

**A RESEARCH TO EXAMINE THE FEASIBILITY OF  
INCORPORATING ESSENTIAL COMPUTER VISION CAPABILITIES  
FROM NETWORK VIDEO ANALYTICS (NVA) INTO A CLOUD-  
BASED SURVEILLANCE SYSTEM**

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**ABSTRACT**

As China's smart city projects and digital governance grow swiftly, there is a growing demand for smart surveillance systems that are both proactive and forward-thinking. But there are a few problems with standard surveillance systems. For example, these systems can't grow, need to use equipment that is already on site, and can't process information in real time. There are several reasons why more and more individuals are opting to use cloud-based monitoring services. They have a number of skills, including being able to centralise, move about, and grow on these systems. At first, Network Video Analytics (NVA) could accomplish a number of various things. These skills included, but were not limited to, identifying faces, seeing motion, locating weird items, and keeping a watch on groups of people. This research looks at how Chinese cloud technology may be used to add computer vision capabilities to surveillance systems. The study demonstrates that cloud computing and video analytics are compatible and may be employed concurrently without issues. Cloud computing can manage the processing that is required to perform complicated algorithms. Computer vision, on the other hand, is helpful since it makes surveillance duties smarter and more efficient. Several problems has included factors such as China's often changing rules around cybersecurity and data protection, as well as its restricted bandwidth and suboptimal networks. The findings of the study is that integration of cloud-based technology into non-value-adding employment is consistent with China's objectives for modernisation and improved digital advancement, notwithstanding the challenges that need resolution. This technology might transform how China does surveillance

if the government invests a lot of money on safety infrastructure and updates the legislation to fit current norms in the context of the research.

**Keywords:** Cloud-based surveillance system; Network Video Analytics (NVA); Computer vision; Data governance; Cybersecurity; China

## 1. INTRODUCTION

The People's Republic of China is spending a lot of money on surveillance technologies to reach its objective of becoming a smart city and going through a digital revolution. In recent years, there has been a big rise in the requirement for sophisticated surveillance systems since cities are growing quickly and public safety problems are becoming more complicated. In addition to being able to record events as they happen, these surveillance systems can also track events and activities and automate tasks. There are several reasons why conventional video surveillance systems are not as useful as they used to be. For instance, they can't develop quickly, they require local storage, and they need someone to keep an eye on them and take care of them. Because of these constraints, cloud-based monitoring technologies have gotten a lot of interest. For example, these technologies may save money, make it easier to manage everything from one place, and make things more flexible (Dara et al., 2024).

This technology development, known as NVA, became known to the public about the same time. Students learnt numerous important skills for computer vision, such as how to tell the difference between faces, look into strange actions, and tell the difference between various forms of movements. In China, it is customary to use surveillance networks to keep people safe, run local governments, and enforce the law. Because of this, these traits are particularly essential in that country. Few difficulties were identified to maintain efficiency, scalability, and cost in the system. NVA may be quite useful, they generally need the purchase of

highperformance hardware that may create serious difficulties in enhancement of surveillance capabilities (Badidi et al., 2023).

Adding NVA's computer vision capabilities to cloud-based monitoring systems has both good and bad effects. People are worried about China's tighter data protection rules, as well as problems with cybersecurity and delays in sending data. Even if smart, scalable, and responsive cybersecurity solutions are put in place, these fears will still be there (Dara et al., 2024). The goal of this investigation is to find out if this is a good way to integrate a system and to learn more about the different ways China could use cloud computing and video analytics to improve its surveillance capabilities.

## **2. BACKGROUND OF THE STUDY**

Using computer vision and artificial intelligence (AI) has led to unprecedented progress in the study and usage of surveillance technology. China is now the best country in the world when it comes to public safety frameworks, beating all other countries in the globe. If this want to stay up with the fast growth of cities in the country and the rise of smart city initiatives, it need to invest in surveillance technologies that go beyond basic video monitoring. Several shortcomings in traditional methods for fundamental monitoring and recording have been highlighted. Some of the problems that have been pointed out include that it can't be expanded, it doesn't have enough storage space, and it doesn't fulfil the criteria for real-time analytics. The number of surveillance systems in China has grown a lot since these systems can hold a lot of data, let one control devices from one place, and let one look at data from afar. The qualities that have been spoken about in the past are in line with the government's plan to safeguard the public's health and safety as well as the digital transformation (Lee et al., 2023).

