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A STUDY TO INVESTIGATE THE PROBABILITY OF INCORPORATING NECESSARY COMPUTER VISION FUNCTIONALITIES FROM NETWORK VIDEO ANALYTICS (NVA) INTO A CLOUD-BASE SURVEILLANCE SYSTEM

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ABSTRACT

Rapid urbanisation, advancements in artificial intelligence, and robust state-driven efforts have propelled China to the forefront of developing and deploying large-scale surveillance networks. The massive amounts of video data produced by millions of cameras pose a growing threat to traditional hardware-based surveillance systems, notwithstanding their extensiveness. In this researcher look at the possibility of integrating cloud-based surveillance with essential computer vision features from Network Video Analytics (NVA) in a Chinese setting. This study delves at the ways in which cloud computing might improve the scalability, intelligence, and efficiency of current surveillance systems by making possible features like behavioural analysis, object detection, anomaly detection, and face recognition. The research places the integration of NVA within wider socio-political and technical agendas, drawing upon China's smart city and safe city programs. With the proliferation of 5G networks and local providers like Alibaba Cloud and Huawei Cloud, new possibilities for centralised, real-time video processing have emerged on cloud platforms. Data protection, cybersecurity, and the compatibility of different systems are some of the remaining obstacles. Examining the pros and cons of moving China's surveillance operations to the cloud is the study's overarching goal. This study sheds light on the practicality of moving away from legacy architectures and towards cloud-enabled systems by conducting a literature review and assessing existing technical capabilities. Finding a balance between technical innovation and legislative imperatives, the results add to the knowledge of how NVA-driven computer vision might be integrated into large-scale surveillance systems. In the end, this study shows how China is

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leading the way in intelligent cloud monitoring and has important implications for academics, governments, and tech companies working on next-gen security solutions.

Keywords: Cloud-based surveillance, Network Video Analytics (NVA), Computer vision, Smart cities in China, 5G network connection.

1. INTRODUCTION

Due to considerations such as increasing security concerns, fast urbanisation, and state-backed technology growth, China has established itself as a world leader in surveillance technologies. A massive amount of data is generated by the widespread installation of closed-circuit television (CCTV) cameras in Chinese cities, which has resulted in the creation of the biggest video surveillance network in the world. This data necessitates increasingly advanced processing and administration capabilities. Such data-intensive activities are becoming more and more difficult for traditional surveillance infrastructures to manage, which mostly use hardware-based solutions and localised storage (Xu et al., 2025). There is a lot of buzz about moving surveillance systems to the cloud so they can take use of cutting-edge computer vision and NVA features. Potentially game-changing for China's surveillance scenario is the incorporation of NVA into cloud frameworks. There has been a lot of study and deployment of computer vision applications in the nation, including face recognition, object detection, behavioural analysis, and anomaly identification. Both the efficiency and accuracy of monitoring in big and complicated metropolitan areas may be improved by integrating these services into cloud-enabled systems, which also increases scalability (Altundogan et al., 2025). The technological infrastructure needed to enable such integration is rapidly improving, thanks to the proliferation of 5G connection and the meteoric rise of local cloud providers such as Alibaba Cloud and Huawei Cloud. China's "Safe City" and "Smart City" programs, among others, provide a solid policy groundwork for this change. In order to improve social

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governance, traffic management, and public safety, these programs promote the use of intelligent monitoring. This makes China an ideal place to study the likelihood of using cloud-based NVA systems, thanks to the confluence of technical progress, government objectives, and economic activity. Still, there are obstacles. Scholars and the general public alike are nonetheless worried about data privacy, cybersecurity, system interoperability, and the moral consequences of extensive monitoring. Whether researcher want to know whether it's possible to integrate NVA-driven computer vision into cloud-based surveillance frameworks, researcher need to know how these things interact with the country's technology goals (Badidi et al., 2023).

