A STUDY TO ASSESS THE VIABILITY OF INTEGRATING CRUCIAL COMPUTER VISION FUNCTIONS FROM NETWORK VIDEO ANALYTICS (NVA) INTO A CLOUD-BASED SURVEILLANCE SYSTEM.

Lin Zhenquan [1], Vivekanandam Balasubramaniam [1]

[1] Lincoln University College, Petaling Jaya, Malaysia.

*Corresponding author: Lin Zhenquan, Lincoln University College, Petaling Jaya, Malaysia.

ABSTRACT

One thing that makes a cloud-based surveillance system different is that it can send footage from security cameras via the internet. It also employs distant cloud servers for storage, data management, and analysis, which makes it different from other forms of surveillance systems. This feature makes the system more efficient than other surveillance systems. On the other hand, this technology might be considered as technology in a way that is different from how most people think of it. The goal of this system is to be able to control the automated streaming of video from IP cameras, as well as to obtain important information, figure out what the data is, and analyse it in real time. The main purpose of this study is to provide people access to important computer vision skills, which includes things like Network Video Analytics (NVA) and cloud-based monitoring tools. A lot of people think that China's surveillance technology will eventually go from just recording to active, smart systems that can analyse and evaluate things in real time. The reason for this is that China is steadily getting closer to reaching its goals in national security and smart city development. One of the many reasons this development is so important is because it came about because of this. Due to this change, benefits of computer vision are in great demand, especially for tasks like recognising faces, finding strange things, and analysing conduct. It is possible to turn unstructured visual data into structured inputs for advanced analytics by employing these features, which make the flow that was spoken about before possible.

Keywords: Cloud-based surveillance system; Network Video Analytics (NVA); computer vision; Artificial Intelligence (AI); China.

INTRODUCTION

In the next several years, the Chinese government plans to spend a lot of money on developing new monitoring systems. This strategy is being looked at in order to keep the calm in the city and protect its citizens. Also, this new technology is a key aspect of the fast-moving digital revolution that is unfolding all throughout the nation right now. More and more people are becoming aware of the problems that come with traditional monitoring systems and the idea of smart cities since it is becoming increasingly popular. Over time, these systems have become less able to do their jobs well, mostly because they depend on people and local technology (Li, 2024). The standards

about how safe contemporary Chinese communities should be are more comprehensive and rigorous than they have ever been. These old systems can't keep up with the security needs of modern Chinese cities because they don't have enough data collecting, storage, and analysis capabilities. One way to fix these problems may be to add more monitoring systems to the cloud. This is only one example of how these systems have become considerably more complex by adding a lot of new capabilities. This is only one of many examples that illustrates how far they have gone in terms of technology. Because of these new talents, the systems can now store data, handle data that is spread out across huge metropolitan networks, and get data in real time (Barkham et al., 2022). Since the start of this progression spurred by technical advancement, NVA has been an important tool for analysing video data and turning it into useful information. This breakthrough is now possible because of advances in technology. One of the best things about microcars is that they are accessible in big cities. There are several possible applications for this specific skill including important parts on the interior of NVA. Recognising faces, gestures, and patterns that are different from the norm, as well as judging activities, are all behaviours that fall under this group. That being said, these aren't the only things that fit under this category of activity. Because of this, NVA has to include a lot of computer vision characteristics for the system to be able to successfully identify, classify, and analyse visual input, these parts must be there. There is a direct link between the requirements that make it possible to maintain the integrity of systems stored in the cloud and the criteria that make it possible (Afzal et al., 2023). This study examined the potential of cloud-based surveillance systems, equipped with fundamental computer vision capabilities, to improve activities that now lack value.

BACKGROUND OF THE STUDY

The Chinese government is aiming to make the cities in the country more urban, even if the number of smart cities is expanding quickly throughout the country. Because of the way things are right now in country, advanced surveillance systems have been created and put into use all throughout China in a matter of minutes. In reality, the capabilities of present monitoring systems are grossly insufficient to address the many security requirements that afflict contemporary society. It doesn't matter whether people still use these old technology every day; this will keep happening. They can't provide real-time predictive insights since they require servers to be physically there and someone to watch over them. These issues are holding them back from getting their enterprises to the next level, which is far higher than where they are presently. Taking all of these problems into account, cloud-based monitoring solutions are becoming more and more popular across the globe for a number of reasons, including the ones previously mentioned. One reason for this functionality is because cloud-based surveillance systems let customers see data from anywhere, select how to store it, and manage everything from one place. All of these things have worked together to make sure that the move to digital is as easy as possible for everyone in the nation (Khriji et al., 2022).

