Sport and Nutrition Digital Analysis: A Legal Assessment

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Abstract. This paper presents and evaluates legal aspects related to digital technologies applied in the elite soccer domain. Data Protection regulations in Europe clearly indicate that compliance-by-design is needed when developing and deploying such technologies. This is particularly true when health data is involved, but a complicating factor is that the distinction between what is health data or not is unclear. Add to the fact that modern analysis algorithms might deduce personal medical-related data when correlating and sifting through what might seem more harmless data in isolation. We conclude with a set of recommendations rooted in current legal frameworks for developers of sports and wellness systems where privacy and data protection can be at risk.

Keywords: Personal Data Protection · Sport and Nutrition Analysis · General Data Protection Regulation· Machine Learning Analysis· Sensitive Data · Health Data ·

1 Introduction

Performance development in international elite soccer is depending on evidence-based insights and best practices. Rapidly-increasing use of massive amounts of heterogeneous digital data and associated analyzes related to individual athletes, their teams, and opponents are fuelling this pervasive trend. Both qualitative and quantitative data are monitored, collected, stored, analyzed, and used. In a top-flight international soccer club, there are often more specialized staff and coaches than there are players. This includes a significant number of data engineers, statisticians, data analysts, nutritionists, and computer scientists.

The digital transformation in elite soccer is not a goal in itself, but an important toolkit for improved player development, player recruitment, team composition, and competition strategy. To illustrate with a common example, a head coach has as a rule a specific style-of-play for the match team. This includes how to organize the fundamental structure of the 11 players on the pitch, specific coordination patterns among sub-groups of players, what to do in specific attack situations, the role of each in a defensive structure and the like. Individual

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athletes are prepared for or even selected for specific roles in the team adhering to this style. The cohort of players will be developed in such an explicit and quantifiable framework, where specific collaboration models and related player position profiles are made. As such, a specific player position might have required properties such as extreme top speed, endurance, and specific technical skills, and analysts typically use massive amounts of relevant data to find the most proper candidate. This candidate can be in the internal player cohort, but also external as potential recruitment when possible. This selected candidate can vary throughout the competition season depending on, for instance, the opponent team or relative development compared with club colleagues competing for the same position, so this analysis is a dynamic and ongoing process.

This digital transformation in elite soccer can be a double-edged sword. On the one hand, are the obvious benefits a coach or individual athlete gains from this type of evidence-based insight. This again can result in, for instance, specific training interventions, adjustments in concrete behaviour outside the training arena such as sleep pattern, and even change in dietary habits. On the other hand, digitizing the personal aspects of an athlete throughout not only the time spent on training facilities, but even 24/7, might violate privacy and even security aspects. Anecdotal experiences from a decade of collaboration with elite soccer teams indicate that this problem does not always get proper attention.

This paper is addressing this contrasting problem as follows. First, we give a brief overview of the practical potential of state-of-art technology in the elite soccer domain. Next, we will discuss relevant legal frameworks related to this domain and its use of digital technologies. We then recommend specific actions to mitigate the legal risk with digital technology applied in the sports domain. Lastly, we conclude.

2 Athlete Monitoring Technologies

The soccer domain is infused with digital technologies, and their applicability has become mainstream for clubs well below the elite athlete level. Particularly elite clubs have embraced this new development, but notice that such clubs guard their technology and practical use with secrecy. Considered a competitive advantage and potential tipping point for the club, obtaining concrete insights from those external to the club might be a challenge. This includes researchers who want to investigate and publish openly on such closed cohorts. Fortunately, we have been on the inside of elite soccer teams and national teams for over a decade carrying out fundamental research in close collaboration with these use partners [10, 12, 11, 15, 3, 18]. The rest of this section will briefly outline our experience with digital systems and their practical use in this context.

2.1 Digital Video

Video footage made its foray into the elite soccer domain decades ago and is considered very important, if not the most, for performance development. The video

comes from many sources and captures previous games, opponent teams, public best-practices and drills, internal team training sessions, and even individual athletes carrying out specific drills. The list is longer.