During this time, NVA became a completely new field. To achieve this, computers need to be able to do things like tell the difference between different faces, figure out how dense crowds are, notice conduct that is out of the norm, and track the flow of traffic. The fast growth of Chinese cities and the fact that public places are hard to go about in have made it necessary to learn how to handle security intelligently and automatically. However, there are practical problems in the integration process of adding NVA activities to cloud-hosted monitoring systems. Additionally, cybersecurity, network capacity, data transmission delay, and amendments to China's data protection regulations are existing challenges requiring definitive solutions in modern times (Creemers, 2022). This study investigated the potential of integrating NVA's core computer vision functionalities with surveillance systems based on Chinese cloud infrastructure.

### **3. THE PURPOSE OF THE RESEARCH**

The goal of this research is to find out whether Chinese surveillance systems that run in the cloud can use NVA to add basic computer vision capabilities. If China genuinely wants to reach its smart city ambitions and follow its digital governance rules, it has to have surveillance equipment that is both affordable and can grow with its needs. This study conducted to determine the adequacy of the cloud computing system's infrastructure in fulfilling the processing and operational requirements of NVA. The examination looked at how data is sent, how the system is set up, and how long it takes to send data. The researcher also want to look at the possible benefits of leveraging these linked networks in a constructive manner. As a result, a number of Chinese communities have seen improvements in their safety and efficiency. This study is conducted to determine the extent to which the constraints of the physical environment restrict technological capabilities. The main purpose of this project is to figure out the best circumstances for monitoring that are depending on how the cloud is used. This kind

of surveillance might have several advantages, such as better detection and monitoring of the population and the capacity to discover problems in real time. Also, it tries to assuage any worries people may have about data security and privacy, as well as deal with any other problems that may come up because of the need to follow rules. Because the data governance environment in China is changing quickly, it is very important to keep all of these problems in mind. This study is very important because it shows how China may be able to employ computer vision and cloud computing to achieve its long-term goals. One of these goals is to create a digital society that is safer, more up-to-date, and always changing.

#### **4. LITERATURE REVIEW**

One plausible theory about the use of surveillance technology in China is its correlation with the creation of smart cities and a digital administration inside the nation. The data shows that conventional monitoring methods are quite popular, but they also can't keep up with how complicated cities are becoming these days. The basic idea behind their technique is that materials need to be stored nearby and watched after. One will have to stop looking for security breakthroughs and real-time insights for now. The cloud is a key part that experts say has made big strides in the field of monitoring feasible. This is because it can combine data storage, expand, and lower the costs of hardware. Because monitoring networks are everywhere in cities throughout China, the advantages of these networks are easier to see in certain regions than in others (Li et al., 2021).

A recent study shows that NVA might start a big change in how security systems are run. The findings of previous studies imply that when operators are real humans, they may be able to pay more attention and get more done by employing computer vision methods including facial recognition, motion detection, and anomaly detection. The Chinese government has been increasingly and consistently interested in how AI may be used to run and administer its cities.

NVA is being employed in a number of areas, such as traffic management, crowd control, and crime prevention, but not restricted to these. Previous research suggests that NVA has significant potential for success. But the same research have also shown that NVA needs a lot of computer power to work. This might be a problem that makes it harder to scale up the process (Singh et al., 2023).

When NVA are added to cloud-based monitoring systems, new opportunities and new problems come up at the same time. It can be thought that cloud computing is a big step forward from the old ways of doing things because it lets one perform analysis in more ways. One benefit of cloud computing is that it gives people access to a wide selection of cutting-edge AI apps. People are feeling anxious because of worries like data breaches, centralisation, and latency in real-time applications. All of these worries have come up because surveillance data is so private. To safeguard data security and personal privacy, the laws that have been put in place in China are becoming more and stricter. So, it is really important to do a full examination into these problems to find out whether they can be handled in China (Zhao & Feng, 2021).