NVA is cutting-edge technology that lets surveillance systems do more than simply satisfy basic monitoring demands. This technology allows these systems to take charge and deal with security issues in a way that takes future events into consideration. To do NVA with the maximum accuracy, one need to use the basic ideas of computer vision. These phases are part of the process because they are important for accurately identifying and analysing visual information (Szeliski, 2022). It will be both thrilling and hard to figure out the challenges and concerns that come up when combine cloud-based systems with computer vision capability. Even if the system is promised to be more efficient and scalable, many are still worried about data security and latency. This is especially true when one think about how the government is continuously adding new information to the rules it sets (Ahmed et al., 2024). This research aimed to evaluate the NVA's capacity to achieve China's smart city and public safety goals by investigating the potential use of cloud-based monitoring technology.

THE PURPOSE OF THE RESEARCH

The goal of this project is to look at the possible advantages of adding basic computer vision features to cloud-based monitoring systems. China is making a lot of progress in building "smart cities" and networks for watching over cities. The government puts the greatest emphasis on finding ways to make technologically sophisticated things that more people can utilise. Cloud infrastructures must have enough storage capacity and processing power to make sure that the system is fully monitored. One must independently determine how to get information in the domain of computer vision, since no assistance is provided. NVA can provide information that is not just more thorough than what can get from passive monitoring, but also information that is predictive and proactive. Examination of the possible risks arising from the constraints of broadband, latency, and the possibility of China rapidly intensifying its data restrictions are essential for its wide spread deployments. Following this, the objective of this inquiry is to find out what the pros and cons of cloud-based surveillance system development with use of modern advancements such as NVA. It aims to decide whether cloud-based solutions can suit NVA's processing demands while still following national data security rules considering diverse computer vision characteristics.

LITERATURE REVIEW

As part of its continuous efforts to improve its digital infrastructure and establish smart cities, China is working to make its monitoring systems stronger. Even while conventional monitoring systems are used a lot, they still don't do a good job of helping people learn, adapt, and grow as things change. These devices can capture video, but there is a chance that they will not work properly when they are first used. The video material that has been collected may be used for research purposes in the future. As a consequence of the difficulty mentioned above, cloud-based monitoring solutions are becoming increasingly common. One can satisfy the demands of the city by making these networks bigger, smaller, or both. People are presently working on building networks to keep an eye on the cities that surround China. In the future, these

monitoring networks will be used to build solutions to problems connected to cybersecurity. The cloud architecture that people in China utilise is not only incredibly effective, but it is also simple to operate, which is another good thing about it (Li et al., 2022). Thanks to progress in the area of NVA, it is now possible to work with large volumes of raw video data. The most valuable information that can be gotten from the data will probably be obtained before it is delivered. Because of this, the surveillance industry has been going through a hard patch. Facial recognition, studying how crowds act, and finding unusual things are all very important in China's megacities. This is because it's well-known that it's hard to keep track of important public meetings, transit hubs, and movement in cities. Even though NVA is a great idea, surveillance system won't be useful unless it can quickly and accurately detect and understand photos (Shen et al., 2025). Theoretically, cloud computing platforms possess the capacity to manage substantial workloads. Even if the possibilities of this happening are not extremely high, the owner of the residence may still need to spend money on equipment that is much cheaper. Cloud computing could be able to enable the capacity to change the size of a surveillance system based on its needs. The advancement of this technology has led to the pervasive accessibility of real-time data in contemporary society. This categorisation method may put all of these traits—poor data transfer, security holes, poor centralised data storage, and a weak network connection—together. Chinese cybersecurity laws and data security standards say that sensitive surveillance data in China must be kept very safe (Creemers, 2022).

More and more people are using both NVA and cloud-based monitoring. At this moment, looking at each of these technologies on its own. Academics have not embraced the concept of employing computer vision as a bridge between the two, as is plainly obvious. There is insufficient research in China investigating the influence of computer vision skills. This is particularly true in the contemporary world, where the process of adding new technologies has been quite sluggish because of problems with both technology and the law. This study seeks to examine the attributes of cloud-based surveillance systems that conform to specified criteria by using fundamental computer vision capabilities. Using these technologies, China could be able to create a monitoring environment that is real, smart, and able to grow (Ma et al., 2024).

