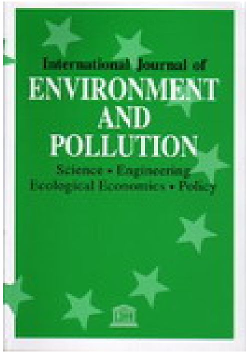

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Generation of virtual reality landscape scenes for digital urban architecture based on AI

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Abstract: This paper presents a new intelligent modelling method based on artificial intelligence and virtual reality technology to solve the problems of low efficiency, low accuracy and low resource utilisation in the traditional 3D modelling of digital city buildings. On the one hand, this technology can provide certain auxiliary effects on urban construction. On the other hand, it can complete safety drills for urban transportation, tourism promotion, and various major emergencies through simulation in VR urban architectural scenes. This paper mainly used relevant algorithms from machine learning (ML) in AI technology and computer vision (CV) technology to generate VR landscape scenes for digital urban architecture. Among them, ML has provided a data processing model for constructing VR landscape scenes of digital urban architecture, while CV technology has completed the preliminary modelling work of digital urban architecture by scanning architectural drawings or building entities. Experimental results demonstrate that the proposed method achieves a median geometric error of merely 0.034 metres in 3D reconstruction, with semantic segmentation accuracy reaching 96.3%. In complex scenarios, the modelling process completes in just 6.9 h while maintaining texture accuracy down to 1.8 pixels. The study reveals that integrating AI and VR technologies enables efficient and high-precision generation of virtual architectural landscapes for digital cities. This approach significantly enhances modelling automation and model realism, providing a practical technical solution for smart city development.

Keywords: virtual scene generation; digital city architecture; artificial intelligence; virtual reality; machine learning.

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1 Introduction

With the high-quality development of the economy in multiple regions and the rapid progress of intelligent technology in the current era, the scale of cities in multiple regions is also further expanding. The first problem brought about by urban expansion is the management and control of various projects in the city, which further reduces the efficiency of urban engineering management and control. At this point, the integration of new intelligent technologies is needed to improve the various negative impacts brought about by the expansion of urban scale. It is specifically manifested as: the sharp increase of infrastructure load leads to the decline of operation efficiency, the uneven distribution of public resources aggravates the imbalance of regional development, the rapid increase of the number of construction projects makes it difficult for traditional supervision methods to cope with, and the difficulty of emergency response to public emergencies is significantly increased. Therefore, researchers in related fields are considering integrating AI and VR technologies into the management of urban multi engineering. The city is scanned by AI technology and VR technology, and a three-dimensional digital city architectural model is built in the virtual network. This model can assist city managers in fine-grained management and control of various aspects of public facilities in the city with higher efficiency.

This paper conducted a deep analysis of the existing 3D (three dimensional) urban modelling technology. This analysis could not only clarify the shortcomings of the existing 3D urban modelling technology, but also select appropriate intelligent technologies based on these shortcomings to provide theoretical support for the new digital urban building modelling model. Therefore, this paper integrated AI technology and VR technology with existing 3D urban modelling technologies, and used CV technology in AI technology to complete more precise scanning of urban buildings. Meanwhile, during this scanning process, the relevant algorithm models in AI technology were relied on to process the scanned image data, further improving the overall work efficiency. In addition, VR technology was used to digitise the virtual model of urban buildings based on processed data. This model construction that integrates VR technology can ensure the authenticity of the model. The core research questions addressed in this paper are as follows:

1 how to effectively integrate computer vision and machine learning algorithms into the existing virtual reality modelling process

2 what are the significant advantages of the proposed method over traditional 3D modelling techniques in terms of resource consumption and scalability?

