Hindawi
Wireless Communications and Mobile Computing
Volume 2022, Article ID 4628038, 8 pages
https://doi.org/10.1155/2022/4628038

Research Article

Application of Image Processing Technology in the Visual Design of Motion Health under the Background of Wireless Communication: Take Swimming as an Example

Juan Wang[1] **and Xu Liu**[2]

[1]*Hebei Institute of International Business and Economics, Qinhuangdao, 066311 Hebei, China*
[2]*College of Physical Education, Taiyuan University of Technology, Taiyuan 030024, China*

Correspondence should be addressed to Xu Liu; liuxu_vip@outlook.com

Received 6 January 2022; Revised 24 May 2022; Accepted 17 June 2022; Published 23 July 2022

Academic Editor: Kalidoss Rajakani

Exercise is an active means to improve the body's immune function, resist disease invasion, and prolong life. Research data shows that healthy people who exercise regularly have better cellular and humoral immunity than ordinary people. Although physical exercise can strengthen the body, unscientific physical exercise can also cause harm to the body. Contingencies in sports add to the complexity of medical care. In recent years, people pay more and more attention to sports health, and the development of information technology can enable experts to use sports health visualization technology to carry out scientific physical exercise, reduce medical accidents, and ensure sports health, which has become a consensus. As an important technology in the field of sports health visualization, image processing technology has attracted more and more attention. Image processing technology is realized with the help of computer vision technology. It uses cameras, computers, collectors, and other equipment instead of human eyes to monitor and identify the catalogue, collect images, and then process and analyze the images. Image processing technology has played a very important role in sports emergencies. This paper studies the image processing technology in the field of sports health visualization and takes swimming as an example to illustrate the role of image processing technology in sports health visual design. Using scientifically designed sensors, data analysis is performed on various images of athletes while swimming, and exercise recommendations are continued based on the principles of exercise science. According to the test results, the visual target recognition rate during swimming has reached a high level, which also greatly improves the scientificity of athletes during exercise.

1. Introduction

With the advancement of science and technology, image processing technology plays an increasingly important role in many fields [1, 2]. After video became the main carrier of information, image processing technology developed rapidly [3, 4]. Due to the advantages of image processing technology in processing various video information, computers have the function of human vision and can automatically learn, understand, and analyze human behavior, and image processing technology has become a research boom [5, 6]. Whether it is security, surveillance, or sports and health sports, visual image processing technology has been adopted on a large scale. Deepening the research on image processing technology has high practical value for the promotion of social applications.

In the field of medical care, visual technology is not only used in the diagnosis and treatment of illness but also extends to the promotion of sports science. For the research of moving target recognition in recent years, some researchers have proposed a behavior description method based on the local features of image sequences, which has been well developed

[7]. Some researchers have also proposed methods based on spatiotemporal patterns. The construction of spatiotemporal patterns requires accurate outlines of human motion, while extracting the contours of moving objects is sensitive to noise interference and background changes. At the same time, the computational cost of constructing 3D patterns is relatively high, and the cost increases significantly with the improvement of accuracy [8, 9]. Some researchers pointed out that the optical flow method in target recognition not only contains the motion information of important moving objects but also contains background information that is very useful for tracking and detection. [10, 11]. Some scholars have developed a MATLAB-based COCOA system for target recognition and UAV aerial video surveillance. The system relies on the video taken by the drone to complete target recognition and tracking through three different technical links [12–15]. In summary, the research of moving target recognition has received more attention from the academic circles, but there are still some problems in the target recognition process, such as background recognition and recognition accuracy [16–18]. This article mainly focuses on the research of motion visualization based on wireless communication and image processing technology. Based on the literature, the general process of motion visualization and the actual application of wireless communication and image processing technology are analyzed, and then the use of wireless communication and image processing is analyzed. The technical movement visualization system was redesigned and tested, and the corresponding research results were obtained by using the test results [19, 20].

