile devices, took while playing games or practicing their favorite sports (Safdarnejad, et.al (2015). Soccer DB is the largest database for comprehensive sports video understanding on various aspects of soccer games (Jiang, et.al (2020).

The extraction of targeted data from the video's captions is receiving special emphasis. In addition to preexisting competition outcomes, notational datastores, and physiological datastores, these types of systems make a vast amount of data available for examination. All of these methods are hypothesis-driven, which implies that they address a specific question. Data mining is a method for discovering new information by systematically exploring large datasets for previously unseen patterns (Wikipedia, 2009c). One of the study questions that Shoeman et al. (2006) tries to answer is "whether proven business data mining techniques can be applied to sports games in order to discover hidden knowledge." Applying what is formally described as the "Cross-Industry Standard Process for Data Mining," they conducted field study including data mining of South African National Cricket team matches. The purpose of this was to prepare the database for link analysis.

Databases of Videos Used in Coaching

Coaches and sports organizations frequently collect data in different formats as they work to improve players' performance. Both the athletes they are coaching and those who are competing against them are the primary subjects of this data. From what I can tell, keeping track of all that data is a real pain and may take up a lot of time. The search for data that might improve training and decision-making is a formidable task. Learning how to correctly store important information is a prerequisite to efficiently retrieving and analysing data. The databases discussed here are tailor-made for the coaching industry's unique needs in terms of video data storage, management, and retrieval. The Digital Scouting method has made it possible for wrestlers and their coaches to see and share videos online (Digital Scouting, 2009). Audio, video, and other digital materials can be easily organized and searched for using the application's limitless number of categories, events, and divisions. Following that, a permission tool is available, allowing the user to assign several degrees of access, including see-only, upload, and modify. Videos from competitions throughout the world, in the United States, and at universities can be found on the Digital Scouting website. You can find examples of many other ways, as well as more advanced and beginner-level educational material, in these videos.

The Sport Technology Research Laboratory at the University of Calgary has developed a web-based tool that is comparable to the Video Report Card. Video sharing is made possible by this application. By integrating with the database, this technology streamlines the process of sharing films and comments on them. This might be particularly useful for the players whose coach is often not in the city or who lives in a faraway place.

By utilizing online video databases, individuals are granted the capability to store, manage, and exchange video content with individuals from around the globe. When it comes to managing subscribers who have access to the content, how the videos are structured, and what is available to watch are all decisions that may be made by database management. Various open databases can be freely downloaded on the website. Google Dataset Search (https://www.blog.google/products/search/making-it-easier-discover-datasets/) is a web application designed to search relevant dataset repositories on the Internet. Data that are difficult to search for online can be found using the Google Dataset Search. Dataset search demands dataset providers describe their datasets using various metadata such as author, publication date, data content, and terms for using the data. So that they become easy to search. In addition, sports big data can be obtained by relying on the social network. For instance, can visit Open Source Sports by using the following website: http://www.seanlahman.com/open-source-sports/. It includes all kinds of sports data sources such as football, baseball, basketball, and college football. In addition, some other websites provide open databases such as the National Football League official website (http://www.NFL.com), Basketball-reference website (Basketball Reference), ACB official website (http://www.ACB.com), NBA official website (http://www.NBA.com), Equibase website (http://www.equibase.com), Basketball Federation of Serbia/Basketball Supervisor software, and Foot-Data website (http://www.football-data.co.uk). The sports video analysis software maker Dartfish has expanded into the web with the introduction of Dart Fish TV (Bai, Z., & Bai, X. (2021). The Dartfish interface makes it easy to upload the results of the analysis and the created materials directly to the user's desktop. Users may choose to share performance data they have collected and organized in a spreadsheet with others who have shown interest in the subject. Any type of file can be attached to a video, just like any sort of file can be attached to an email.

On top of that, there are other video databases where everyone can submit videos. However, users usually do not have the ability to create their own spaces, manage content, or restrict access to these kinds of websites. Even though "YouTube" is the most famous of these sites, all its features are accessible. Both Robinson (2009) and Siegchrist (2009) state that these video-hosting websites come in many formats. Searches involving phrases like "uploading video to video sites" or "content management databases for storing sports data" may yield current details regarding the numerous online video and content management databases that are now accessible. Every facet of the sports and gaming industry has changed because of the use of databases, from talent identification and player performance analysis to integrity monitoring and fan engagement.

Sports Analytics: The field of big data analytics in sports is expanding quickly and presents a wealth of opportunities for practitioners and researchers alike (El-Maghrabi, Y., & Sharif, M. (2022). Over the past few decades, the sports analytics industry has experienced remarkable growth and transformation. Sports analytics is the process of gathering and

evaluating sports data, which includes elements of sports like player performance, business operations, and pertinent past statistics that can provide a team or individual with a competitive advantage. Teams can make better decisions about game strategies, nutrition plans, and other strategies to improve the performance of their athletes by using data metrics from on-field activities. Moreover, Sports scientists and trainers can examine players' biomechanics during practice and competition by using data from sports analytics. With the aid of this data, players' techniques and form can be improved, enabling customized training plans to maximize performance and lower the risk of injury. The examination of player performance data provides fans with a deeper comprehension of the game in addition to helping teams and coaches optimise their tactics (Wang and Song, 2023).
In many sports, sports analytics has become essential such as cricket, football/soccer, basketball, baseball, hockey, tennis, etc. In professional sports, the data can be used on a granular level to augment the involvement of all such parties that are involved directly or indirectly within it. Analyzing data enables one to become familiar with the real story instead of believing in stories, instincts, and familiarities (Kaur, G., & Jagdev, G. (2020). For example: SportsKPI is a benguluru based sports analytics company that is using various tools to analyse performance indicators. Both individual and team players can use it, and it analyses sports data. It has previously collaborated with the Sports Authority of India, Kabaddi teams, and several professional Indian and Asian football teams. Indian sports organisations use a variety of video and image analysis tools, such as Hawk-Eye, SportVU, Second Spectrum, Pixellot, ChyronHego, InStat, Wyscout, CricViz, and Criclytics etc. (Bhosale, S., & Ray, S. (2023).

Sports Analyst: A sports analyst is a person who analyses and provides explanations on various aspects of sports. He collaborates with the sports coach and sports science team to enhance athlete performance by examining technical, tactical, physiological, and psychological performance metrics. Professional team sports analysts routinely analyze to obtain tactical and strategic insights into the behaviour of players and teams. Goals of team sports analysis frequently include determining an opponent's weak points or evaluating a coached team's performance and room for improvement (M. Stein et al. (2017).

CONCLUSION

The public, administrators, players, coaches, scholars, and teachers could all benefit greatly from multimedia databases in changing the perspective on sports. Their opinions have the potential to shape how sports are judged, which players make teams, how coaches feel about training, and how the general public views athletic institutions. Making decisions sometimes comes down to gut feelings and past experiences for many top-level administrators and coaches. Nevertheless, performance databases can promote evidence-based decision-making by integrating crucial data modeling into the procedure. The availability of online databases has greatly improved the likelihood of making decisions in sports based on evidence. One way to lower the likelihood of selection disputes is to keep track of players' histories, stats, ailments, and abilities. Important for making sure data is thorough, correct, up-to-date, and useful for decisions, data governance is a must. Ensuring the preservation and sharing of athletes' data, including medical information, necessitates privacy policies and procedures. The potential of databases is great, despite limitations, and the work is well worth it. Ensuring that objects are suitably organized and labeled for efficient retrieval and analysis is a crucial part of database development and maintenance.

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