2 Related work

Some researchers in related fields have first explored the application of VR technology in architecture in the current society, and verified the application ideas of various VR technologies in architecture. Safikhani et al. (2022) systematically reviewed recent research on VR applications in BIM, highlighting how virtual reality can provide additional functionalities previously unavailable or impractical for BIM implementation. Hajirasouli et al. (2024) developed a BIM-based VR teaching framework for architectural studio courses, demonstrating that technology-enhanced and digital teaching methodologies can be successfully implemented in architectural design studios. Zhang et al. (2022) utilised SketchUp for modelling and digital cameras for continuous digital photography, merging multiple digital landscape images into a complete panoramic view before importing the simplified model into a virtual reality platform to adjust material textures and scene lighting. Wang (2025) explored the application of environmental perception technology and virtual reality in urban landscape design, aiming to address challenges in traditional design processes such as insufficient data collection, lack of display and interaction methods, disconnection between design and real-world environments, and difficulties in multi-disciplinary collaboration. Ji et al. (2025) proposed a green landscape spatial optimisation design scheme based on virtual generation algorithms. By applying these algorithms, the study optimises the virtual generation of building and landscape dimensions, with optimisation objectives including the cost of public facilities such as buildings and green belts. The proof of these VR technology application ideas shows that a VR urban architectural model can play a better role in social and economic development.

In addition, some researchers in related fields have conducted research on the further development ideas of VR technology, and explored the development mode of combining AI technology with VR technology. Rodriguez et al. (2025) explored architectural innovation through new technologies, focusing on the integration of artificial intelligence (AI) and virtual reality (VR) in architectural design. This approach considers architects' perception of virtual spaces during decision-making processes. Regona et al. (2022) views AI as a powerful technology with diverse capabilities, noting its growing adoption in the construction industry. Meanwhile, Ma et al. (2022) highlighted the accelerating development of new energy landscape design, where research and design have become a focal point. This field incorporates environmental analysis and edge-driven AI-powered soft multimedia to assist in landscape design for new energy production. Budi et al. (2021) explored the trend of the application of VR technology in social knowledge learning, and confirmed the reliability of this VR technology application through data analysis. Mariano et al. (2022) validated the feasibility of a method for identifying something by combining VR technology and ML, and combined this method with multiple operating modes.

However, most of these studies have not conducted in-depth research on the combination mode of the two technologies in the establishment of digital urban architectural models.

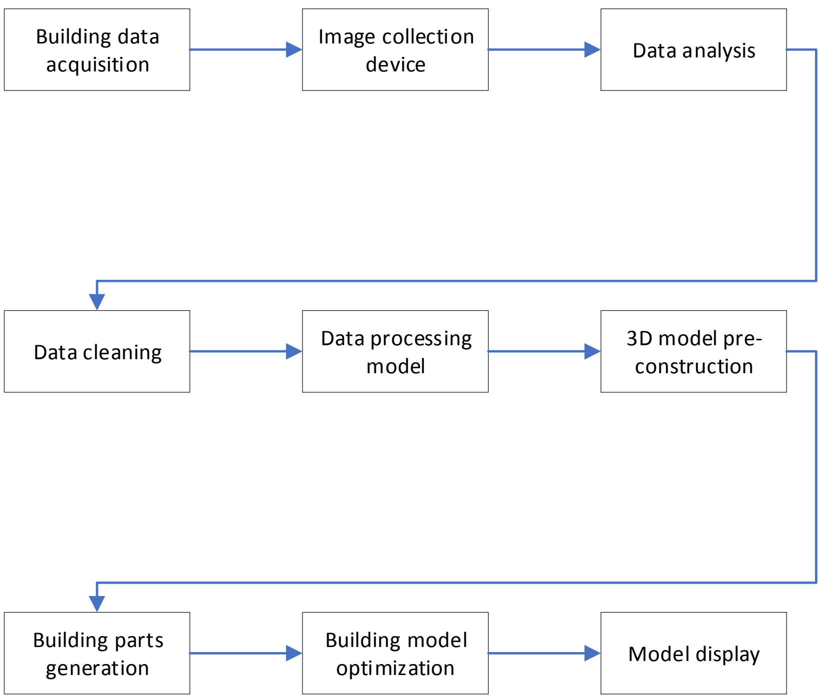
3 Generation of a digital urban architectural scene constructed by AI