RESEARCH QUESTION

What is the impact of cloud-based surveillance system on Network Video Analytics considering necessary computer vision functionalities?

METHODOLOGY

Research Design: SPSS version 25 was used for the quantitative data analysis. The researchers used a 95% confidence interval and an odds ratio to ascertain the size and direction of the statistical association. The researchers established statistical significance at $p < 0.05$. The main qualities of the data were identified after comprehensive analysis. Quantitative methods are

often used to analyse data obtained from surveys, polls, and questionnaires, as well as data processed by computing tools for statistical evaluation.

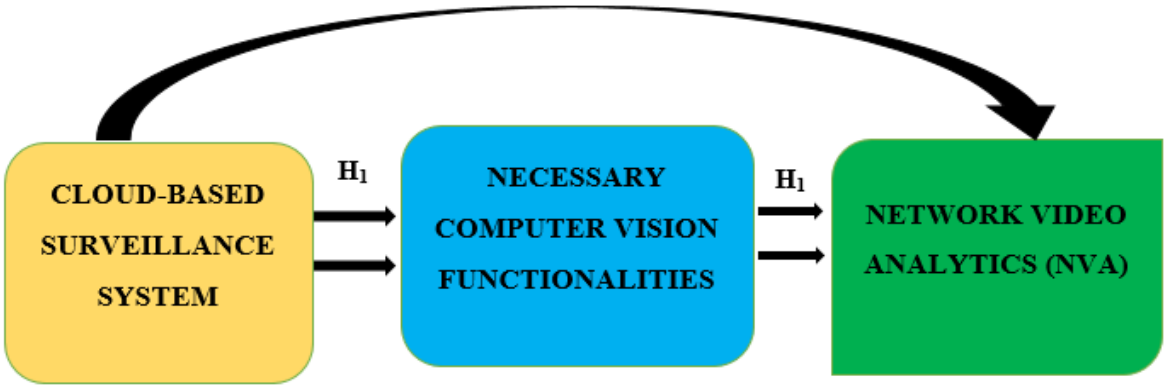
Sampling: Researchers requested research participants to complete questionnaires to enhance the data collection. Researchers used the Rao-soft methodology to determine that 657 individuals participated in the survey. Nine hundred questionnaires were sent to members of the general public by the authors of the research. Following the removal of seventy-three incomplete responses, the researchers retained seven hundred fifty.

Data and Measurement: A survey questionnaire was used to collect the primary data for the study. Initially, the researcher requires essential participant demographics. The participants used five-point Likert scales to evaluate the in-person and internet venues. To assemble secondary data, the researchers meticulously examined several sources, mostly internet databases.

Statistical Software: MS Excel and SPSS 25 were the statistical tools used by the researchers.

Statistical Tools: A basic comprehension of the data was achieved by the researcher using descriptive analysis. Using ANOVA, the researcher must examine the data.

CONCEPTUAL FRAMEWORK



RESULT

Factor Analysis: Investigating the fundamental component structure of a set of measurement items is a prevalent use of Factor Analysis (FA). The observed variable ratings are purportedly influenced by subtle factors. The FA approach relies on models. The fundamental objective of this study was to identify correlations between visible phenomena, their underlying causes, and measurement inaccuracies. The Kaiser-Meyer-Olkin (KMO) Method may be used to assess the applicability of factor analysis. The researcher assesses if there is a sufficient number of participants to adequately represent the model as a whole and to evaluate each independent variable. Statistical approaches may be used to assess common deviations across several variables. Factor analysis is more effective with data that exhibits lower percentages in the majority of instances.

The KMO output is an integer ranging from zero to one. Sampling is deemed suitable when the KMO score ranges from 0.8 to 1. A KMO value below 0.6 indicates an inadequate sample, necessitating remedial measures. Exercise the judgement; some authors choose for 0.5 for this objective, hence the range is 0.5 to 0.6. Partial correlations are statistically significant for total correlations as the KMO score approaches zero. To emphasise, component analysis is significantly impeded by elevated correlations.

The further admittance criteria established by Kaiser are as follows:

The range of 0.050 to 0.059 is alarming.

The range of 0.60 to 0.69 is inadequate.

The range for a mediocre grade often falls between 0.70 and 0.79.

A quality scale score between 0.80 and 0.89.

The disparity between 0.90 and 1.00 is significant.

Table 1. The Kaiser-Meyer-Olkin (KMO) and Bartlett's Method.

