AN INVESTIGATION INTO THE FEASIBILITY OF INCORPORATING ESSENTIAL COMPUTER VISION CAPABILITIES FROM NETWORK VIDEO ANALYTICS (NVA) INTO A CLOUD-BASED SURVEILLANCE SYSTEM.

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ABSTRACT

The cloud-based surveillance system can be identified as transmitting footage from security cameras on the internet while using remote cloud servers for storing them, management of the footages as well as analysis of the same. On the other hand, network video analytics can be assessed as a technology using computer algorithms that is powered by artificial intelligence (AI) and computer vision to manage automatic streaming of video from IP cameras, extracting important information, identifying as well as understanding the information in real time. The main purpose of this project, which is located in China, is to provide important computer vision features from Network Video Analytics (NVA) to cloud-based monitoring systems. The specific instance to be analysed is China. The investigation also looked into how possible the activity stated earlier is. People think that China's surveillance technology will change from passive recording to active, smart systems that can analyse and make choices in real time. Everyone is looking forward to this. This is beginning to happen more and more regularly, and people are learning to anticipate it. This is because China is always getting closer to reaching its goals in the fields of smart city development and national security. Because of this change, computer vision features including object identification, face recognition, anomaly detection, and behaviour analysis are in great demand. Object detection and face recognition are two of the numerous things that fall under this category. These traits help the flow that was spoken about before happen so that unstructured visual data may be turned into structured inputs for higher-order analytics.

Keywords: Cloud-based surveillance system; network video analytics (NVA); computer vision; artificial intelligence (AI); China.

INTRODUCTION

The People's Republic of China government has promised to spend a lot of money on building advanced surveillance systems to keep the city under control and keep the people safe. This technology is also a key part of the fast digital transformation that is happening all throughout the nation. More and more people are learning about the problems with traditional monitoring systems since the idea of smart cities is becoming more prominent. These systems, which largely depend on people and local technology to run, are become less and less capable over

time. Municipalities in modern China have more extensive and sophisticated security demands than they ever had before. These old systems can't collect, store, and analyse data to the level that is needed to fulfil the security needs of contemporary Chinese cities, which are becoming more complicated and changing all the time. One possible solution to these problems is to deploy more cloud-based surveillance technologies. One way these systems have become better is by adding new features to them. These new talents let the systems handle data over large metropolitan networks, get data in real time, and store data (Ullah et al., 2024).

Ever since the early days of this technology-driven change, NVA has been an important tool for analysing video data and turning it into useful information. The ability to get little cars in big cities is a big plus. This specific capability is often used in situations like the current one. Inside NVA, one may find a long number of useful parts. Some examples include seeing patterns that are out of the ordinary, seeing motion, judging behaviour, and recognising faces. That stated, for NVA to work well, it has to integrate important parts of computer vision. To make sure the system can reliably identify, sort, and rate visual input, these parts are needed. The criteria that assist preserve the integrity of systems in the cloud are exactly the same as the results one want to get from using advanced analytics (Al-Jumaili et al., 2023). The objective of this study is to ascertain if the incorporation of fundamental computer vision capabilities into cloud-based surveillance systems would enhance operations that do not provide value. This study seeks to evaluate the limits and promise of the research by situating the inquiry within the context of China's swiftly digitising security landscape. In further detail, it will focus more on following the rules, the potential for growth, and efficiency.

BACKGROUND OF THE STUDY

The Chinese government wants to make cities more urbanised, and smart cities are growing quickly throughout the country. This has led to the widespread use of smart monitoring systems in China. The truth is that standard monitoring systems can't meet all of the security demands that are so common in today's society. This is the case even if these old systems are still widely used. They can't provide real-time predictive insights since they require servers on site and someone to watch over them. Because of all of these problems, they can't make their businesses much bigger than they already are. Cloud-based surveillance systems are very popular because they let one see data from anywhere, let choose how to store it, and let manage it all from one place. All of these parts have worked together to help the entire country migrate to a digital format (Yadav et al., 2022). NVA is a cutting-edge technology that helps surveillance systems do things that go beyond just watching. This is how these systems are able to take charge and handle security issues in a manner that looks to the future. The NVA has a lot of different responsibilities and extremely sophisticated powers. Some of these skills include the capacity to tell the difference between various faces, the ability to perceive movement, and the ability to judge behaviour, among others. The following skills make it much simpler to cope with the problems of keeping public places clean and managing large groups of people in cities.