2. BACKGROUND OF THE STUDY

China has lately been a world leader in the use and development of surveillance technologies. This is because its population is growing quickly, its cities are becoming bigger, and the government is making big expenditures in digital security infrastructure. This change has put China at the top of the world in all of these areas. China's sudden rise to the top may be due to the fact that it is now at the top of the list of countries that may lead the world. China really needs sophisticated video analytics that can assist people make choices right now. Because CCTV systems are now widely used in China's cities, there is a significant demand. This need has come up since so many cities in China have begun implementing these systems. People think that traditional Chinese surveillance systems are not very scalable, efficient, or adaptable, even if they are quite big. This is because the company's hardware-based and data storage solutions only work in the region around them (Yousif et al., 2025). This is the reason behind the predicament. There are a lot of things that are making cloud-based monitoring technology very popular very quickly. One reason for this is that these systems provide a lot of advantages. Some of these include centralised processing, flexible scaling, and easy integration with sophisticated analytics. NVA is an important thing to think about while deciding whether or

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not to make this adjustment. China's big investments in computer vision and artificial intelligence are making it possible for smarter city frameworks to use NVA technologies. These costs are directly related to China's efforts to make public safety, traffic management, and security monitoring better. This has happened because of the steps that China has taken. China is seeking to add capabilities like face recognition, object identification, and behavioural analysis to cloud-based surveillance systems as part of its attempts to construct high-performance, data-driven surveillance platforms (Barrington et al., 2025). The Chinese government also wants to add comparable tools to its own networks for surveillance. As part of its larger ambition, China is trying to construct these platforms, and they will have these features. This is because the parts don't require people to touch them directly. This is because the system's structure takes into consideration all of its parts. As China's laws and rules change all the time, cloud-based video surveillance systems are becoming more and more important to the country's security infrastructure. Cloud computing has made it feasible to manage the huge volumes of data that millions of cameras throughout the country collect. Because the state wants to maintain social order and protect the country, clever surveillance systems have been put in place swiftly. Because of this dedication, the state has been able to maintain national security at the top of its list of things to do. Cloud computing is the foundation of operations management. There is also the possibility to add NVA's computer vision features to cloud frameworks, which is currently possible. This is possible because of the rapid expansion of China's cloud service providers and the improvements in 5G connection. Now that both of these things have been taken into account, it is feasible to do so. In China's surveillance environment, it would be a good idea to combine cloud-based surveillance systems with computer vision that uses natural language processing. This program were put into action, it would bring together the needs of politics and society with the progress of technology (Haliczer et al., 2025).

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3. PURPOSE OF THE STUDY

The aim of this research the potential and practicality of using NVA core computer vision features in a cloud-based surveillance system in a Chinese setting. Given China's fast progress in AI, computer vision, and large-scale surveillance deployment, the country offers a key and distinctive setting for this kind of inquiry. This research intends to assess the efficacy, scalability, and decision-making capabilities of cloud-based infrastructures in enhancing preexisting surveillance networks via the integration of intelligent video analytics. This research aims to better understand how policy, operations, and technology all play a role in how NVA is integrated into cloud frameworks. In China, surveillance networks create huge amounts of video data everyday, imposing substantial strain on conventional hardware-based systems. An additional important goal is to analyse the impact of government-led programs and regulations in China on the uptake of cloud-based video analytics, specifically in the context of "smart city" and "safe city" initiatives. Since Chinese policies often dictate large-scale implementation, it is critical to link technology feasibility with governmental goals, which is why this topic is so significant. Data privacy, system interoperability, as well as cybersecurity hazards are some of the possible obstacles that the research hopes to bring to light. These issues are especially important in the Chinese setting. By addressing both the benefits and restrictions, this study tries to give a fair evaluation of whether cloud-based surveillance systems in China can reliably include sophisticated NVA-driven computer vision capabilities. In the end, the study hopes to add to what is already known about intelligent monitoring in China and give academics, politicians, and tech companies with information they can use to improve cloud-based security solutions for the future.