There is a substantial knowledge deficit regarding the interplay between cloud monitoring in China and neighbourhood watch groups. At present time, each of these domains is being investigated; both domains are being examined separately from one another. One major problem is that there isn't enough research on how to shift the NVA important functions to the cloud without breaking any laws or making operations less effective (Neoaz, 2025). The goal of this research is to find out how China may employ cloud computing and video analytics to create a surveillance system that is both good for the environment and can be expanded.

## 5. RESEARCH QUESTION

- What is the influence of cloud-base surveillance system on necessary computer vision functionalities?

## 6. METHODOLOGY

### 6.1 Research Design

SPSS version 25 was used for the quantitative data analysis. Researchers assessed the magnitude and direction of the statistical association using an odds ratio and a 95% confidence interval. The researchers established a criteria of  $p < 0.05$  as statistically significant.

Following extensive investigation, the essential attributes of the data were revealed. Quantitative methods are often used for evaluating data collected from polls, questionnaires, and surveys, or data processed by computing tools for statistical evaluation.

### 6.2 Sampling

Research participants completed questionnaires to augment the study's data collection. Researchers determined that 657 individuals participated in the research using the Rao-soft approach. The researchers conducted a survey of the public using 900 questionnaires. Subsequent to the elimination of 73 incomplete replies, the researchers retained 750 responses from an initial total of 823.

### 6.3 Data and Measurement:

The predominant data used in the study was derived from a survey questionnaire. Initially, the researcher need the participant's essential demographic information. Subsequently, participants evaluated the online and offline channels using a 5-point Likert scale. In their secondary data collection, the researchers performed comprehensive assessments of various sources, mostly internet databases.

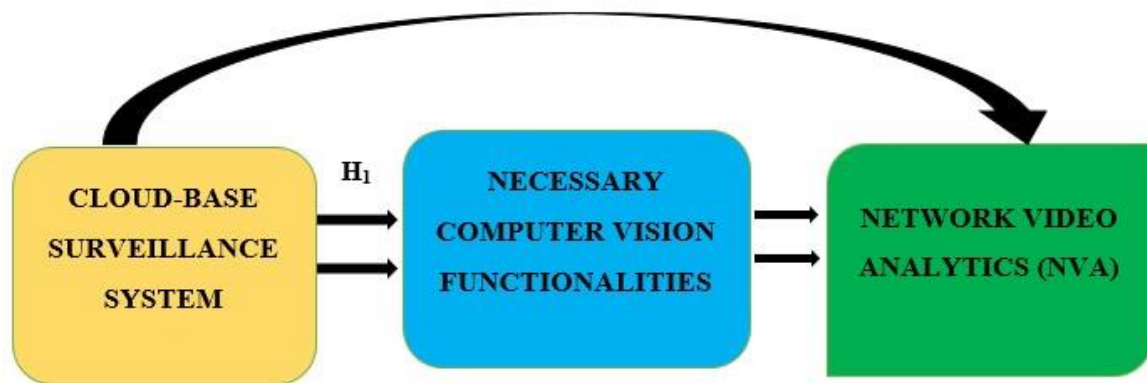
### 6.4 Statistical Software:

The statistical study was performed with SPSS 25 and Microsoft Excel.

### 6.5 Statistical Tools:

The researcher used descriptive analysis to understand the data on a basic level. Using ANOVA, the researcher must examine the data.

## 7. CONCEPTUAL FRAMEWORK



## 8. RESULT

### • Factor Analysis

Assessing the fundamental component structure of a set of measurement items is a prevalent use of Factor Analysis (FA). The scores of the observed variables are assumed to be modified by hidden factors that are not immediately apparent. The FA technique is a model-driven approach. This study largely focused on establishing causal pathways that connect observable events, latent causes, and measurement mistakes.