Conduction of NVA, one need to integrate the essential parts of computer vision that are important for correctly categorising and analysing visual data (Nagy & Lăzăroiu, 2022).

Assessment of the challenges and roadblocks that come up when combining cloud-based systems with computer vision skills can be difficult as well as an intriguing task. While attending to a more scalable and efficient system, it also increase concerns about data security and latency, following constantly changing governmental regulations (Atadoga et al., 2024). Following this, this study emphasised to determine the viability of integrating cloud-based monitoring systems as a means to assess NVA's capacity to fulfil China's goals for smart cities and public safety.

THE PURPOSE OF THE RESEARCH

The aim of this research is to investigate the possible advantages of incorporating fundamental computer vision functionalities into cloud-based surveillance systems for the execution of NVA in China. China is making great strides in the creation of smart cities and urban surveillance networks. It is very important that the government discover ways to manufacture technology that is not only more sophisticated but also can be used by more people. It is important for cloud infrastructures to have adequate storage space and processing power to make sure that the system can be fully monitored. Also, they need to be able to make analysis when the events are happening. Because of this, students have to figure out how to learn about computer vision on their own. NVA can provide information that is not only predictive and proactive, but also goes beyond what passive monitoring can do. It achieves this by employing skills including behavioural analysis, anomaly detection, and object identification. When individuals operate together as a team, they face a lot of different problems. The main purpose of this study is to learn more about these problems. This paper talks about worries about broadband's limits, latency, and the fact that Chinese data legislation may change quickly. These fears generally have all of these things in common. This study aims to evaluate the positive and negative associations with the use of cloud-based technology to o determine whether these solutions can fulfil NVA's processing requirements while adhering to national data security rules.

LITERATURE REVIEW

China is working on building smart cities and improving its digital infrastructure at the same time as it is working on technology for monitoring. Even though traditional monitoring systems are used a lot, they have been shown time and time again to not be able to learn, adapt, and evolve as needed. These devices are unlikely to be able to do anything right away; they can only record footage for later examination. The problem that was mentioned above is the main reason why cloud-hosted monitoring solutions are becoming more popular. These systems have the ability to centralise control, add more storage space, and change the size of the system to fit the demands of the metropolis. People employ large networks to keep an eye on the cities around China. These monitoring networks will be the building blocks of the security systems of the

future. The cloud infrastructure in China is not only extremely simple to use, but it is also quite efficient (Golightly et al., 2022). Because of the growth of NVA, it is now feasible to sort through huge amounts of unprocessed video data and send just the most useful information. This has changed the realm of monitoring. Crowd behaviour analysis, facial identification, and the detection of irregularities are very important in Chinese megacities since it is hard to keep an eye on big public events, mass transportation hubs, and urban mobility. The idea that NVA enhances situational awareness; yet, for NVA to function effectively, systems must be able to correctly recognise and process visual information (Nilsson, 2023).