4. LITERATURE REVIEW

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By integrating computer vision and natural language processing into large-scale security frameworks, China has been doing substantial research and deploying these technologies at the forefront of surveillance innovation. Government policies supporting safe cities and smart cities efforts have significantly impacted the country's surveillance ecosystem, which has been fast evolving from traditional CCTV systems to sophisticated, cloud-enabled infrastructures, according to the literature. These shows highlight how crucial sophisticated analytics are for managing cities, keeping an eye on things in real time, and preventing crime (Komeh et al., 2025). The use of computer vision in cloud-based settings is one of the most important fields of study. Cloud platforms like Alibaba Cloud and Huawei Cloud provide the processing power needed for demanding video analytics jobs like face recognition, anomaly detection, and crowd movement analysis, according to studies. Many people in the academic and business communities have taken an interest in facial recognition because of its central role in NVA research in China. Faster cross-regional identification is essential for border control and law enforcement, and cloud computing with face recognition makes it possible. Public safety and commercial applications alike are seeing an uptick in the use of object identification and tracking algorithms integrated into surveillance networks (Kulbacki et al., 2023). These algorithms are often the result of joint development efforts between academic institutions and artificial intelligence (AI) companies like SenseTime and Hikvision. The potential of 5G networks to bolster cloud-based monitoring is another area of investigation. In heavily populated metropolitan regions, real-time analysis and fast alert creation are made possible by high-speed connection, which mitigates latency difficulties in video transmission (Kumar et al., 2024). But experts warn that there are hazards to data privacy, cybersecurity, and system overload when dealing with huge video feeds. A delicate balancing act between technical advantages and ethical and practical considerations is required in light of these difficulties. When it comes to promoting NVA-driven cloud surveillance, the Chinese literature shows that

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technical innovation, commercial business, and state governance are strongly aligned. Ongoing studies highlight the significance of resolving privacy protections, interoperability standards, and sustainable infrastructure development, although academic consensus indicates that integrating computer vision features into cloud-based systems is feasible (Liu et al., 2025).

5. RESEARCH QUESTION

- What is the influence of cloud-base surveillance system on network video analytics?

6. RESEARCH METHODOLOGY

6.1. Research Design

The SPSS version 25 was used for the quantitative data analysis. A 95% confidence interval and odds ratio were used by the researchers to assess the direction and strength of the statistical association. A statistically significant criteria was established by the researchers at $p < 0.05$. The data's basic features were revealed via a thorough investigation. Quantitative methods are often used to evaluate data collected via polls, questionnaires, and surveys, as well as data analysed using computing tools for statistical evaluation.

6.2. Sampling

Research participants completed questionnaires to furnish data for the study. Utilising the Rao-soft tool, researchers ascertained that the study comprised 657 individuals. Researchers disseminated 900 questionnaires to the public. The researchers obtained 823 replies, eliminating 73 due to incompleteness, yielding a final sample size of 750.

6.3. Data & Measurement

The study mostly utilised data acquired from a questionnaire survey. The participant's essential demographic information was requested first. Participants were subsequently given a 5-point

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Likert scale to evaluate the online and offline channels. The researchers rigorously analysed several resources, especially internet databases, for this secondary data acquisition.

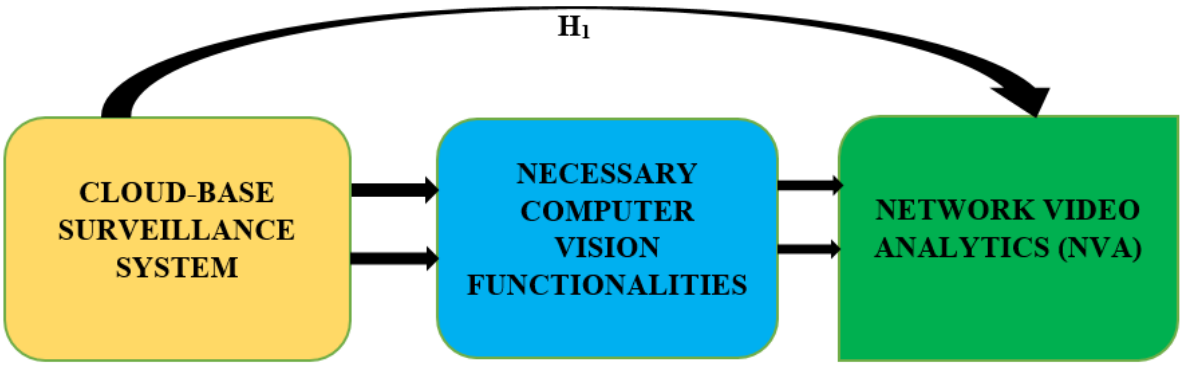
6.4. Statistical Software

The statistical analysis was conducted using SPSS 25 and MS Excel.

6.5. Statistical Tools

The primary characteristics of the data were understood via the use of descriptive analysis. Using ANOVA, the researcher must examine the data.