Soccer clubs can obtain videos from past games from numerous sources. One such is a commercial broadcast channel, even if the specific video has been made for a public audience. This might be a problem for soccer analysis since replays and detailed close-up views might lose some aspects of importance for an expert. Coach staff analyzing the match might rather prefer video footage from the entire soccer field while the game unfolds, not just where the ball currently is located and covered by the public broadcaster.

A decade ago, we were challenged by our collaborators in the soccer domain to research and develop a video system covering the entire pitch. It was not an option to use a single-camera due to low resolution, but we managed to build a series of novel Bagadus systems [18] stitching together video streams from multiple cameras covering the entire field. This stitching is a very computationally demanding process, but using specialized GPU hardware and fine-tuned software modules we managed to produce such a panoramic stitch from 5 different 4K cameras in real-time. The analyst could now zoom into specific details of the pitch, and even replay this content in the locker room during the break in the middle of the game. We are pleased to observe that similar systems have later been implemented by industry and deployed at many soccer stadiums throughout the world. This includes high-end solutions at Allianz Arena in Munich from SAP and Panasonic, and numerous low-end systems with a single camera setup.

Body-carried cameras can also be used by coaching staff moving about on the larger pitch during a training session. We have built such analysis systems using, for instance, GoPro cameras, Panasonic Lumix on hand-carried gimbals, chest body cameras, and even Google glasses worn by coaches. The applicability of such videos was primarily for player feedback during or following a specific drill sequence. Such drills can be on the pitch up-close, for instance, capturing a goalkeeper in action to determine bodily balance details, a specific sprint acceleration session, a technical drill, or how a player is acting in a man-to-man situation on a corner.

The analysis of video data is still primarily manual where soccer experts attempt to find specific events in the video. This can be to detect minor details or what exactly went wrong in a situation, or the opposite, to find positive sequences to, for instance, reinforce learning positively for the players involved. Some commercial actors also tout support from artificial intelligence (AI) analysis solutions, but we consider these at a relatively early functional stage.

Video can also be used to extract quantified data, either semi-automatically or fully automated. Algorithmic parsing of video by feature extraction or feature tracking software is commonly used. This type of extraction can be used to gain insight into how many meters a specific player or entire team covers during a match or the number of successful passes. This feature extraction process is often semi-automated as humans in the loop evaluate and adjust the algorithmic output; examples, where feature extraction software has problems, are

during player occlusion and for accurate ball detection. Enterprise companies have emerged that produce semi-automated solutions in this domain, but their result is often produced with a delay of a day or so after the sports event.

2.2 Positional Data

Video state-of-art analysis software is not accurate and timely enough, and it has primarily been a toolkit for resource-rich clubs. Nevertheless, public broadcasters have increased the use of video-extracting software for their audience. An example of applicability is to illustrate and visualize quantified data with colourful heat maps of player positions at half-time or in the minutes following a game. For sports scientists and coaching staff in elite clubs, this type of video feature extraction is seldom accurate enough in a performance development context. They have found alternatives in the use of Internet of Things (IoT) based solutions.

Alternatives to capture positional data have emerged in the last decade and are now commonly used in many mid- to top-flight teams. This works as follows. A body-worn sensor captures the positions of the athlete wearing it on the back with a frequency of 10 Hz or more, and these IoT devices are either radio- or GPS-based. A radio-based system has antennas installed around the soccer pitch and receives signals from the sensors worn by the athletes. A back-end server computes the position of the players in soft real-time with relatively high accuracy. A GPS-based system is satellite-based and has less accuracy, but is more portable as no stationary antennas are needed.

We have been using both radio-based and GPS-based systems with our player cohorts, the former type for a decade. Such a system provides high precision down to 10 cm error deviation and is an important toolkit for sports science research [2, 14, 21]. Also, this technology provides ground truth data that coaches can use to determine the specific performance parameters and overall load of the individual athletes. This is frequently used when planning and executing practices during a micro-cycle (week), and real-time feedback from the system enables immediate and customized interventions for specific athletes. In particular, a common performance indicator in elite soccer is the number of high-intensity runs and distance, and physical coaches even intervene during a training session and inform the athletes that they need more (or less). If the athlete does not take this feedback into account while practising with the cohort, extra sprint meters can be added afterwards to meet the desired training goal. In some cases, specific players have even been pulled out of practice before it ended due to overload worries.