The results of this study show that it is possible for cloud computing platforms to have the processing power needed to handle a lot of workloads. The results of this study back up the idea. If this were to happen, which is quite rare, the property could need to buy technology that is far less expensive. Using cloud resources may help with scalability since they let surveillance systems spread tasks over several servers. This technology also makes it possible to do analytics in real time. The research did, in fact, warn about the difficulties that may happen as a consequence. This group includes problems including poor network connections, security vulnerabilities in centralised data, and not enough data transfer. The Chinese Cybersecurity Law and the Chinese Data Security Law both have very strict rules on how sensitive surveillance data may be used. Because of these rules, it's harder to handle issues that include private information (Creemers, 2022). More and more individuals are looking at NVA and cloud-based monitoring. Right now, each of these technologies is being looked at on its own. Conversely, researchers have shown less interest in using computer vision to facilitate the integration of the two. There is a lack of extensive study investigating the implications of computer vision capabilities in China. This is particularly true now, when new technology is being adopted more slowly because of legal and technological problems (Zhang, 2022). As part of this inquiry, an evaluation will be performed on the functionalities of cloud-based surveillance systems that have essential computer vision capabilities to address this need. The final goal is to make the NVA better. By employing these methods, it could be possible to set up a monitoring environment in China that is legal, smart, and able to grow.

RESEARCH QUESTION

What is the influence of necessary computer vision functionalities on Network Video Analytics?

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 strength and direction of the statistical association. The researchers established statistical significance at $p < 0.05$. Thorough examination resulted in the discovery of the data's principal attributes. Data obtained by surveys, polls, and questionnaires, together with information analysed using computing tools for statistical evaluation, is often analysed using quantitative methods.

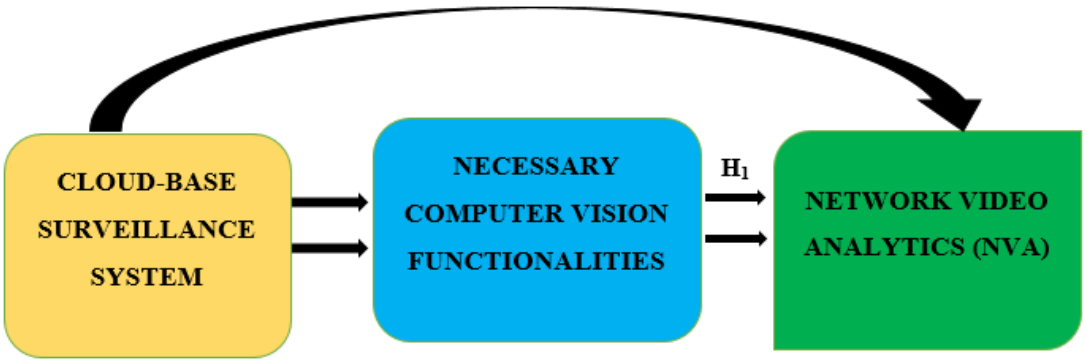
Sampling: To augment the data gathered from the study, research participants were requested to complete questionnaires. Employing the Rao-soft methodology, researchers determined that 657 individuals participated in the study. The authors of the research distributed 900 questionnaires to individuals from the general community. The researchers began with 823 responses and retained 750 after excluding 73 incomplete submissions.

Data and Measurement: The primary data used in the study was obtained via a survey questionnaire. The researcher need essential demographic information about participants initially. The participants used a 5-point Likert scale to evaluate the physical and online channels. During their secondary data collection, the researchers meticulously assessed several sources, mostly internet databases.

Statistical Software: The statistical analysis was carried out using SPSS 25 and Excel from Microsoft.

Statistical Tools: Descriptive analysis helped the researcher get a fundamental understanding of the data. The researcher has to look at the data using ANOVA.

CONCEPTUAL FRAMEWORK



RESULT

Factor Analysis: A prevalent use of Factor Analysis (FA) is to investigate the fundamental component structure of a set of measurement items. It is posited that subtle factors influence the observable variable scores. The FA approach is a model-driven strategy. The fundamental objective of this study was to identify links among visible phenomena, underlying causes, and measurement inaccuracies. The Kaiser-Meyer-Olkin (KMO) Method may be used to assess the appropriateness of data for factor analysis. The researcher assess if the sample size is sufficient for the overall model and for each specific variable. Statistical approaches enable the quantification of shared variation across several variables. In most instances, it is more suitable to use data with diminished percentages for factor analysis.