The main contributions of this research are as follows:

(1) Provide suggestion for the application of wireless communication and Internet of Things technology in medical and healthcare, especially in sports field

(2) Build a more stable and efficient exercise monitoring system

(3) Fill the gap in the field of underwater visual monitoring

2. Research on Wireless Communication and Image Processing Technology and Motion Visualization

2.1. General Process of Motion Visualization

(1) In order to improve the accuracy and efficiency of computer classification and recognition of all targets, the acquired information needs to use the symbols on the computer that can be used as the description of the research object [21–25]. In this article, the focus is to collect information about the identified video pictures

(2) Preprocessing: the main purpose of preprocessing is to reduce noise, release useful signals, and restore ambiguity loss caused by input gauges or other reasons. In actual work, emphasizing the useful information of the image is mainly to enlarge and improve the obtained image information

(3) Attribute extraction and selection: the amount of data received from an image or waveform is very large, and a text image can contain thousands of data. In order to effectively classify and identify, the original data must be converted to obtain the features that can best reflect the classification content. This is the process of exporting and selecting features

(4) Classification determination: classification determination is to use statistical methods to classify the identified objects into specific categories in the attribute space. The basic method is to determine a specific decision rule based on a set of training samples and to minimize the error recognition rate or loss rate caused by the classification of the object identified according to the decision rule

2.2. Application of Wireless Communication. The application of wireless communication in sports visualization is to capture sports actions, capture athletes' movements, digitize them, and then perform quantitative analysis [26–30]. The analysis results, combined with the principles of human biology and physics, will promote sports training to a higher level. Therefore, it is possible to get rid of ineffective exercise methods based purely on past experience. The applicable technologies are as follows:

(1) MEMS integrates information acquisition, processing, and execution to form a multifunctional microsystem. First of all, the MEMS system sends out various signals, such as power, light, and sound. Analog/digital (A/D) processing is transmitted as an electrical signal through the sensor, and finally, the actuator performs related functions

(2) When the movement occurs, the generated acceleration drives the movement of the sensitive mass to cause displacement, and the displacement is proportional to the acceleration can be measured in many ways

2.3. Application of Image Processing Technology

(1) Ideally, the human eye can recognize up to 500 gray levels. Therefore, 9-bit quantization accuracy is sufficient to display grayscale images. The most widely used CRT monitor can display from 4 to about 6 bits of grayscale [31, 32]. For images, such quantization accuracy may already meet the requirements. In areas such as calculating image resolution, grayscale accuracy directly affects the processing results. Therefore, a measurement accuracy of ten digits or higher is generally used. Under normal circumstances, the overall measurement accuracy is one minus ten digits. In actual use, the quantified three-negative five-digit picture may improve the picture quality in applications such as printing

2.3.1. Image Enhancement

(1) Average Filtration Method. Media filtering is a partial smoothing technique, but later, it was widely used in two-dimensional graphics signal processing [33]. Under certain conditions, the averaging filter can also solve the blurring of image details caused by the linear filter, thereby more effectively eliminating impulse interference and particle noise. However, the average filtering method is not suitable for some images, including the processing of many details, special points, lines, and backbones.

(2) Threshold Method. This is a commonly used image segmentation method for image preprocessing. As the concept of entropy was introduced into threshold segmentation, researchers used the principle of entropy to propose different image segmentation methods [34]. The principle of maximum entropy is widely used in image segmentation, and this method is also suitable for separating and zooming aerial images. The principle of the entropy correlation method is to maximize the entropy correlation between the target and the background, which often conceals the shortcomings of the maximum entropy method. Due to the absorption of light, air humidity, low light conditions, etc., the contrast of a typical air image is very low. In order to better process photos and identify them later, it is necessary to enhance the contrast of the image and emphasize the object of interest.

2.4. Algorithm. The optical flow method uses the "optical flow field" to estimate the motion of each pixel in successive frames and successfully separates the foreground target from the background method. It is to segment the video image according to the various motion characteristics of the moving target, which is used to identify the moving target and feature [35]. This is only considered under two restrictive assumptions: one is that the gradation of gray is basically unchanged, and the other is that the brightness is constant [36, 37]. The basic idea is as follows: according to the vector characteristics of each pixel, the image is dynamically analyzed to determine the position, quantity, and movement speed of the moving target [38].