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 other words, it verifies the accuracy of assertions on the sample's execution. The researchers used Bartlett's Test of Sphericity to examine the correlation matrices. The sample is deemed satisfactory with a KMO measure value of 0.923. Upon doing Bartlett's sphericity test, the p-value is determined to be 0.00. Statistically significant results from Bartlett's sphericity test indicate that the correlation matrix does not approach an identity matrix.

INDEPENDENT VARIABLE

Cloud-based surveillance system: Because more and more surveillance systems are stored on the cloud, modern security systems are changing how they are built. These systems are moving away from processing and storage that happens on-site and towards scalable, distributed, and centralised solutions that are hosted in the cloud. People think these systems are more flexible than others because they let users acquire data from a lot of different security cameras, send it back, and watch it in real time from a distance. The government's digital transformation initiatives, together with the fast growth of smart cities in China, have led to a big

increase in the number of people who use cloud-based monitoring. Costs for hardware go down, scalability goes up, and it's easier to use technologies that use AI. Surveillance systems are now so advanced that they may help with many important city tasks. The cloud connects many different types of businesses, such as healthcare, transportation, and law enforcement. This issue is still not addressed, and the problems are particularly clear in the areas of cybersecurity, data privacy, and the massive amounts of data that China's surveillance networks collect. Cloud computing is still working on adding these advanced features, but it doesn't imply that these tasks can't be a good base for more complex features like NVA and others. With cloud-based monitoring technology, one can always make improvements and save resources. Since of this, they are a suitable choice for large-scale deployments since they are adaptable and can be changed to meet a wide range of needs. It is a strategic weapon that can be used to improve government surveillance operations throughout the nation by adding information and advanced analytics in China (Jili, 2022).

MEDIATING VARIABLE

Necessary computer vision functionalities: The most significant things that help advanced analytics and surveillance data that hasn't been handled yet are the basic functions of computer vision. These skills might be as simple as being able to tell the difference between different objects, faces, and deformities, following movement, and paying close attention to behaviour. Because China has advanced and pervasive surveillance systems, computer vision is utilised there to turn video data into usable and actionable information. It is feasible to use anomaly detection technology to find suspect behaviour in crowded areas, and it is also conceivable to use facial recognition technology to check identities in real time. These features not only make work more productive, but they also make it safer by cutting down on the number of false signals and the amount of human monitoring that is needed. They provide organised data for higher-order analysis, which is an important job since they are the input layer for NVA. The NVA's capacity to provide reliable intelligence depends on its ability to employ advanced computer vision technology. There are problems caused by the fact that visual tasks are hard to compute, algorithms might be biased, and ethical difficulties connected to privacy and fairness. The Chinese government is giving a lot of money to the creation and research of AI that is now going on in China. The country's internet infrastructure is another thing that helps AI to thrive. As a result, the capabilities of computer vision functions have a big impact on how well NVA can work with cloud-based surveillance systems (Alsayfi et al., 2022).

DEPENDENT VARIABLE

Network Video Analytics (NVA): NVA is an advanced surveillance layer that lets computers look at a lot of video data streams and provide useful information. NVA means using AI and algorithms to automatically find, sort, and guess what will happen. This helps keep track of the steps that are done to prevent security breaches before they happen. The Chinese government wants to modernise local administrations, build smarter metropolitan centres, and make public

places safer and more secure. The NVA is being rolled out at the same time as these objectives are being set. This technology might be used in a lot of different ways, such as keeping an eye on population density, watching criminals in real time, responding to crises, and controlling traffic on its own, to mention just a few. The dependability and accuracy of the computer vision characteristics that offer the original data are the two criteria that decide to what degree NVA is capable of attaining its aims. Analytics loses a lot of its credibility when it can't find or identify things quickly and easily. The NVA has to deal with a number of important problems, such as concerns about the high costs of integration, privacy difficulties, and anxieties about too much information and government surveillance. Even yet, the growth of both fifth-generation networks and AI has drawn a lot of money into the country's digital economy. These improvements have made it such that China normally gets greater benefits from the NVA currently than it did in the past. The results of NVA are based on the use of cloud computing and computer vision together. In this way, the variable NVA depends on the values of other parameters. The highest degree of practicality achievable is the establishment of system intelligence. This outcome is possible because of the utilisation of technologies that function together (Mujtaba, 2025).