The appropriateness of the data for factor analysis may be assessed with the Kaiser-MeyerOlkin (KMO) Method. The adequacy of the sample for each individual model variable and the overall model is assessed. The statistics quantify the extent of possible common variation across many variables. Typically, data with diminished percentages is more suitable for factor analysis.

KMO produces integers between zero and one. Sampling is deemed adequate if the KMO value ranges from 0.8 to 1.

Remedial measures are necessary if the KMO is below 0.6, indicating inadequate sampling. Employ optimum judgement; some authors choose 0.5 for this aim, therefore creating a range of 0.5 to 0.6.

A KMO score around 0 indicates that the partial correlations are significant in respect to the overall correlations. Component analysis is considerably hindered by strong correlations, to restate.

The admission criteria set by Kaiser are as follows:

A dismal range of 0.050 to 0.059.

0.60 - 0.69 is considered as inadequate.

The standard range for a medium grade is 0.70 to 0.79.

A quality point value between 0.80 and 0.89.

The gap from 0.90 to 1.00 is extremely outstanding.

**Table 1: KMO and Bartlett's Test**

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

This verifies that assertions on the execution of a sample are authentic. Researchers used Bartlett's Test of Sphericity to evaluate the relevance of the correlation matrices. The KMO measure deems the sample satisfactory when the result attains 0.923. The p-value obtained from Bartlett's sphericity test is 0.00. Bartlett's sphericity test produces statistically significant findings, indicating that the correlation matrix diverges from an identity matrix.

## ‡ INDEPENDENT VARIABLE

### **Cloud-base surveillance system**

Cloud-based surveillance systems are a big step forward in security design since they are cheaper, more flexible, and easier to scale than traditional video monitoring systems. In cloudbased models, data storage and analysis are all done on distant platforms. This makes it easier to integrate and manage. On the other hand, traditional systems depend on hardware and servers that are close by. This centralisation allows China to efficiently monitor large-scale activities since networks that provide surveillance cover important infrastructure and major urban areas. Cloud systems can also observe and keep track of locations that are far apart from one other in real time. This feature helps make remote access even better. Also, the cloud helps cut down on expensive physical infrastructure, which fits with China's goal of becoming more creative and efficient via digital transformation. There will be certain obstacles that need to be conquered, and they should be handled very seriously. People are worried about the constraints that come with protecting data, the cybersecurity issues that may come up, and the delays that could arise when data is sent. Cloud-based monitoring is still an important part of China's security system's ongoing modernisation. This technology makes it feasible for surveillance systems at the national level to use the most current technical advances (Bernot, 2024).

## ‡ MEDIATING VARIABLE

### **Necessary computer vision functionalities**

To make surveillance systems smarter and more useful in today's society, they need to have computer vision parts added to them. Two of the traits that come under this category include the capacity to notice objects, faces, and strange things, as well as the ability to see how groups work. Because China has such a large population, it is important that proactive security

measures focus on building surveillance networks in public areas, big cities, and transportation hubs. They can do more than just take pictures; they can also see patterns and trends owing to the surveillance technology they utilise. They will be able to respond quickly if a dangerous scenario arises. It is important to know how many people are going to a big event in real time in order to make sure that everyone is safe. But keeping an eye on traffic patterns can also help people in the city move around. The underlying infrastructure's processing and scaling capabilities, on the other hand, have a big impact on how likely it is that computer vision will work. It is an unavoidable reality that traditional on-premises solutions will eventually encounter issues with flexibility and performance when tasked with resource-intensive operations. On this case, it is possible to add computer vision capabilities to systems that are hosted on the cloud. This is because cloud computing has made it possible to leverage dispersed computer resources that can handle both massive datasets and complicated algorithms. So, the features of cloud-based monitoring systems have a big impact on how well, how quickly, and how smart China's security measures are when it comes to running their government (Ahmad et al., 2021).