Let $G(x, y, t)$ be the grayscale of the point (x, y) on the image plane at time t. After the dt time, the grayscale pattern of this point moves along the x direction by dx, along and by dy. According to the assumption of conservation of gray mode, there are

$$G(x, y, t) = G(x + dx, y + dy, t + dt). \quad (1)$$

Performing Taylor series expansion on the right side of formula (1), we can get

$$G(x, y, t) = G(x, y, t) + \frac{\partial G}{\partial x} dx + \frac{\partial G}{\partial y} dy + \frac{\partial G}{\partial t} dt. \quad (2)$$

The advantage of the visual flow method is that the visual flow can not only convey the movement information of the target but also convey the 3D structure information of the scene where the target is located. It is suitable for static and moving backgrounds and can recognize movement in different situations without knowing the target, but a lot of calculations are required. This is because it needs to process a large amount of data, which is complicated and time-consuming. Without specific hardware support, achieving real-time performance is often difficult. This article improves the algorithm:

(1) In the conventional algorithm, the first frame is selected as the background image, but in many cases, a target moves to the first frame, and the target in the foreground is always updated to the background; so, an error will occur in the first recognition. In addition, some backlights and other factors are constantly changing. The first box cannot give a big picture, and the update may cause errors. Therefore, a certain number of images can be selected and averaged as the original background, which can minimize changes in factors such as moving targets and background lighting in the first frame

(2) Selection restrictions: in general, the threshold selection selects the maximum class variation method, because the image is binary, and the fixed threshold cannot respond to the continuous change of the image for custom and accurate segmentation

Table 1: The influence of the significance threshold on the recognition result.

The significant threshold increases	Database YouTube	Database Hollywood2
0	0.607	0.575
10	0.609	0.584
20	0.617	0.599
30	0.619	0.604
40	0.619	0.610
50	0.609	0.616
60	0.600	0.619
70	0.590	0.609
80	0.580	0.599

3. Motion Visualization Design Based on Wireless Communication and Image Processing Technology: Taking Swimming as an Example

The research flow framework of this article mainly includes Theoretical research, Algorithm selection, Monitoring distribution, Data collection and comparison and Get conclusion.

3.1. Data Collection

(1) In this article, the Mako U-130B industrial camera will be used to capture swimming images. The resolution of the camera is 1280×1024. The camera

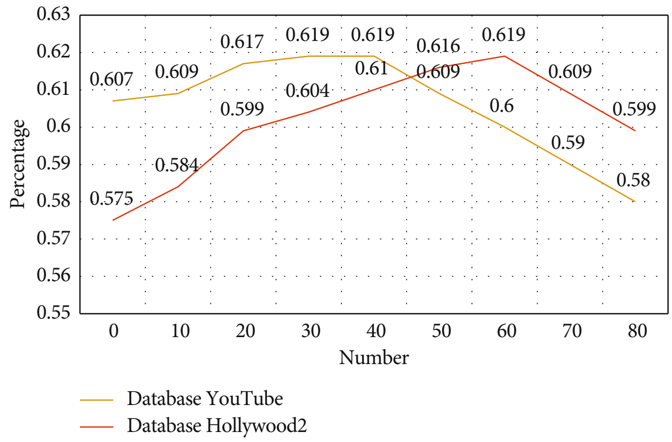

FIGURE 1: The influence of the significance threshold on the recognition result.

selects the tip of the 3D Helmholtz coil as the observation point. The coordinate system of the swimmer's image is collected by the camera

(2) The microprocessor module adopts ARM Cortex-M3 LPC1768, the power supply module provides 3.3 V voltage, and the communication module adopts Bluetooth communication, EEROM storage module, etc.