Relationship between cloud-based surveillance system and Network Video Analytics considering necessary computer vision functionalities: One may use basic computer vision methods to link NVA to cloud-based surveillance systems. The cloud has given China the tools it needs to gather, store, and analyse all of its surveillance data. It can get information from a place other than the source, has a lot of processing power, and storage that can be expanded. Computer vision algorithms turn unstructured video into organised, understandable data to make NVA analysis easier. NVA gets the information it needs to tell the difference between different patterns of behaviour from computer vision technologies. One may add to the inputs by using additional technologies, such face recognition and object recognition. Without this middle layer, NVA could provide the findings that are missing or wrong. When one look at it from that angle, the link between efforts to build smart cities in China and technologies used for government surveillance is considerably stronger. NVA can provide data that is very important for traffic management at the regional and municipal levels, public safety, and governance thanks to cloud computing and computer vision. Because these changes aren't linear, cloud infrastructure, analytics, and vision-based capabilities need to be improved in a systematic way for the adoption phase to be successful (Liu et al., 2021). In light of this context, the primary aim of the study was to investigate the correlation between cloud-based surveillance systems and Network Video Analytics, focussing on critical computer vision attributes.

“H_{01}: There is no significant relationship between cloud-based surveillance system and Network Video Analytics considering necessary computer vision functionalities.”

“H_1: There is a significant relationship between cloud-based surveillance system and Network Video Analytics considering necessary computer vision functionalities.”

Table 2. H1 ANOVA Test.

ANOVA					
Sum					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	41846.382	332	5359.874	896.150	.000
Within Groups	597.761	417	5.981		
Total	42444.143	749			

This discovery is significant in this study. The p-value of 0.000, being smaller than the 0.05 alpha level, fulfils the significance criterion with an F-value of 896.150. The researcher accepts **"H_1: There is a significant relationship between cloud-based surveillance system and Network Video Analytics considering necessary computer vision functionalities"** upon the rejection of the null hypothesis.

DISCUSSION

The findings of the study have shown the interdependence of cloud-based surveillance systems, essential computer vision functionalities, and NVA. China's quick and widespread use of surveillance technology has made adopting these technologies a geopolitical and technological priority. This is because China is already well ahead of the game when it comes to creating surveillance systems. Cloud computing not only makes it easier to turn huge volumes of raw data into organised and intelligible outputs, but it also provides the scalability and computational underpinning needed to manage installations throughout the state. Not to add that computer vision functions already make sure that this change will happen. The NVA will next use the information it has already given out to create higher-order intelligence. This implied that leveraging this information to help with things like real-time criminal identification, managing traffic, and predicting traffic patterns is quite possible.

However, there are still a lot of problems that need to be solved before integration can be called a success. It is important to remember that computer vision systems use a lot of processing power and bandwidth, which puts a burden on the cloud. This is something to think about since China will probably keep up its comprehensive surveillance activities for the time being. Ethical issues like the right to privacy and the danger of algorithmic bias are again in the news since monitoring is becoming more common in government work. Using NVA to make decisions might be risky if the visual features that help one make decisions aren't as accurate as they should be. China's big investments in AI research, cloud infrastructure, and national digitalisation have created the best conditions for this integration to grow. To achieve practicability, which in turn needs us to establish technical frameworks, it is important to stress that responsible governance frameworks must be put in place to ensure accountability, justice, and transparency in surveillance activities.

CONCLUSION

In conclusion, fundamental computer vision competencies are crucial for the incorporation of NVA into Chinese cloud-based surveillance systems. NVA may also make money from these features as well as offer both the foundation for NVA's income and help turn raw visual data into useful information. If powerful computer vision skills weren't accessible, NVA would be far less useful. This set of skills includes things like recognising items and faces, as well as being able to find strange things. China's efforts in AI, cloud computing, and smart city initiatives have made it possible for these technologies to be used by a lot of people. The establishment of this foundation will make sure that these technologies are used by many people. This doesn't change the reality that there are still problems in ethics, legislation, and technology. For the integration to work and last, a number of obstacles must be taken into account and dealt with in the right way. Some of these worries are around privacy protection, algorithm dependability, and data security. The frameworks that regulate a technology's acceptable employment are just as crucial as its feasibility, as the conclusion makes clear. In the end, China's smart surveillance strategy will be defined by how well it balances new technologies with rules that build confidence and responsibility. This strategy will determine the future of China's smart surveillance program. Cloud-based technology might have a big effect on the progress of public safety and city management.

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