**• Relationship between cloud-base surveillance system on necessary computer vision functionalities**

Combining computer vision skills in a way that works for everyone is good for cloud-based surveillance systems. One need more than just processing power and storage capacity to meet the needs of the complex algorithms employed in computer vision. One may be able to get to all of these features using cloud-based infrastructures. Surveillance systems are becoming more advanced and can now perform more complex things, such monitoring movements in real time over large metropolitan networks, recognising faces, and spotting strange behaviour as a result. There are a lot of people living in this region, and it is home to several Chinese government

buildings, smart cities, and metro stations. This region also includes a lot of ways to keep an eye on things. These things make this place very important for connecting people. Combining surveillance devices with cloud-based computer vision might change the way security works completely. This fusion may turn passive monitoring into a more proactive and forwardthinking way to deal with security issues. At the same time, cloud-based solutions may become more efficient when they are utilised with computer visual intelligence by turning huge amounts of raw video data into useful information. Management of a full integration, a number of important issues need to be found and solved including bandwidth issues, keeping private data safe, and fixing problems with latency. Other than this, data governance systems in China, and the usefulness of these systems is greatly affected by how well they follow the rules. Additionally, China may set up a central monitoring system that uses both cloud computing and computer vision to give smart, long-term, and effective security solutions (Alsayfi et al., 2022).

In light of the above, the researcher set out to test the following hypothesis: examine the impact of cloud-based surveillance systems on critical computer vision capabilities.

***“H<sub>01</sub>: There is no significant relationship between cloud-base surveillance systems and necessary computer vision functionalities.”***

***“H<sub>1</sub>: There is a significant relationship between cloud-base surveillance systems and necessary computer vision functionalities.”***

Table 2:  $H_1$  ANOVA Test

ANOVA					
Sum					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	40946.286	262	5184.283	920.995	.000
Within Groups	646.827	487	5.629		
Total	41593.113	749			

This discovery is significant in this study. The p-value of .000, which is below the .05 alpha level, indicates that the significance criterion is met with an F-value of 920.995. By rejecting the null hypothesis, the researcher conclude that " *$H_1$ : There is a significant relationship between cloud-base surveillance systems and necessary computer vision functionalities*" may be accepted.

## 9. DISCUSSION

Adding computer vision to NVA in cloud-based surveillance systems might make smart city systems in China safer for people. Some of the perks include being able to find things in real time, observe how people act all throughout the city, and recognising objects. The cloud infrastructure is quite strong and big, which makes all of these functions feasible. This technology may be used to build smart platforms that can gather and share data from current systems in a proactive fashion in countries with a lot of monitoring networks. One also need to think a lot about the more practical parts of putting things together. Cloud-based distributed computing has a lot of good points, but it also has some big problems, such sluggish networks and not enough capacity. There are still a lot of obstacles with making apps that employ realtime computing, and these problems are preventing big steps forward from happening. There are more individuals utilising monitoring data today, which makes the internet less safe and private.

This fits with China's ambitions to make its data security and governance rules better. The best way to run a company is to meticulously follow the laws and build a strong foundation that can handle any problems that may come up. There are many more benefits to combining computer vision with cloud-based monitoring than simply the most apparent one. If China takes full use of this opportunity, it will be able to build better infrastructure, set rules that safeguard data while also fostering new ideas, and build systems that people can trust more.

## 10. CONCLUSION

In conclusion, the integration of cloud-based surveillance systems in China with computer vision functionalities derived from NVA. The study findings demonstrate that several industries would significantly benefit from this kind of integration. These include initiatives to make cities smarter, programs to make large-scale monitoring networks operate better, and attempts to make public safety better. Computer vision technologies might greatly improve surveillance operations. There is a chance that this kind of technology might greatly improve these operations' capacity to collect information and adjust to a wide variety of possible situations. If the cloud computing infrastructure can handle their needs in terms of scalability and processing power, they could also be able to undertake sophisticated analysis at the same time. The research said that among of the biggest problems include keeping up with China's constantly changing rules and finding a way to deal with concerns about bandwidth and latency. When one look at all of this information, it becomes clear that one need to come up with ways to limit technological progress and the risks that come with it. The improvement of video analytics using cloud computing gives China a great chance to reach its long-term objectives of sustainable local government and digital modernisation. It is reasonable to think that China would take the lead in intelligent surveillance as the Chinese government has been spending a lot of money and developing new rules in this area.

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