The emergence of AI technology in the current society not only represents that some information technologies have reached a sufficiently mature level, but also indicates that the information society is beginning to transform towards an intelligent society. This transformation has enabled multiple industries in society to embrace intelligent operation models, while also providing a more excellent driving force for the economic development of multiple industries in society (Fakahani et al., 2022). The rise and development speed of AI technology is rapidly increasing over time, especially in technologies such as ML, CV, and neural networks. Among them, ML technology is mainly an algorithm model that enables computers to have automated learning capabilities through the analysis and processing of a large amount of related data. This model can automatically distinguish the regularity between data in a large amount of related data, and use this regularity to predict unknown data (Cao and Li, 2022). In addition, CV technology in AI technology is a technology that helps computers possess visual abilities. This technology can help computers extract useful information from different types of images and videos, and provide recommendations to users based on the results of analysing this information. CV technology mainly completes the target work in a short time through some intelligent cameras and related algorithms in this technology. Therefore, in many industries in real life, it can complete the detection of product defects with higher quality in a shorter time. Computer vision technology, by integrating high-resolution industrial cameras with deep learning algorithms, has achieved efficient automated quality inspection in manufacturing, agriculture, and healthcare sectors. This vision-based intelligent judgement capability has significantly improved defect detection accuracy and efficiency, becoming a key technology driving industrial intelligent upgrading.

VR technology is a computer technology in current society that can digitise various objects. This technology typically uses current computer software to analyse and process entities in the material world, ensuring that these entities can achieve the expected results. At present, VR technology is applied in people's lives through multiple types of devices, enabling real-time updates and optimisation of products in multiple fields of society. VR technology has been widely used in urban planning, industrial simulation, medical training, cultural education and real estate marketing through head-mounted displays, data gloves and panoramic cameras. This optimisation ultimately greatly promotes the economic development speed of multiple industries in society. VR technology has deep applications in both hardware manufacturing and software development in daily life. Some devices derived from VR technology for achieving digital display of objects also have in-depth applications in hardware equipment manufacturing and software development. The first step is to digitise the display of the final product of hardware through VR technology and related equipment in hardware manufacturing. During this presentation, it is able to analyse the defects present in the hardware. In software development, it is also possible to visually demonstrate data processing capabilities.

This paper mainly studies the generation of a VR landscape scene for digital urban architecture. Through research on the VR landscape scene generation mode of existing digital urban buildings, it is first determined that the work efficiency and resource utilisation rate of the existing generation mode cannot achieve the expected goals. Therefore, this paper explores the integration of AI technology into the existing VR landscape scene generation mode of digital urban buildings, in order to improve the work efficiency and resource utilisation of the existing VR landscape scene generation mode of digital urban buildings. In optimising the VR landscape scene generation mode of existing digital city buildings, the CV technology and ML algorithm model in AI technology are mainly used. Firstly, the pre-construction scanning part of the existing VR landscape scene generation mode is replaced by CV technology, and the scanning work of urban buildings is completed by the relevant equipment and image processing algorithms in CV technology (Fernberg and Chamberlain, 2023). Then, the data processing model in the VR landscape scene generation mode of existing digital urban buildings is optimised. This optimisation mainly involves replacing the algorithm in the ML algorithm model with the data processing model in the existing VR landscape scene generation mode. The process of generating VR landscape scenes for a digital urban building built using AI technology is shown in Figure 1.

Figure 1 Schematic diagram of the process of generating a VR landscape scene of a digital city building built by AI technology (see online version for colours)



4 AI and VR landscape scene generation mode algorithms

With the rapid development of AI technology, it is also being applied in more and more traditional industries. These industries combine AI technology with their various work modes to significantly improve the work efficiency of relevant personnel in the industry. VR technology, as an emerging information technology that has emerged in recent times, has been deeply applied in industries in multiple regions. However, current VR technology is limited by various factors such as computer costs, and its display performance cannot achieve the best results. Beyond the cost of computer hardware, VR technology currently faces multiple limitations: insufficient real-time rendering and realism in graphics, unnatural user interaction methods, motion sickness and discomfort from wearing devices, and inefficient creation of high-quality 3D models. These bottlenecks collectively restrict the immersive experience and accessibility of VR. The advantages of AI technology in image generation, motion prediction, and automated model construction are emerging as key pathways to overcome these constraints.