3.2. Image Data Fusion

(1) Fusion of pixel data: the pixel-level fusion preregistration process requires that the measurement data in the observation area of each sensor corresponds to the observation area of the sensor with the highest spatial resolution. The spatial registration accuracy should reach subpixel accuracy to avoid unrelated data merging

(2) Feature-level fusion uses target feature fusion output by independent sensors to complete detection and recognition, and the recording requirements are not high. At this level, each independent sensor detects and extracts the target function separately, merges all the derived target attributes into a common attribute space, and then classifies the target. Feature layer fusion needs to provide accurate information compression to meet real-time processing requirements, but this level of data fusion loses a lot of target information compared with pixel layer

(3) The decision-making layer fusion uses the results of local target recognition by each independent sensor to complete the target recognition decision. At this level, each sensor individually finds the target, completes the first partial recognition and target determination process, and then processes all the decisions related to the recognition result to obtain the final result. The decision-level fusion method requires each sensor to complete the detection and classification of independent detection targets, and then the fusion provides the final decision. Compared with other methods, the decision-level fusion has a much smaller impact on the registration error. Even if the error is much larger than the pixel-level fusion, accurate target correlation can be guaranteed

TABLE 2: The influence of the time window value on the recognition result.

	Database YouTube	Database Hollywood2
1	0.839	0.839
2	0.873	0.879
3	0.883	0.886
4	0.889	0.898
5	0.896	0.890
6	0.899	0.886
7	0.895	0.880
8	0.893	0.879
9	0.890	0.878
10	0.891	0.879

Therefore, it is necessary to decide which data fusion method to use according to the specific requirements of the system. There is no universal structure that can adapt to all situations. When considering data fusion methods, which uses engineering applications, the selected sensor performance, overall system computing power, and other factors should be considered to determine the best method. The above three fusion methods can also be combined. According to the characteristics of this article, the data of each camera is independent of each other; so, this document selects the decision-making layer to take decision-level data fusion method and complete image data fusion.

3.3. Image Processing

3.3.1. Underwater Visual Features

(1) Due to the specific light absorption characteristics of water, most swimming pool lighting systems use

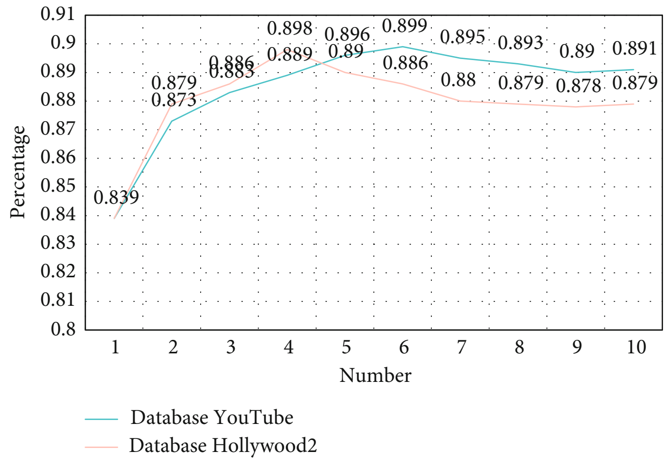

Figure 2: The influence of the time window value on the recognition result.

high power and strong light. At the same time, due to the limited depth of the pool, the energy loss caused by light absorption of water has little effect on underwater images

(2) In addition to adding chemicals to improve water quality, such as copper sulfate and flocculants, there are many types of particles and other small particles in the pool water, such as various human body decomposition substances, which will scatter light. Generally speaking, scattering will deflect the light into the transmission process, scatter the light received by the sensor, blur the image, and reduce the contrast. Backscattering causes the sensor to pull light out of the light field, thereby blurring the background. The sensor can also receive diffuse backlight information installed on the target. This will cause the graphics to appear "fuzzy." At the same time, the lighting system in the swimming pool mainly uses a powerful light source to reduce the absorption of light into the water body, but because of the small particle size existing in the water body, if a huge power lighting system is used, it has certain drawbacks and increases the effect of water scattering, so that the water scattering has a particularly strong impact on the lighting system; so, it is necessary to strengthen the underwater image processing of the swimming pool to achieve clearer and more realistic colors

3.3.2. Emphasize Underwater Images. The main purpose of underwater image enhancement is to increase the underwater image information by increasing the contrast and clarity of the underwater image, so as to achieve the effect of visually increasing the underwater image. The most common solution is to use histogram balancing and sharpening.