7. CONCEPTUAL FRAMEWORK



8. RESULT

- **Factor Analysis**

Factor Analysis (FA) is often used to find hidden variables in observable data. It is common practice to use regression coefficients to generate ratings when there are no easily visible visual or diagnostic signs. Success in FA is highly dependent on models. The goals of modelling are to identify errors, intrusions, and apparent linkages. The Kaiser-Meyer-Olkin (KMO) Test is one tool for evaluating datasets that have been generated by numerous regression analyses.

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The representativeness of the model and the variables in the sample are checked by them. There seems to be data duplication based on the numbers. Data is more easily comprehensible when proportions are smaller. The output of KMO is an integer from 0 to 1. A sufficient sample size is defined as a KMO value between 0.8 and 1. According to Kaiser, these are the acceptable limits: The standards that Kaiser has established for admission are as follows:

A dismal 0.050 to 0.059, worse than the typical 0.60 to 0.69

The typical range for middle grades is between 0.70 and 0.79.

Having a quality point score between 0.80 and 0.89.

Between 0.90 and 1.00, they find wonder.

Testing for Bartlett's Sampling Adequacy and KMO (Table1) The Kaiser-Meyer-Olkin .923 scale

According to Bartlett's sphericity test, these are the results: chi-square, sig. =.000, about 190 degrees of freedom this proves that the statements made for sampling were legitimate. In order to determine whether the correlation matrices were relevant, the researchers used Bartlett's Test of Sphericity. An adequate sample is defined as one with a value of 0.923 according to the Kaiser-Meyer-Olkin measure. The results of Bartlett's sphericity test provide a p-value of 0.00. Researcher can tell the correlation matrix isn't an identity matrix if Bartlett's sphericity test returns a positive result.

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Table 1: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.923
Bartlett's Test of Sphericity	Approx. Chi-Square	3252.968
	df	190
	Sig.	.000

In addition, the widespread use of correlation matrices was confirmed by Bartlett's Test of Sphericity. The sample adequacy measure, as measured by Kaiser-Meyer-Olkin, is 0.923. Using Bartlett's sphericity test, the researchers obtained a p-value of 0.00. A substantial result of Bartlett's sphericity test demonstrated that the correlation matrix was ineffective.

❖ INDEPENDENT VARIABLE

- **Cloud-Base Surveillance System**

The technical foundation that impacts the integration of advanced analytics is provided by the cloud-based monitoring system, which serves as the independent variable in this research. The need for centralised, efficient, and scalable systems to handle massive amounts of video data is driving a change in China away from hardware-driven surveillance and towards cloud-based infrastructures. Centralised storage, processing, and analysis of video feeds from millions of cameras is made possible by cloud technologies, allowing for intelligent monitoring and easy access. These systems use 5G connection, artificial intelligence, and machine learning to enhance real-time decision-making with the help of Chinese cloud providers like Alibaba Cloud and Huawei Cloud. When it comes to the technological environment and operational capability that NVA activities may be placed inside, cloud-based surveillance is the independent variable. The efficiency with which computer vision capabilities can be integrated

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into China's surveillance networks is directly correlated to its processing power, adaptability, and scalability (Saini & Kumar, 2024).

❖ DEPENDENT VARIABLE

- **Network Video Analytics (NVA)**

The efficiency and implementation of NVA are contingent upon the cloud-based surveillance system's foundational components, making them the dependent variable. Facial recognition, object detection, behavioural analysis, and anomaly detection are all part of NVA in China. These capabilities are essential for smart surveillance in heavily populated metropolitan areas. The capacity of cloud platforms to handle and analyse data on a large scale determines the effectiveness of these analytics. Take NVA functions as an example; they are very dependent on the processing power and data transfer capacity offered by cloud computing. The Chinese government's "Safe Cities" and "Smart Cities" programs put NVA applications at the centre of urban security plans. Using NVA as a dependent variable, researcher can see how well cloud-based infrastructures enable intelligent video processing and how the results of incorporating sophisticated analytics into surveillance pan out (Shan, 2025).