Therefore, some researchers are exploring the combination of AI technology and VR technology. This combination promotes excellent algorithm models in AI technology to replace data processing algorithms in VR technology, thereby improving the ability and efficiency of image and data processing algorithms in VR technology. During this replacement process, the relevant algorithm models in ML in AI technology are mainly used. The data analysis and processing work in VR models is generally completed by linear regression algorithms and decision tree algorithms.

In VR modelling workflows, linear regression algorithms are primarily used to predict coordinate offset parameters for texture mapping of architectural components, thereby optimising texture mapping accuracy. Decision trees are employed to perform semantic classification on point clouds, automatically identifying and separating elements such as building structures, windows, and vegetation. This significantly enhances structural accuracy in 3D model reconstruction and improves post-editing efficiency. The integration of these two algorithms effectively replaces traditional manual parameter adjustments and classification processes, enabling efficient and automated conversion from raw data to standardised modular models.

Firstly, the ML linear regression algorithm model in AI technology is used to model and analyse the correlation between collected multiple independent and dependent variable data. This analysis is generally composed of a combination of one or more linear model parameters with regression coefficients. The first step is to establish a linear regression formula, as shown in formula (1).

$$H = \sum_{i=1}^{n} w_i * x_i \tag{1}$$

Among them, H is the predicted output value, n represents the characteristic values in the sample data, represents the characteristic values of the sample data, and represents the coefficients of the sample data. Then it is necessary to calculate the loss value in the process of sample data operation, which generally needs to be calculated using the loss function. During the formula operation process, this error is gradually minimised.

When selecting machine learning algorithms, this study prioritises their adaptability to 3D spatial data and processing efficiency. Linear regression, with its simple model and high computational efficiency, proves effective for rapidly fitting texture mapping parameters of architectural components from massive point cloud datasets. Decision trees, leveraging their inherent interpretability for high-dimensional features and robust classification performance, efficiently handle semantic segmentation tasks for irregular architectural point clouds. This approach not only maintains model accuracy but also significantly enhances the automation level of 3D reconstruction. The error optimisation formula is shown in formula (2).

$$J = \frac{1}{2} \sum_{i=1}^{n} (y - \theta_i * x_i)^2 \tag{2}$$

In the formula, represents a predicted value of the sample data, while y represents the true value. *J* is the loss value, and y is the true value. Next, a decision tree algorithm model is used to analyse multiple types of data during the VR model establishment process, in order to provide accurate decision-making for the establishment of the VR model. Firstly, the purity of the sample dataset during the model establishment process is calculated, as shown in formula (3).

$$E = \sum_{i=1}^{y} p_i \log_2 p \tag{3}$$

Among them, represents the proportion of the *i*th category of sample data in the sample dataset. *E* is the information entropy. Then, the weight values of the sample size set are calculated, as shown in formula (4).

$$G = E - \sum_{i=1}^{v} p_i E \tag{4}$$

Among them, *v* mainly represents the possible values of the sample data. *G* is the information gain. Next, an exponential calculation formula is used to calculate the probability of inconsistent identification of sample data, which can also directly reflect the purity of the sample data, as shown in formula (5).

$$Gi = 1 - \sum_{i=1}^{y} p_i^2 \tag{5}$$

Gi is the Gini index. By integrating the aforementioned AI computing model, VR technology not only improves the efficiency of model building algorithms, but also enables the establishment of VR models of the same scale with less computational costs. This performance optimisation enables VR models to gradually penetrate into multiple levels of society, providing more convenience for people in these industries in their work. The performance optimisation of VR models is driving their widespread adoption across urban planning, real estate visualisation, cultural heritage preservation, industrial design, and medical simulation. For instance, planners can conduct real-time simulations of proposals, surgeons can rehearse surgical procedures, and engineers can virtually assemble equipment. This integration has significantly enhanced decision-making scientific rigour, training safety, and operational precision across industries. At the same time, this model can also play an important role in the construction of urban architectural model. In the process of building a digital city architectural model, this VR technology integrating AI algorithm model cannot only complete the analysis and processing of image data faster, but also reduce the workload of staff during the construction process.