(1) Histogram Balance Method. Although the histogram equalization method is intuitive and fast, the gray-scale distribution of some images is relatively concentrated, resulting in a decrease in image contrast. The histogram equalization method is to linearly magnify the gray histogram of the original image, expand the area of the more concentrated gray distribution, and make the gray distribution of the magnified original image more balanced. The gray value in the original image is redivided, and the gray value distribution obtained is consistent with the original image.

Table 3: Computational complexity analysis results.

	Time window length (frames)	Spatial patch size (pixels)
1	1.20	0.19
2	1.10	0.63
3	1.50	1.01
4	1.49	1.61
5	1.60	1.50
6	1.42	1.13
7	1.98	0.76

(2) Lapala Play. The Laplacian sharpening method increases the edge information of the underwater image, which makes the contour of the object easier to observe. While the enhanced underwater image has better visual effects, it also has an enhanced effect on image noise, and Laplace's sharpening method fails to improve the color.

3.4. Human Body Recognition. First of all, in this article, it is necessary to obtain discrete output probabilities based on multiple SVM classifications and use the probability output of the obtained SVM classifier combined with the Bayesian method to fuse the image output fusion decision and then use the different orientation target output to make the decision fusion.

According to the above analysis, neither the histogram balance nor the Laplacian sharpening method can achieve a good improvement effect. Therefore, referring to the documents related to this issue, the ASMR image enhancement method was selected. Adaptive multiscale Retinex algorithm (AMSR algorithm) was as follows. First, set high weights on

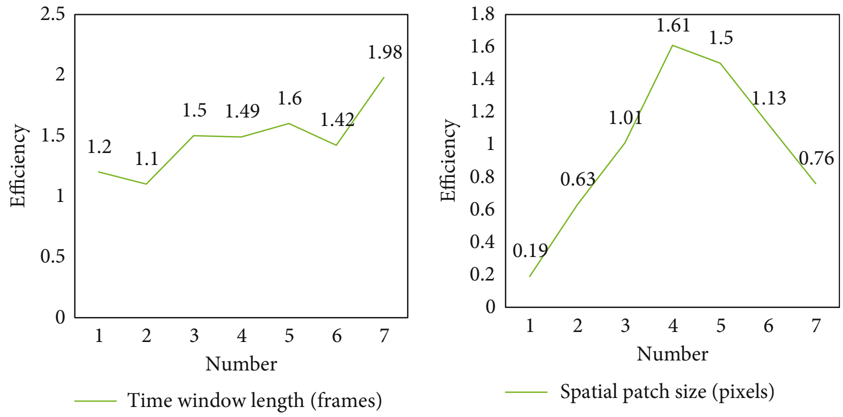

Figure 3: Computational complexity analysis results.

Table 4: Target recognition detection result.

	Hollywood2 (%)	YouTube (%)	HMDB51 (%)	UCF101 (%)
Bag of 3D points	0.922	0.912	0.956	0.932
DMM-HOG	0.955	0.932	0.977	0.965
HOJ3D	0.963	0.941	0.931	0.961
Space-time occupancy patterns	0.983	0.951	0.953	0.956
Algorithm	0.986	0.989	0.986	0.984

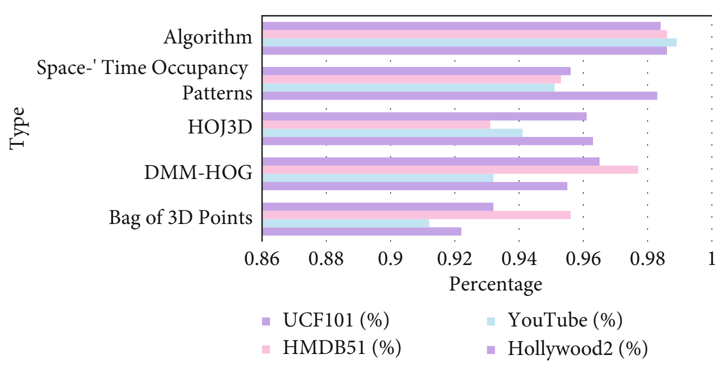

Figure 4: Target recognition detection result.

large images enhanced with SSR, compare the ratio of the SSR-enhanced small image to the SSR-enhanced large image, and adjust the weight of the SSR-enhanced small image accordingly.