- **Relationship between Cloud-Base Surveillance System and Network Video Analytics (NVA)**

NVA and cloud-based surveillance technologies in China have a transformational and interdependent interaction. The ability to store, manage, and transmit large amounts of video data is made possible by cloud platforms, and the intelligence needed to derive insights from that data is provided by NVA. Face recognition and real-time anomaly detection are two examples of NVA capabilities that would be severely constrained in breadth and efficiency without the scalability and processing capacity offered by cloud systems. On the other side, modern NVA capabilities included in cloud-based surveillance greatly increase its value by

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allowing for more accurate monitoring, faster reaction, and predictive analytics. Given the scope of China's monitoring networks and the importance the government places on digital governance, this link is of utmost importance. When combined, cloud infrastructures and NVA provide an ecosystem that can run intelligent surveillance on a massive scale, which in turn may influence how smart cities develop and further solidify China's position as a global leader in security technology (Shi et al., 2024).

On the basis of the above discussion, the researcher formulated the following hypothesis, which was analyse the relationship between Cloud-Base Surveillance System and Network Video Analytics (NVA).

***"H_{01}: There is no significant relationship between* Cloud-Base Surveillance System and Network Video Analytics (NVA)."**

***"H_1: There is a significant relationship between* Cloud-Base Surveillance System and Network Video Analytics (NVA)."**

Table 2: H_1 ANOVA Test

ANOVA					
Sum					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	43617.620	218	5655.517	1050.040	.000
Within Groups	535.770	531	5.386		
Total	44153.390	749			

The outcome is substantial in this research. Statistical significance is achieved with a p-value of .000 (below the .05 alpha level), and the F value is 1050.040. This suggests that researchers might support the alternative view, ***"H_1: There is a significant relationship between* Cloud-Base Surveillance System and Network Video Analytics (NVA)"** is accepted and the null hypothesis is rejected.

9. DISCUSSSION

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This study's results show the benefits and drawbacks of using NVA's computer vision capabilities in Chinese cloud-based surveillance systems. On the one hand, the country's advantageous atmosphere for such integration is created by the fast progress of artificial intelligence and cloud computing infrastructure. Chinese IT companies like Huawei Cloud, Alibaba Cloud, SenseTime, and Hikvision have shown they can roll out intelligent video systems on a massive scale. Faster transmission of high-resolution video feeds and support for real-time analysis made possible by 5G connection adds weight to the argument. From a societal and political standpoint, cloud-enabled surveillance technologies have been greatly accelerated by the Chinese government's dedication to the "Safe City" and "Smart City" initiatives. Authorities may improve their monitoring and reaction capabilities in heavily populated metropolitan areas by integrating cloud frameworks with functionality like face recognition, behavioural analysis, and anomaly detection. This exemplifies China's larger goal of using digital technology for the sake of national security, urban development, and governance. The integration procedure, nevertheless, is not trouble-free. Data privacy, cybersecurity, and the moral consequences of widespread monitoring continue to be major issues. The concentration of video analytics on cloud platforms may increase the dangers of data breaches or abuse, despite the fact that China has implemented legal frameworks to control data security. Given the scope of China's surveillance networks, the technological hurdle of compatibility between different camera systems and analytics software is even more significant. From a societal and political standpoint, cloud-enabled surveillance technologies have been greatly accelerated by the Chinese government's dedication to the "Safe City" and "Smart City" initiatives. Authorities may improve their monitoring and reaction capabilities in heavily populated metropolitan areas by integrating cloud frameworks with functionality like face recognition, behavioural analysis, as well as anomaly detection. This exemplifies China's

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larger goal of using digital technology for the sake of national security, urban development, and governance.