Figure 2 systematically demonstrates the complete application workflow of the AI-VR integration technology proposed in this paper for smart city planning, while visually illustrating its operational principles and technical implementation pathways.

As shown in Figure 2, the layout is a professional three-column layout and provides the layout with three independent areas that each have a separate coordinate axis. Each of the three independent areas corresponds with one stage of the technical process of

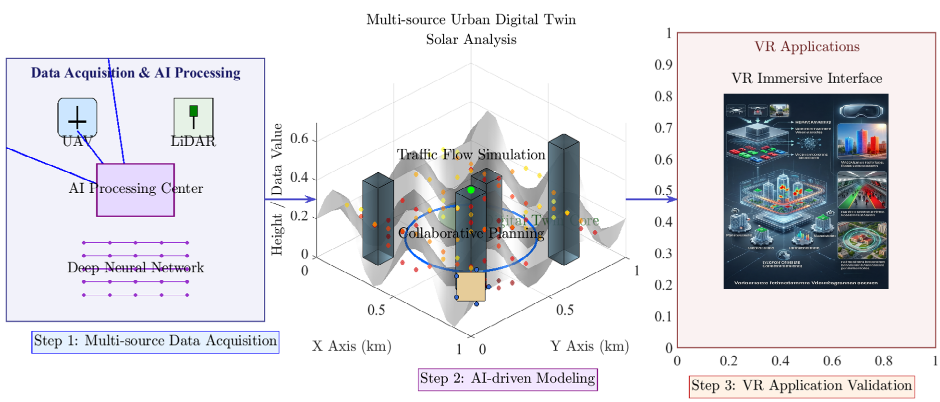
1 data acquisition and artificial intelligence (AI) processing zone

2 digital twin core zone

3 virtual reality (VR) application zone, where data acquisition and AI processing zone provides an illustration of multi-source data inputs and the AI processing workflow as an illustration of neural network architecture used to create a virtual model.

The Digital Twin Core zone generates a 3D urban model using information that includes historical and projected information about traffic flow, heat maps, and green spaces, achieving an intuitive way to visualise the complete integration of virtual reality and the real world. The VR application zone also utilise three sub-scenarios to demonstrate how an urban planning application would work, including solar radiation analysis, traffic simulation/analysis, and collaborative planning analysis.

Figure 2 AI-VR convergence technology in smart city planning (see online version for colours)



5 Virtual landscape scene construction and experimental analysis of digital city architecture

5.1 System composition and modelling method of virtual landscape scene

In recent years, the rise and rapid development of AI and VR technologies have led to rapid socio-economic development in multiple regions. More and more researchers are paying attention to the research and application of AI and VR technologies. AI technology and VR technology cannot only optimise the operation mode of multiple industries in the current society, but also deeply integrate with the comprehensive control and promotion of cities in different regions, and achieve the construction of regional digital city systems through VR technology. This digital urban system can collect the status of public equipment in the city, and also control these devices in real-time.

The 'virtual landscape scenario' developed in this study represents an integrated concept comprising three core components: 3D geometric models of urban architectural entities and their clusters, surface topography with vegetation coverage, transportation networks, public infrastructure, and simulated dynamic pedestrian and vehicular flows. This scenario transcends a mere aggregation of static architectural models, instead forming a comprehensive digital urban system that seamlessly integrates natural and artificial environments while combining static spatial structures with dynamic behavioural simulations. Designed to provide a complete virtual reference framework for urban planning, management, and experiential applications, it serves as a holistic digital counterpart to physical urban environments. With the rapid development of urban construction in the new era, the scale of cities is rapidly expanding. At the same time, the design and regulation of urban landscape scenes have also received great attention from people. The existing urban landscape scene control methods generally detect and control various public facilities in the city by constructing a three-dimensional urban building landscape scene.