4. Motion Visualization Test Based on Wireless Communication and Image Processing Technology

4.1. The Influence of the Significance Detection Parameters on the Recognition Results. This article uses a null crossvalidation method and a partial overlap crossvalidation method. First, highlight the video data set used in the experiment and select one of the videos for query verification. As part of the experimental training, the remaining method is to leave mutual verification. For similar behaviors, select a location for query verification. The remaining experimental training method is to leave some mutual verification.

4.1.1. The Influence of the Significance Threshold on the Recognition Result. This paper conducts experiments on the influence of the significance threshold parameters on the recognition results. The experimental results are shown in Table 1.

It can be seen from Figure 1, in the field of significant threshold, that the recognition rate presents an obvious wave-like pattern. As the significant threshold increases, the recognition rate first increases, then decreases, and reaches a peak between 40 and 60. After exceeding 60, the recognition rate will be significant now.

4.1.2. The Influence of the Time Window Value on the Recognition Result. This paper conducts experiments on the influence of the significance threshold parameters on the recognition results and uses the above methods to practice detection, and the experimental results are shown in Table 2.

It can be seen from Figure 2 that as the time window value increases, the recognition rate first rises and then decreases after reaching the peak. On the database YouTube, the recognition rate reaches its peak at a value of 4, and on the database Hollywood2, the recognition rate is at a value of 6 at the peak. Although the image display in the time window area also conforms to the wave shape, the speed from the crest to the trough slows down significantly. This feature can help us have more choices when setting time.

4.2. Computational Complexity Analysis. This part evaluates the influence of parameters w and s on the computational complexity, and the experimental results are shown in Table 3.

It can be seen from Figure 3 that in the time window trend line, as the value increases, the calculation efficiency should increase. On the spatial window trend line, as the value increases, the calculation efficiency first increases and then decreases, where the value is the peak is reached at 4.

4.3. Target Recognition and Detection. This paper evaluates the overall recognition performance based on four data sets and calculates the average recognition accuracy in all action classes. Table 4 compares different identification methods.

It can be seen from Figure 4 that for average recognition, the method in this paper is only about 0.3% higher than the spatiotemporal mode, but higher than the total state of DMM-HOG, HOJ3D, spatiotemporal occupancy mode, and the three action subsets, and the overall stability is very balanced. The values are basically in line with the expected assumptions of the study.

5. Conclusions

With the development of information technology, its application in the field of sports has gradually developed to a deeper level. In addition to traditional functions such as training plans, it also helps to accurately grasp the movement characteristics of some athletes outside the visual range, so as to help athletes improve their technical advantages more accurately. This paper focuses on the research of motion visualization based on wireless communication and image processing technology and analyzes the swimming motion as the starting point. After understanding the relevant theories, a motion visualization based on wireless communication and image processing technology and a monitoring system with longer-term effects are designed. Using this system, several cycles of observation tests were carried out on the observed objects, the data were deeply analyzed, and the training results of the athletes were tracked and compared in real time. Through the experimental verification, the experimental results show that the target recognition accuracy in the motion visualization of this paper is high and the stability is high. In future research, I will focus on continuing to improve the stability and clarity of the system for greater generalization value.

Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

It is declared by the authors that this article is free of conflict of interest.

References

[1] W. Xuyi, P. Jianping, Z. Junfeng, S. Chao, C. Yimin, and C. Xiaodong, “Application of three-dimensional computerised tomography reconstruction and image processing technology in individual operation design of developmental dysplasia of the hip patients,” *International Orthopaedics*, vol. 40, no. 2, pp. 255–265, 2016.