2.3 Physiological Data

Positional data systems provide massive amounts of physiological data. Additionally, these IoT devices might have other sensors included like a heart rate monitor. This is clearly a medical sensor device, and similar sensor data can

be obtained from, for instance, a smartwatch. Other types of biosensors can be packaged, for instance, as patches glued on the body.

The coaching staff also have other sources of data to profile their athletes. An example is a regular body weight, and another is as simple as a device for measurement of heights (to take into account load for younger players when in growth periods). Despite simple devices, this data is important and is logged in the digital profiles of the players. A more digital toolkit is a force platform that measures, for instance, the jumping, landing, and isometric movements of an athlete. Coaching staff or the players themselves also input data manually into digital logs from, for instance, a weight- and strength session.

A medical device like a DEXA scanner is not uncommon in elite clubs, a scanner that determines body composition by passing low-radiation x-ray beams through tissues. This is used to determine tissue composition in the body, which includes the relative difference of muscle mass in the left and right foot or a change from the previous scan (particularly when recovering from an injury).

2.4 Medical Data

A DEXA scanner is not necessarily operated by a medical doctor. In one of the clubs we have collaborated the most with, the physical coach and head of sports science are in charge. Other medical data is also involved, particularly when a player is injured. If the injury does not need medical attention, non-medical staff can log this data. This is entering a grey zone with regard to special data confidentiality procedures that medical staff must follow with regard to what can be shared and by whom. It is no longer in the grey zone when the athlete is considered a patient undergoing treatment by the medical staff in the club.

We have frequently observed that blood samples are taken from athletes during intense training periods, but not necessarily by medical staff. Lactate testing is actually testing the blood of an athlete to calculate their lactate threshold, or the intensity of experience before the lactate increases exponentially.

2.5 Qualitative Data

Proper recovery relaxation and nutrition habits matter very much for the healthy development of an athlete. An elite player will not be able to reach their full potential without these two aspects seriously addressed. Numerous devices exist for monitoring recovery like sleep and physical activity external to the training facilities and diet. We have worked with clubs using sensor armbands, and some have used even more invasive monitoring technology in beds and bedrooms. This has been considered very invasive and was only used for a few weeks. With diet, pictures have been taken of meals and uploaded to a club-operated server, often supplemented with textual input of nutrition details. This has proven to be a tedious task for most athletes with frequent dropouts of such logging regimes.

Subjective data from athletes themselves, however, can provide important insights that digital technologies cannot properly (yet). One example is subjective measurements of the important recovery part of an athlete's daily life which

includes, for instance, sleep quality and time slept. This type of data can be manually entered into a digital log by the players themselves, or as observed in one U.S. Major League Soccer elite club, reported orally and logged by coaching staff as part of the morning assessment of each player and their readiness to train that day. In one Premier League Club in England visited half a decade ago, an iPad was even mounted on the wall in the locker room, with players lining up to report their session Rating of Perceived Exertion (sRPE). So much for privacy.

We have developed a more private system, PMSys [11], that is app-based and reports and quantifies aspects including an athlete's mood, sleep quality, readiness to train, any illness symptoms, and the like. More recently, this system has also become a toolkit for many elite female soccer teams in Norway. Notably, this system was totally re-designed and re-implemented before the GDPR came effective in May 2018. The next section will return to such regulatory aspects.

3 Legal Aspects of Sport and Nutritional Digital Analysis

3.1 Legal Bases for Processing Personal Data in Sports Analysis

The General Data Protection Regulation (GDPR) regulates the processing of personal data in the European Union and the European Economic Area [16]. Processing is defined broadly in the regulation compared to traditional use in computer science. GDPR Art 4(2) defines that "processing means any operation or set of operations which is performed on personal data or on sets of personal data, whether or not by automated means (...)".

Personal data is defined in Article 4(1) and Recital 26 of the regulation as any information relating to an identified or identifiable natural person. The identification of a natural person can be both direct and indirect by reference to an identifier of a natural person or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural, or social identity of a person.