At the same time, the VR landscape scenes of digital urban architecture are generally divided into data collection and processing modules, three-dimensional models of urban architecture, VR technology integration modules, and display modules. In constructing 3D models of digital cities, this study employs computer vision technologies primarily based on motion restoration structures and multi-view stereo algorithms. These methods accurately reconstruct building geometries and spatial positions from captured sequence images, automatically generating dense 3D point clouds at low hardware costs. This approach is particularly suitable for rapid and large-scale 3D reconstruction of urban infrastructure across extensive areas.

The data collection and processing module generally collects and processes data from urban buildings through intelligent devices. Not only does it require the collection of overall data on buildings and landscapes in cities, but it also requires the collection of aggregated feature data and relevant data in urban construction to complete the parameterised layout of digital urban architecture. The three-dimensional model of urban architecture is mainly constructed through this parameterised layout to complete the preliminary construction work of the three-dimensional model. The VR technology integration module provides each module with data processing and scene processing capabilities for VR landscape scenes. Ultimately, the display module is responsible for comprehensively showcasing the VR landscape scenes of the completed digital city buildings.

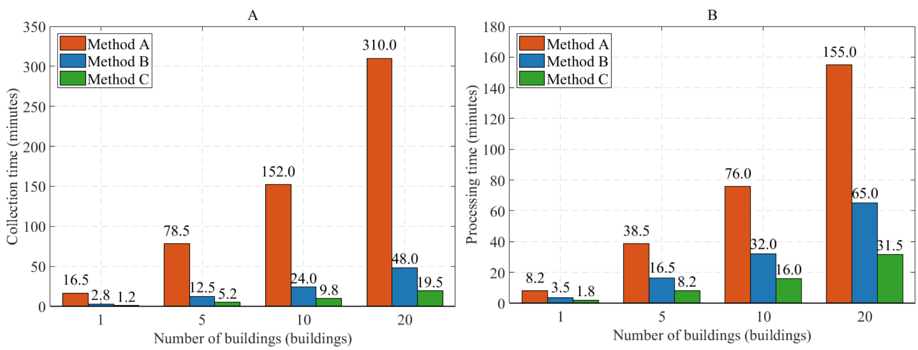
5.2 Virtual landscape scene generation experiment and performance analysis

The aim of the experimental study was to provide an objective, standardised comparison of the three modelling techniques and their corresponding results, in a Fair Comparison of Results environment, under similar conditions. To do so, the following modelling techniques were employed in conjunction with a series of standardised tests. These included the following.

A Series of Standardised Tests: *Method A*: Manual Modelling, which followed the traditional field measurement, hand drawn design process. The modelling consisted of using CAD and/or 3ds Max modelling software to model using manual methods. *Method B*: Automated Modelling, using a semi-automated process. Point Cloud data were captured using a LiDAR scanner; the data were then processed by using point cloud analysis techniques followed by using parametric modelling techniques. *Method C*: New Intelligent Modelling Techniques. These techniques comprise a fully integrated intelligent Modelling System that uses Computer Vision, Machine Learning and Virtual reality technology for modelling. The combination of these techniques allows for complete data capture, integration and rendering of the scene in one process.

The construction of digital city models through the creation of virtual landscape visuals depends on how efficiently data is collected and the time it takes to process the data. The feasibility and overall practicality of creating a digital city model largely depend on both factors. To evaluate objectively the efficiency and practicality of each of the different technical methods used in this critical stage of the workflow, a comparative experiment utilising three specific kinds of methodologies was conducted. Each experimental session was carried out within the exact same urban environment, and the time taken to collect the required data from various structures, as well as process the collected data, were tracked and compared according to the building styles and sample sizes used in each session. The experimental findings are shown in Figure 3.