[2] J. K. Dave, D. J. Eschelman, J. R. Wasserman, C. F. Gonsalves, and E. L. Gingold, “A phantom study and a retrospective clinical analysis to investigate the impact of a new image processing technology on radiation dose and image quality during hepatic embolization,” *Journal of Vascular & Interventional Radiology Jvir*, vol. 27, no. 4, pp. 593–600, 2016.

[3] F. Xu, “Accurate measurement of structural vibration based on digital image processing technology,” *Concurrency & Computation Practice & Experiencer*, vol. 31, no. 10, p. e4767, 2019.

[4] G. Zhang and B. Xin, “An overview of the application of image processing technology for yarn hairiness evaluation,” *Research Journal of Textile & Apparel*, vol. 20, no. 1, pp. 24–36, 2016.

[5] Q. Yun and C. L. Leng, “Intelligent control of urban lighting system based on video image processing technology,” *Access*, vol. 8, pp. 155506–155518, 2020.

[6] P. Bolourchi, M. Moradi, H. Demirel, and S. Uysal, “Improved SAR target recognition by selecting moment methods based on fisher score,” *Signal, Image and Video Processing*, vol. 14, no. 1, pp. 39–47, 2020.

[7] W. Liu and S. Li, “Human motion target recognition using convolutional neural network and global constraint block matching,” *Access*, vol. 8, pp. 69378–69388, 2020.

[8] Y. Lee, H. Choo, S. Kim, and H. Kim, “RCS based target recognition with real FMCW radar implementation,” *Microwave & Optical Technology Letters*, vol. 58, no. 7, pp. 1745–1750, 2016.

[9] Y. Ma and Y. Li, “Millimeter-wave InSAR target recognition with deep convolutional neural network,” *IEICE Transactions on Information and Systems*, vol. 102, no. 3, pp. 655–658, 2019.

[10] Y. Feng, H. Liu, and S. Zhao, “Moving target recognition and tracking algorithm based on multi-source information perception,” *Multimedia Tools and Applications*, vol. 79, no. 23-24, pp. 16941–16954, 2020.

[11] J. Qin, “Research of multiple-instance learning for target recognition and tracking,” *Eurasip Journal on Embedded System*, vol. 2016, no. 1, pp. 1–6, 2016.

[12] O. Kechagias-Stamatis and N. Aouf, “A new passive 3-D automatic target recognition architecture for aerial platforms,” *IEEE Transactions on Geoscience and Remote Sensing*, vol. 57, no. 1, pp. 406–415, 2019.

[13] S. Yang, L. Gong, and D. Qiao, “Image offset density distribution model and recognition of hand knuckle,” *EURASIP Journal on Image and Video Processing*, vol. 2019, no. 1, p. 20, 2019.

[14] Z. Lv, D. Chen, H. Feng, W. Wei, and H. Lv, "Artificial intelligence in underwater digital twins sensor networks," *ACM Transactions on Sensor Networks*, vol. 18, no. 3, pp. 1–27, 2022.

[15] Y. Zhou, G. Xu, K. Tang, L. Tian, and Y. Sun, "Video coding optimization in AVS2," *Information Processing & Management*, vol. 59, no. 2, p. 102808, 2022.

[16] D. W. Yang and H. W. Park, "A new shape feature for vehicle classification in thermal video sequences," *IEEE Transactions on Circuits & Systems for Video Technology*, vol. 26, no. 7, pp. 1363–1375, 2016.

[17] B. Li, J. Yang, Y. Yang, C. Li, and Y. Zhang, "Sign language/gesture recognition based on cumulative distribution density features using UWB radar," *IEEE Transactions on Instrumentation and Measurement*, vol. 70, pp. 1–13, 2021.

[18] H. Duy, Y. Dengy, J. Xueyz, D. Mengyz, Q. Zhaoy, and Z. Xuy, "Robust online CSI estimation in a complex environment," *IEEE Transactions on Wireless Communications*, vol. 1, p. 1, 2022.

[19] Q. N. Zhang, Y. D. Sun, J. Yang, and H. B. Liu, "Real-time multi-class moving target tracking and recognition," *IET Intelligent Transport Systems*, vol. 10, no. 5, pp. 308–317, 2016.