In the context of sport and nutritional analysis, any information directly or indirectly linked to a natural person processed in an electronic system would be under the scope of the regulation [9]. This includes, for example, performance monitoring or nutritional logging of athletes in a sports club.

Personal data belongs to the natural person it identifies. The GDPR builds on the notion of informational self-determination.[4] A sports club processing personal data, therefore, need to rely on one of the legal bases in Article 6 of the GDPR for the processing to be lawful. With regard to the processing of sports and nutritional data carried out by a sports club, the legal bases a) Consent, b) Performance of a contract or the legal basis in f) Legitimate interests after a proportionality assessment are the potential relevant legal bases.

3.2 Consent as the Legal Basis for Processing Personal Data

Article 7(1)(a) requires that the entity processing the personal data relying on consent shall be able to demonstrate and prove that the data subject has con-

[4] See, Articles 13,15,17 GDPR.

sented. The consent should be intelligible and in an easily accessible form with clear and plain language. The consent should be informed and given by a clear affirmative act establishing a freely given, specific, and unambiguous indication of the data subject's agreement, according to Recital 32 of the GDPR.

Recitals 42 and 43 of the GDPR lays down the requirements for a given consent: *"Consent should not be regarded as freely given if the data subject has no genuine or free choice or is unable to refuse or withdraw consent without detriment"*. Furthermore, according to Recital 43, consent should *"not provide a valid legal ground for the processing of personal data in a specific case where there is a clear imbalance between the data subject and the controller* (...)".

The European Data Protection Board (EDPB), tasked under Article 68 of the GDPR to ensure the consistent interpretation of the GDPR in different member states across the EU and EEA, has discussed the use of consent as a legal basis in digital sports analysis in sports clubs. The EDPB has stated:

"Athletes may request monitoring during individual exercises in order to analyse their techniques and performance. On the other hand, where a sports club takes the initiative to monitor a whole team for the same purpose, consent will often not be valid, as the individual athletes may feel pressured into giving consent so that their refusal of consent does not adversely affect teammates" [8].

Both the recitals of the GDPR and the statement from the EDBP denote problematic aspects of relying on consent as the legal basis for processing personal data in sports analysis. Both the pressure to consent and the power imbalance between the athlete and the club indicate that consent may not be a valid basis for processing personal data in such a situation.

3.3 Performance of a Contract as the Legal Basis

Professional athletes are often employed by a team. The performance of a contract might therefore be a potential basis for processing personal data. According to Article 6(1)(b) of the GDPR, processing shall be lawful if the processing is *necessary* for the performance of a contract to which the data subject is party. The assessment of the necessity of collecting and analysing personal data combines a fact-based assessment of the processing *"for the objective pursued and of whether it is less intrusive compared to other options for achieving the same goal"* [7]. The performance of a contract could only represent a valid legal basis for processing if less intrusive means of processing could not achieve the same goal. When assessing whether Article 6(1)(b) is a valid basis for processing personal data in sports and nutritional analysis in a team or a sports club, it is vital to assess whether the same goal as the goal achieved by the analysis could be achieved by less intrusive means than the athletes logging their performance and food intake. There is, therefore, a need to assess the specifics of each case under question in order to conclude that Article 6(1)(b) could be a valid basis for sports and nutritional digital analysis.

3.4 Legitimate Interests as the Legal Basis

GDPR Article 6(1)(f) could be a relevant legal basis for processing personal data in sports analysis. Under Article 6(1)(f), the processing must first be necessary for the purposes of "the legitimate interests" pursued by the sports club. The interests pursued through sports analysis would, most likely, be to improve the performance of the athletes or the total performance of the team. Such a system also has the potential to be used to control the athletes. Such a control regime comes with the potential to give athletes that have not complied with the exercise or food regime a sanction. The predecessor of the EDPB has in their opinion on the concept of *legitimate interests* held that measures of controls are harder to justify as legitimate interest [22]. Lastly, the legitimate interests established under Article 6(1)(f) must override the data subjects' interests in protecting their personal data and privacy.

Systems for sports and nutritional analysis often process data regarded as sensitive personal data under Article 9(1), such as health data. According to Article 9(2), Article 6(1)(f) is not a valid legal basis for processing sensitive personal data. Article 6(1)(f) is therefore not a valid legal basis for systems both processing personal and sensitive personal data.