10. CONCLUSION

In Conclusion, this research has investigated the likelihood of integrating essential computer vision features from NVA into a cloud-based surveillance system. According to the research, this technological shift is well-suited to China's current climate, thanks to the country's fast progress in cloud computing, computer vision, and artificial intelligence and government-driven programs like the "Safe City" and "Smart City" efforts. A cloud architecture that incorporates face recognition, anomaly detection, and behavioural analysis has the capacity to improve the scalability, efficiency, and real-time monitoring of China's extensive surveillance networks, among other benefits. The technological feasibility of such systems is further enhanced by the country's strong digital infrastructure, which is backed by prominent firms like Hikvision, Alibaba Cloud, and Huawei Cloud. In addition, the growth of 5G networks provides the link for real-time processing and high-speed data transmission, solving the problem of latency that has long prevented widespread monitoring. Based on these advancements, China seems to be in a good position to be a leader in intelligent security systems that are enabled by the cloud, both nationally and in metropolitan areas. Nevertheless, the research also brings attention to persistent obstacles. There are valid worries about data security, privacy, and cybersecurity vulnerabilities associated with centralising analytics on the cloud. Addressing the ethical concerns around mass monitoring and public trust is crucial for the sustainability of adoption in Chinese society. In addition, there may be obstacles to universal adoption due to price differences, platform incompatibilities, and regional infrastructural constraints. Ultimately, the integration of NVA-driven computer vision into China's cloud-based surveillance systems has a good chance of succeeding; however, this can only be achieved with stringent legislation, strong security protocols, and ethical supervision.

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China has the potential to lead the world in developing next-generation intelligent surveillance systems, striking a balance between technical innovation and social responsibility, if these challenges are handled well.

REFERENCES

Altundogan, T. G., Karakose, M., & Mert, F. (2025). A New Multi Objective Video Summarization Approach for Video Surveillance Analytics Applications on Smart Cities. IEEE Access.

Badidi, E., Moumane, K., & El Ghazi, F. (2023). Opportunities, applications, and challenges of edge-AI enabled video analytics in smart cities: a systematic review. IEEE access, 11, 80543-80572.

Barrington, H., McCabe, T. J. D., Donnachie, K., Fyfe, C., McFall, A., Gladkikh, M. & Reid, M. (2025). Parallel and high throughput reaction monitoring with computer vision. Angewandte Chemie International Edition, 64(1), e202413395.

Haliczer, D. T., Mecikalski, J. R., & Kollias, P. (2025). Use of satellite, surface observations and numerical weather prediction model data to improve cloud base height and cloud base vertical velocity estimation. Journal of Geophysical Research: Atmospheres, 130(1), e2024JD041853.

10.48047/jocaaa.2023.31.04.55

Komeh, Z., Hamzeh, S., Memarian, H., Attarchi, S., & Alavipanah, S. K. (2025). A Remote Sensing Approach to Spatiotemporal Analysis of Land Surface Temperature in Response to Land Use/Land Cover Change via Cloud Base and Machine Learning Methods, Case Study: Sari Metropolis, Iran. International Journal of Environmental Research, 19(3), 98.

Kulbacki, M., Segen, J., Chaczko, Z., Rozenblit, J. W., Kulbacki, M., Klempous, R., & Wojciechowski, K. (2023). Intelligent video analytics for human action recognition: The state of knowledge. Sensors, 23(9), 4258.

Kumar, T., Sharma, P., Tanwar, J., Alsghier, H., Bhushan, S., Alhumyani, H., & Alutaibi, A. I. (2024). Cloud-based video streaming services: Trends, challenges, and opportunities. CAAI Transactions on Intelligence Technology, 9(2), 265-285.

Liu, J., Liu, Y., Lin, J., Li, J., Cao, L., Sun, P. & Leung, V. C. (2025). Networking systems for video anomaly detection: A tutorial and survey. ACM Computing Surveys, 57(10), 1-37.

Saini, P., & Kumar, K. (2024). S-method: secure multimedia encryption technique in cloud environment. Multimedia Tools and Applications, 83(3), 8295-8309.

Shan, D. (2025). Development and Application of Cloud Storage Technology in Video Surveillance. Journal of Artificial Intelligence and Information, 2, 207-210.

Shi, W., Li, Q., Yu, Q., Wang, F., Shen, G., Jiang, Y. & Muntean, G. M. (2024). A survey on intelligent solutions for increased video delivery quality in cloud-edge-end networks. IEEE Communications Surveys & Tutorials.

10.48047/jocaaa.2023.31.04.55

Xu, Y., Khan, T. M., Song, Y., & Meijering, E. (2025). Edge deep learning in computer vision and medical diagnostics: a comprehensive survey. Artificial Intelligence Review, 58(3), 93.

Yousif, I., Burns, L., El Kalach, F., & Harik, R. (2025). Leveraging computer vision towards high-efficiency autonomous industrial facilities. Journal of intelligent manufacturing, 36(5), 2983-3008.