The KMO output is an integer ranging from 0 to 1. A KMO score ranging from 0.8 to 1 indicates adequate sampling.

A KMO value below 0.6 indicates an inadequate sample, necessitating remedial measures. Exercise the best judgement; for this objective, some authors opt for 0.5, resulting in a range of 0.5 to 0.6.

The partial correlations are statistically significant for the overall correlations if the KMO score approaches zero. To restate, substantial correlations significantly obstruct component analysis.

Kaiser has set the following entry standards: A terrible range of 0.050 to 0.059.

An inadequate range is 0.60 to 0.69.

A middling grade often ranges from 0.70 to 0.79.

A quality point score between 0.80 and 0.89.

There is a significant difference between 0.90 and 1.00.

Table 2. 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 about the execution of a sample. The researchers used Bartlett's Test of Sphericity to ascertain the relevance of the correlation matrices. A KMO measure result of 0.923 indicates that the sample is deemed satisfactory. The p-value from Bartlett's sphericity test is 0.00. The correlation matrix diverges from an identity matrix, shown by statistically significant outcomes from Bartlett's sphericity test.

MEDIATING VARIABLE

Necessary computer vision functionalities: Computer vision is an important feature of both intelligent video analysis and the creation of current surveillance systems. It is essential for intelligent video analysis to be a viable alternative. People have the skills to employ a number of different methods to get information from material that has been given to them in a visual way. Some of the many uses for these tactics include finding goods, figuring out how crowds behave, telling people apart, keeping an eye on movements, and finding strange things. However, these are not the only times these strategies are used. In Chinese cities, where there are a lot of people and buildings, these kinds of skills are quite important. They provide individuals the power to

predict what will happen in the future and to witness changes as they unfold. Surveillance equipment may only employ passive data gathering to acquire information (Zwerts et al., 2021).

Computer vision characteristics are what connect the results of NVA with infrastructure, such cloud-based platforms. They are in charge of handling the outputs that come from the NVA. They are in charge of deciding what smart insights the cloud can provide. This means recognising the effects of these ideas, processing and understanding them, and then passing them on to others. As soon as these important parts are included, the NVA's accuracy, efficiency, and scalability are all affected right away. Because of advances in AI and machine learning, computer vision has become a technology that is growing more important, and intelligent surveillance has grown more reliant on it. These accomplishments have paved the way for more enhancements in both accuracy and flexibility. In the framework of China's surveillance environment, computer vision functions connect technical systems with analytical performance (Zhou et al., 2025).

DEPENDENT VARIABLE

Network Video Analytics (NVA): NVA uses advanced algorithms and methods that are based on AI to look at data from video surveillance. Computers can now accomplish things like find particular information in data sets and analyse pictures, to name a few. The NVA offers a lot of sophisticated surveillance tools, such as behaviour analysis, face recognition, and motion detection. What makes it distinct from other systems is that it can do more than just record and play back video. NVA is very important to the Chinese people who live in cities, use public places, and travel by public transit. This is because it offers several advantages, such as better situational awareness, more effective law enforcement, and safer communities (Wang et al., 2021). NVA relies heavily on computer vision technology, thus it has to be very precise and easy to get. The NVA can tell people apart, see patterns in difficult situations, and find strange actions without any help from others. Cloud-based infrastructures are becoming increasingly significant for the scalability of NVA since they can handle the huge amounts of data that are being created. Researchers in this field utilise NVA as the dependent variable since it is the ultimate product of combining cloud computing with computer vision. To be successful in a Chinese firm, one need to cope with cybersecurity concerns, quickly adapt to new technologies, and keep up with the rules that are always changing (Sacks & Li, 2022).