Recently, professional athletes have launched legal initiatives related to protecting the privacy of performance data in various jurisdictions [1, 17, 20]. Under the GDPR, controllers or processors relying on an invalid legal basis or breaching other data protection regulations, risk receiving administrative fines of up to 20 000 000 EURO or 6 % of global annual turnover, according to GDPR Article 83(5). The various lawsuits from athletes illustrate the importance of thoroughly assessing the legal basis of processing personal data in sports analysis.

3.5 Processing of Sensitive Personal Data

The GDPR differentiates between personal data under Article 4(1) and sensitive personal data in Article 9. The most relevant category of sensitive personal data in sports analysis is data concerning health. Health data under Article 9(1) is defined as *"all data pertaining to the health status of a data subject which reveal information relating to the past or the current physical or mental health status of a data subject"*, according to Recital 35 of the GDPR. The Court of Justice of the European Union (CJEU) has interpreted the definition of health data "in a wide interpretation" and included information regarding all aspects of the health of an individual [4].

In a sport and nutritional analysis context, information on, for instance, known diseases and allergies would be included in the definition of health data, but also information on sleep quality, menstrual cycle, or information on respiratory rate, blood oxygen, and heart rate.

As a general rule, the processing of sensitive personal data is prohibited under Article 9(1). When processing personal data in a digital sports analysis context, it is, therefore, very significant to categorise whether the personal data is also regarded as sensitive personal data under Article 9(1). A recent judgement from

the CJEU [5], analyses the understanding of when personal data under Article 4 also could be regarded as sensitive personal data under Article 9.

After analysing the legal sources, the CJEU concluded in paragraph 127 of the Judgement that: "(...) Personal data that are liable indirectly to reveal sensitive information concerning a natural person" should not be excluded from the strengthed protection regime of Article 9 GDPR.

The potential effect the judgement from the CJEU would have on sport and nutrition analysis could be illustrated by an example: Suppose that athletes in a female sports team log information on food and nutrition. Some of the athletes change their diet slightly in one week of the month in a repetitive pattern. Under the new understanding of sensitive personal data from the CJEU, the logging of food intake would, potentially, be regarded as health data under Article 9(1) if it is possible to deduce health information from the personal data.

Processing of sensitive personal data under Article 9(1) of the GDPR requires that both the conditions in Article 6(1)(a-f) of the GDPR and one of the exemptions from the prohibition in Article 9(1) are fulfilled for the processing to be lawful.

Article 9(2) opens for processing sensitive personal data under ten different exemptions. The most relevant legal basis for processing sensitive health data in a cohort of athletes under Article 9(2) GDPR is explicit consent under Article 9(2)(a). Such consent must list the purposes of the processing and should also list the nature of the sensitive personal data. Explicit consent is not that much different from consent under Article 6(1)(b). The key difference is that consent could be expressed through behaviour, while explicit consent must be oral or written and the entity processing the data must keep a record of the explicit consent.

3.6 Compliance by Design and by Default

According to Articles 5(1)(c) and (f), the processor or controller processing personal data should limit the amount of personal data to what is necessary for the purpose of the processing and process the data in a manner that ensures the confidentiality and security of the personal data. A sports analysis system both processing personal and sensitive personal data needs to have some limitations on access to sensitive personal data, in order to respect the principles of purpose limitation and the confidentiality requirements expressed in Article 5

Article 25 of the GDPR lays down requirements for data protection by design and by default. In order to fully comply with these requirements, it is important to assess data protection aspects in the process of designing the software and continuously throughout the lifetime of the system.

3.7 Third-Party Applications and Third Countries

Digital analysis for sports purposes in sports clubs frequently applies third-party and off-the-shelf applications for logging exercise and food intake.

The GDPR regulates the processing of personal data in the EU. In order to safeguard the rights relating to personal data for data subjects from this area, the regulation has a general prohibition of transfers of personal data from the EU to countries outside of the union, known as third countries.