[20] Z. Huang, R. Wang, X. Li et al., "Geometry-aware similarity learning on SPD manifolds for visual recognition," *IEEE Transactions on Circuits & Systems for Video Technology*, vol. 28, pp. 2513–2523, 2017.

[21] K. Chen, "Information technology contributes to the development of physical education and health education——on the strategy of integrating information technology and elementary school physical education," *Sports-Leisure: Sports for All*, vol. 8, p. 1, 2021.

[22] T. Sui, D. Marelli, X. Sun, and M. Fu, "Multi-sensor state estimation over lossy channels using coded measurements," *Automatica (Oxford)*, vol. 111, p. 108561, 2020.

[23] W. Zheng, X. Liu, and L. Yin, "Research on image classification method based on improved multi-scale relational network," *PeerJ Computer Science*, vol. 7, article e613, 2021.

[24] W. Zheng, L. Yin, X. Chen, Z. Ma, S. Liu, and B. Yang, "Knowledge base graph embedding module design for visual question answering model," *Pattern Recognition*, vol. 120, p. 108153, 2021.

[25] W. Zheng, X. Tian, B. Yang et al., "A few shot classification methods based on multiscale relational networks," *Applied Sciences*, vol. 12, no. 8, p. 4059, 2022.

[26] G. D. Wang and F. J. Chang, "The application of modern information technology in primary school physical education and health teaching," *Chinese Journal of Multimedia and Network Teaching (Late Edition)*, vol. 8, pp. 251-252, 2020.

[27] Y. J. Zhao, X. L. Xiang, C. Z. Chen, and J. Wang, "The Characteristics of the 2018 American Physical Activity Guidelines and their Implications for the Implementation of the Healthy China strategy," *Journal of Jilin Sport University*, vol. 35, no. 5, pp. 8–14, 2019.

[28] M. Zhang, Y. Chen, and J. Lin, "A privacy-preserving optimization of neighborhood-based recommendation for medical-aided diagnosis and treatment," *IEEE Internet of Things Journal*, vol. 8, no. 13, pp. 10830–10842, 2021.

[29] M. Zhang, Y. Chen, and W. Susilo, "PPO-CPQ: a privacy-preserving optimization of clinical pathway query for E-healthcare systems," *IEEE Internet of Things Journal*, vol. 7, no. 10, pp. 10660–10672, 2020.

[30] J. Li, K. Xu, S. Chaudhuri, E. Yumer, H. Zhang, and L. Guibas, "GRASS," *ACM Transactions on Graphics*, vol. 36, no. 4, pp. 1–14, 2017.

[31] Y. Lin, "An example analysis of the integration of wisdom-teaching mathematics classroom resources from the perspective of the new curriculum standard," *Huaxia Teachers*, vol. 19, p. 2, 2020.

[32] J. Zhang, C. Zhu, L. Zheng, and K. Xu, "ROSEFusion," *ACM Transactions on Graphics*, vol. 40, no. 4, pp. 1–17, 2021.

[33] C. Yuan and H. M. Du, "Application of information technology in football," *Digital Technology and Application*, vol. 38, no. 2, p. 2, 2020.

[34] L. Qin and M. Z. Wang, "Research on the impact of information technology application on sports," *Food Research and Development*, vol. 41, no. 14, p. 1, 2020.

[35] J. J. Li, "Research on the application of information Technology in Sports Training and Sports Events," *Electronic World*, vol. 4, p. 2, 2020.

[36] N. Zhang, "Application of modern information technology in primary school physical education and health teaching," *Sports-Leisure: Mass Sports*, vol. 8, p. 1, 2021.

[37] X. C. Wang, "Application of modern educational information Technology in Physical Education and Health Teaching," *Scientific Consultation*, 2020.

[38] S. Yan, "Research on information technology and its application in sports——comment on research on modern physical education teaching reform and informatization development," *Chinese Science and Technology Paper*, vol. 15, no. 9, p. 1, 2020.