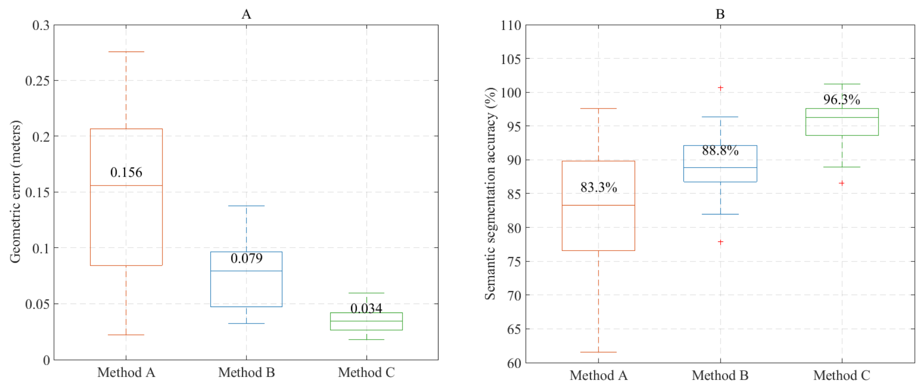
Figure 3 Comparison of data acquisition and processing efficiency: (A) comparison of data acquisition time and (B) comparison of data processing time (see online version for colours)



As shown in Figure 3, Method C is the most efficient method for processing time at all scales of buildings (Figure 3(A)). Method C collected data for a singular building in 1.2 h which is much faster than both Method A at 16.5 h and Method B at 2.8 h. When scaled to 20 buildings, Method C completed data collection in 19.5 h compared to Method A at 310 h and Method B at 48 h. These results illustrate the efficiency benefit of Method C in the use case of large-scale applications, such as the development of urban digital cities. In terms of data processing (Figure 3(B)), Method C processed the data collected for each building in 1.8 h, while Method A took 8.2 h and Method B took 3.5 h to process the same data. For the processing of 20 buildings, Method C performed the processing in 31.5 h, which is a 79.7% and 51.5% efficiency gain compared to Method A's 155 h and Method B's 65 h, respectively. These results serve to substantiate the efficacy of using machine learning algorithms for automatically processing data and provide technical backing for the rapid generation of virtual landscapes. Collectively, Method C represents a strong showing of the benefit of applying AI technologies to improve city modelling workflows. The efficiency benefit gained from using Method C also reduces the time required for creating models and increases the collection and use of virtual landscapes by urban planners and managers, making Method C a viable, efficient means of developing smart cities.

The primary technical benchmark used to evaluate the quality of a digital city's virtual landscape scenes is how accurately 3D models are reconstructed. This has a direct impact on how accurately these models represent physical structures and therefore affect how reliable subsequent uses of the models are. To compare the results between different methods for performing geometric fidelity, we chose to use a test building as our modelling object for this study. The geometric complexity was taken into account when choosing our model. The objectives of our testing included evaluating the two primary metrics of the study -- geometric error and semantic segmentation accuracy (determining how well the performance of the 2D image was and how closely it matched the real object). A visual comparison of the two types of accuracy is shown in Figure 4.

Figure 4 Comparison of 3D model reconstruction accuracy: (A) comparison of geometric error and (B) comparison of semantic segmentation accuracy (see online version for colours)



As illustrated in Figure 4, the box plot analysis results in the accuracy comparison experiment for 3D model reconstruction reveal that Method C, which integrates artificial intelligence (AI) and virtual reality (VR) technologies, has far exceeded the results of the other two methods (Methods A and B) in terms of all performance measures of accuracy. For example, Figure 4(A) indicates that the geometric error for the Method C is 0.034 m (median), whereas the Method A had a median geometric error of 0.156 m, and the Method B had a median geometric error of 0.079 m. These results demonstrate how effective the use of machine learning algorithms can be for optimising spatial coordinates during the fitting of a 3D model. Figure 4(B) substantiates this assertion when comparing the results for the semantic segmentation accuracy of each of the three methods. The Method C achieved a segmentation accuracy of 96.3%, which is significantly higher than the Method A's segmentation accuracy of 83.3% and the Method B's segmentation accuracy of 88.8%. This variance highlights how much greater the reliability of AI algorithms can be for recognising and classifying architectural components and will lead to more accurate interactions through VR technology that are based on the results of the accurate segmentation performed by AI algorithms.