This general prohibition comes with some exemptions, among others countries pre-approved by the European Commission (EC). In July 2020 the CJEU invalidated such a pre-approval regarding the U.S. due to indiscriminate U.S. surveillance programs [6]. After the invalidation, transfers to the U.S. have to rely on, for instance, the EC Standard Contractual Clause decision. As part of this legal basis, exporters of personal data are required to conduct an impact assessment, assessing whether the data protection laws and practices of the receiving third country are essentially equivalent EU data protection law.

Third-country transfers in digital sports analysis could be illustrated with an example: A Norwegian football club mandates their players to log their exercise in Strava and their food intake in Lifesum. Strava's servers are located in San Francisco and they transfer personal data from the users in the EEA to the U.S. servers [19]. Lifesum also transfer data to the U.S. and other third countries to be processed by third-party providers that process data on behalf of Lifesum [13]. In the example, the football club determines the purposes and means of the outputs of the logged data in the applications and has the role of the controller under Article 4(7) of the GDPR. The football club might be held responsible for the transfer of personal data to third countries on a somewhat inadequate legal basis. In such a situation the more opportune approach would be to use applications that do not transfer personal data to third countries.

4 Mitigating Legal Risks: Recommendations

Based on the legal analysis above, the following recommendations for compliance with EU data protection law in digital sport and nutrition analysis should be carefully considered:

1. If a sport club processes personal data that is regarded as sensitive personal data under Article 9(1), *explicit* consent is the potential valid legal basis under both Articles 6(1)(b) and 9(2) of the GDPR.
2. The sports club should introduce measures to ensure that such a consent is freely given, that the data subjects are informed of the purposes of the processing and the type of data processed, that the consent is without pressure from neither the club nor teammates, and that there is no negative consequence for not consenting to the processing of personal data.
3. If off-the-shelf applications for sport and nutritional logging are used in a sports club, it is safer to choose a provider that does not transfer data to third countries. The use of providers that transfer data to third countries requires an examination of whether the receiving jurisdiction offers essentially equivalent personal data protection.
4. Private data obtained from elite athletes might be very relevant and interesting for a broader external audience. Proper security platforms and

procedures must ensure data confidentiality and integrity of such valuable data.
5. A role-specific security approach where personal data is further classified based on sensitivity is recommended and particularly required when health data is involved. A strict access regime must be in place, even internally, to ensure that, health (related) data is not shared with non-medical staff. A particular concern is when data is moved outside the administrative domain of the enterprise (club), and this off-loading of data must be carefully validated in a compliance context.
6. A compliance-by-design software development process is highly recommended, where compliance is a first-order non-functional property from the specification of the software to be built and throughout the life-cycle of the software.

5 Concluding Remarks

A digital transformation has happened in elite sports over the last decade. Athletes are monitored while practising or during gameplay, and this monitoring extends to cover life outside the sports facilities. Personal data is not only monitored, but stored, federated and combined, analysed, shared at least internally among club staff, and further used. This can be problematic in a legal context, and we have briefly evaluated the applicability of the technology in a legal framework in Europe. The developers of systems built for the sports domain must be aware of and take into account these laws and regulations. We, therefore, advise a compliance-by-design approach when such software is developed and deployed.

Notice that we have used elite soccer as a use case to enable proper and concrete evaluation of more general legal frameworks. Our findings and recommendations though extend beyond a specific sport like soccer and should be generally applicable to any sport using similar digital solutions.

References

1. ABC News, Data collection in Australian sport leading to privacy issues for athletes (2022). Available:https://www.abc.net.au/news/2022-04-15/data-collection-in-australian-sport-leading-to-privacy-issues/100993950
2. Baptista, I., Johansen, D., Figueiredo, P., Rebelo, A., Pettersen, S.A: Positional Differences in Peak- and Accumulated Training Load Relative to Match Load in Elite Football. 2019. Sports 8. doi: 10.3390/sports8010001
3. Baptista, I., Johansen, D., Seabra, A., Pettersen, S. A.: Position specific player load during match- play in a professional football club. PloS one 13. (2014). doi: 10.1371/journal.pone.0198115
4. Case C-101/01 *Lindqvist* (2003) EU:C:2003:596.
5. Case C-184/20 *OT Vyriausioji tarnybinės etikos komisija* (2022) EU:C:2022:601.
6. Case C-311/18 *Data Protection Commissioner v Facebook Ireland Limited and Maximillian Schrems* (2020) EU:C:2020:559.
7. EDPB, Guidelines 2/2019. Version 2.0. Adopted on 8 October 2019.
8. EDPB, Guidelines 3/2019. Version 2.0. Adopted on 29 January 2020.