Relationship between necessary computer vision functionalities and Network Video Analytics: NVA and computer vision function well together. They are responsible for doing their jobs to the best of their ability, and they depend on each other to do so. NVA is a way to turn unstructured data from computer vision into information that can be used to examine visual films. Using this method makes it possible to keep a wider view of the problems that need to be solved. In practical scenarios, the extent to which the capability to accurately identify things at close range is beneficial is closely linked to the precision, effectiveness, and efficiency of computer vision systems. This includes things like watching what other individuals do, naming things, and seeing times when something doesn't make sense. One of the problems that has

come up with putting the NVRA into action is making sure that monitoring is both up-to-date and thorough, especially when it comes to NVA.

The partnership is very important since China has so many professional surveillance networks that cover a huge area. Computer vision is an extremely useful skill that may be utilised in many different fields. Computer vision can accomplish a lot of different things, such as keeping people safe, keeping an eye on traffic, and controlling crowds, to name a few. This is because it can quickly comprehend a lot of difficult information. The grade a student gets in computer vision is closely linked to how reliable the NVA they utilise is. Recent advancements in machine learning have greatly increased the NVA capacity to tackle challenges that are common in big cities, which are always changing and creating a large number of problems. Overall, the connection shows that NVA's computer vision technology is highly important for making China's smart surveillance environment better (Bernot & Smith, 2023).

In light of this context, the study's main aim was to investigate the relationship between Network Video Analytics and fundamental computer vision functionalities.

"H_{01}: There is no significant relationship between necessary computer vision functionalities and Network Video Analytics."

"H_1: There is a significant relationship between necessary computer vision functionalities and Network Video Analytics."

Table 2. H1 ANOVA Test.

ANOVA					
Sum					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	42962.869	337	5978.948	1069.196	.000
Within Groups	597.984	412	5.592		
Total	43560.853	749			

This discovery is significant in this study. The significance criterion is met with an F-value of 1069.196, since the p-value of 0.000 is below the 0.05 alpha threshold. The researcher accepts **"H_1: There is a significant relationship between necessary computer vision functionalities and Network Video Analytics"** subsequent to the rejection of the null hypothesis.

DISCUSSION

This study's results indicate that the incorporation of NVA into cloud-based surveillance systems requires the establishment of an adequate array of computer vision capabilities. Computer vision is not only a simple technical improvement; it is also a strategic imperative for

China's quickly growing surveillance infrastructure. The building of smart cities and the protection of national security are two major goals that depend on computer vision as a key part. This is what caused this to happen. Computer vision includes things like facial recognition, behavioural analysis, and the capacity to find problems. This is why computer vision is such an important part of NVA's attempts to construct higher-order intelligence. It seems that the sector cannot achieve its full potential due to the limitations imposed by the computer vision methodologies used during the training of NVA. This dependence enables the derivation of an identical conclusion. The People's Republic of China has earned a lot of money on cloud computing and AI, which has led to big achievements. Still, there are a lot of problems that need to be fixed. There are several kinds of issues that might come up, such as invading privacy, algorithmic discrimination, and the difficulties that come with using computers. To prevent any vulnerabilities from arising due to the large amounts of data acquired by state surveillance networks, it is very important to put rigorous limits on cybersecurity, transmission, and storage. Furthermore, China has to enhance its technological infrastructure and come up with appropriate methods to innovate in order to successfully add new value-added applications to cloud-based technology.

CONCLUSION

The research shows that China is more likely to pick cloud-based surveillance systems that include important computer vision features, such as NVA. This is one reason why NVA can't handle smart public service management, smart governance, and urban safety all at once. The government and AI have presumably spent a lot of money into this. To maintain computer vision and NVA operating together, it is highly necessary to develop new technical breakthroughs on a regular basis. When designing a full plan, one should consider about social responsibility as well as if the regulations are being followed and whether the technology is feasible. This plan might help China gain the advantages of cloud-based monitoring without having to cope with the problems that come with depending too much on automated decision-making. The findings imply that China has to make a lot of changes to its administrative processes and enhance its technical skills if it wants to keep performing at the same level. These adjustments are especially critical for making its creative value agriculture more accountable, accessible, and predictable.

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