The last application in the category of Virtual Landscape Generation for Digital City Architecture is how well the system operates and how good it is from an end user point of view. The performance of Virtual Landscape Generation modelling is critical to the evaluation of how well the method performs when integrated into a real-world dataset is evaluated by this study using a multidimensional testing framework. The framework evaluates Precision, Efficiency, and Quality. The full results of the comparison are in Table 1.

Table 1 shows that algorithmic precision for Method C has improved significantly over Method A, with greater than 96.70% prediction accuracy and a 0.97 SSIM visual similarity score; improvements of 23.12% and 18.29%, respectively. It can be concluded that Method C represents a significant increase in the ability of an intelligent algorithm to understand scene content and visually simulate the environment. Method C also has the best average response performance, with latencies of 16.8 ms and rendering times of 12.4 ms, representing 41.26% and 41.78% reductions respectively from Method B. This gives an essential foundation for technical support in real-time applications. Environmental adaptability metrics for Method C show remarkable results for colour reproduction accuracy at 98.30%, 94.60% lighting variation robustness, and 95.20% occluded scene completion; improvements of 15.38%, 38.10%, and 30.77%, respectively over Method A. It indicates that computer vision and machine learning methodologies can produce consistent and repeatable performance even with a variety of unpredictable real-world conditions, especially useful for urban application areas where lighting differences and occlusion are unpredictable.

Table 1 Multidimensional comparison of comprehensive performance

Performance indicators	*Method A*	*Method B*	*Method C*
Prediction accuracy (%)	78.50	88.20	96.70
Visual similarity (SSIM)	0.82	0.91	0.97
Average response delay (milliseconds)	45.3	28.6	16.8
Rendering time (single frame, milliseconds)	32.5	21.3	12.4
Colour reproduction (%)	85.20	92.50	98.30
Light change robustness (%)	68.50	82.30	94.60
Blocking scene completion (%)	72.80	86.50	95.20

6 Conclusions

With the increasing popularity of the concept of the intelligent era, more and more intelligent technologies have emerged and developed rapidly. These intelligent technologies have driven the rapid transformation of the current information society towards an intelligent society. This social transformation is evident in many current fields, specifically manifested in the deep integration of intelligent technology represented by AI technology with multiple industries. This integration has led to further changes in the information operation mode of these industries. In the process of building 3D models of existing urban buildings, image scanning equipment was generally used to carefully scan the appearance and internal structure of urban buildings. These 3D buildings have been converted into 2D paper models in the computer. Then, the relevant software in the computer was used to complete the splicing of these drawings, so as to obtain a preliminary three-dimensional architectural model. However, the development of intelligent technology has made this process more convenient. By using CV technology in AI technology to conduct a more comprehensive scan of the buildings in the target city, the relevant algorithm models in AI technology were used to complete the conversion of image data, and the converted data was analysed, classified, and processed. In this process of integrating intelligent technology into 3D model construction, there is generally no need for human intervention, which may minimise errors and further save labour costs for 3D model construction. This VR scene modelling technology that integrates AI and VR technologies in digital urban architecture can more highlight the various conveniences and advantages brought by the transformation from an information society to an intelligent society. This intelligent VR scene modelling enables professionals in related fields to complete modelling work for most urban buildings at a lower cost, providing multifaceted assistance for the high-quality development of the urban economy.

This study has several limitations. First, the experimental section lacks clear specifications regarding the dataset's size and source, which compromises the reliability and reproducibility of the results. Second, the integration mechanism between AI and VR technologies is inadequately explained, failing to clearly demonstrate the specific alignment between algorithms and modelling processes. Finally, the proposed method's limitations in computational efficiency and hardware costs are not discussed, which affects a comprehensive evaluation of its practical application value.

Conflict of interests

All authors declare that they have no conflicts of interest.

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