9. Flanagan, C.A: Stats Entertainment: The Legal and Regulatory Issues Arising from the Data Analytics Movment in Association Football. Entertainment and Sports Law Journal 19(1). (2022). doi: 10.16997/eslj.1082
10. Johansen, D., Halvorsen, P., Johansen, H., Risser, H., Gurrin, C., Olstad, B., Griwodx, C., Kvalnes, Å., Hurley, J., Kupka, T: Search-based composition, streaming and playback of video archive content. Multimedia Tools and Applications. 61, 419-445. (2012). doi: 10.1007/s11042-011-0847-5
11. Johansen, H.D., Johansen, D., Kupka, T., Riegler, M.A., Halvorsen, P: Scalable Infrastructures for Efficient Real-Time Sports Analytics. In: ICMI'20 Companion: Companion Publication of the 2020 International Conference on Multimodal Interaction 230-234. (2020). doi: 10.1145/3395035.3425300
12. Johansen, D., Stenhaug, M., Hansen, R.B.A., Christensen, A., Høgmo, P.M: Muithu: Smaller footprint, potentially larger imprint. IN: Seventh International Conference on Digitial Information Mangement (ICDIM) 205-214. (2012). doi: 10.1109/ICDIM.2012.6360105.
13. Lifesum AB, Privacy Policy (2022). Available: https://lifesum.com/policy/. Last accessed 17.09.2022.
14. Pedersen, S., Welde, B., Sagelv, E.H., Heitmann, K.A., Randers, M.B, Johansen, D., Pettersen, S.A.: Associations between maximal strength, sprint, and jump height and match physical performance in high-level female football players. Scandinavian Journal of Medicine and Science in Sports. 2022(32) 54-61. doi: 10.1111/sms.14009
15. Pettersen, S. A., Johansen, D., Johansen, H., Berg-Johansen, V., Gaddam, V. R., Mortensen, A., Langseth, R., Griwodz, C., Stensland, H. K., Halvorsen, P: Soccer video and player position dataset. In: MMSys'14: Proceedings of the 5th ACM Multimedia Systems Conference 18-23. (2014). doi: 10.1145/2557642.2563677
16. Regulation (EU) 2016/679 of the European Parliament and of the Council of Europe of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/47/EC (General Data Protection Regulation) OJ L 119.
17. SportTechie, Sportradar CEO Carsten Koerl Calls Wearables Data 'A Huge Market' (2022). Available:https://www.sporttechie.com/sportradar-ceo-monitors-collective-bargaining-with-eye-on-whether-sportsbooks-can-receive-a-players-wearable-data
18. Stensland, H. K., Gaddam, V. R., Tennøe, M., Helgedagsrud, E., Næss, M., Alstad, H. K., Mortensen, A., Langseth, R., Ljødal, S., Landsverk, Ø., Griwodz, C., Halvorsen, P., Stenhaug, M., Johansen,D.: Bagadus: An integrated real-time system for soccer analytics. ACM Transacions on Multimedia Computing, Communcations, and Applications Volume 10, Issue 1. (2014). doi: 10.1145/2541011
19. Strava, Privacy Policy (2021). Available:https://www.strava.com/legal/privacy. Last accessed 17.09.2022.
20. The Football, What is 'Project Red Card' (2022). Available: https://www.foottheball.com/explainer/what-is-project-red-card-russell-slade-gdpr-player-data-lawsuit-illegal-collection-processing-implications/
21. Winther, A.K., Baptista, I.A.M-D.V., Pedersen, S., Thomsen, M.B.R., Krustrup, P., Johansen, D., Pettersen, S.A.: Position specific physical performance and running intensity fluctuations in elite women's football. Scandinavian Journal of Medicine and Science in Sports. 2022(32) 105-114. doi: 10.1111/sms.14161
22. WP29, Opinion 06/2014. Adopted on 9 April 2014.