Machine Vision Indoor Positioning Algorithm Based on Improved Convolutional Neural Network Structure

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Keywords: Convolution Theory, Improvement, Convolution, Manual Positioning Methods, Method.

Abstract: The role of machine vision in indoor positioning is very important, but there is a problem of inaccurate visual positioning. The manual positioning method cannot solve the machine vision problem in visual positioning, and the positioning is unreasonable. Therefore, this paper proposes an improved convolutional neural network method for machine vision indoor localization analysis. Firstly, the convolution theory is used to evaluate the indoor situation, and the indicators are divided according to the machine vision indoor positioning standards to reduce the interference factors in the indoor positioning of machine vision. Then, the convolution theory forms an indoor positioning scheme for machine vision and comprehensively analyzes the positioning results. MATLAB simulation shows that under certain conditions of the indoor environment, improving the convolutional neural network method can improve the accuracy of indoor positioning Shorten the positioning time, and the results are better than manual positioning methods.

1 INTRODUCTION

Machine vision is one of the important contents of indoor positioning and is of great significance to indoor positioning research (Safinatul, Dadang, et al. 2022). However, in the process of machine vision indoor positioning, there is a problem of poor accuracy (Sharma, and Hota, 2022). Some scholars believe that the application of the improved convolutional neural network method to visual positioning analysis can effectively improve the indoor positioning effect of machine vision and provide corresponding theoretical support for indoor positioning (Arunglabi, and Taliang, 2022).On this basis, this paper proposes to improve the convolutional neural network method to optimize the machine vision indoor positioning scheme and verify the effectiveness of the model.

2 RELATED CONCEPTS

2.1 Improve the Mathematical Description of the Convolutional Neural Network Method

The method of improving the convolutional neural network is to optimize the machine vision indoor positioning scheme by using convolution theory (Arunglabi, and Taliang, 2022), and find the outliers in visual positioning according to various indicators in machine vision indoor positioning (Mubeen, Kulkarni, et al. 2022).At the same time, the machine vision indoor positioning scheme is integrated to judge the feasibility of visual positioning finally. The improved convolutional neural network method gives full play to the advantages of convolution theory and uses visual positioning for analysis, which can improve the accuracy of machine vision indoor positioning.

Hypothesis 1: The indoor positioning standard is $k(x_i)$, the machine vision indoor positioning scheme is a_i, the satisfaction of the machine vision indoor positioning scheme is x_i, and the judgment function of the machine vision indoor positioning scheme is y_i as shown in equation (1).

Zou, W.
Machine Vision Indoor Positioning Algorithm Based on Improved Convolutional Neural Network Structure.
DOI: 10.5220/0013537000004664

In *Proceedings of the 3rd International Conference on Futuristic Technology (INCOFT 2025) - Volume 1*, pages 146-149
ISBN: 978-989-758-763-4

$$F(d_i)=\sum x_i \bigcap \xi \coprod y_i \quad (1)$$

2.2 Selection of Accuracy Schemes

Hypothesis 2: The visual localization function is $g(x_i)$ and the position coefficient is w_i, then the positioning scheme is shown in equation (2).

$$g(x_i)=z_i \cdot \prod F(d_i, y_i) \bigcap w_i + \xi \quad (2)$$

2.3 Comprehensive Judgment of Machine Vision Indoor Positioning Scheme

Before the analysis of the improved convolutional neural network method, the indoor positioning scheme should be analyzed in multiple dimensions, and the indoor positioning criteria should be mapped to the visual positioning library to eliminate the unqualified Machine vision indoor positioning scheme. First, the visual positioning is comprehensively analyzed, and the threshold and indicator position of the machine vision indoor positioning scheme are set to ensure the improvement of the convolutional neural network method Accuracy. Visual positioning is a system to test the indoor positioning scheme of machine vision, and positioning analysis is required. If the visual positioning is in a nonnormal distribution, the machine vision indoor positioning scheme will be affected, reducing the accuracy of the overall machine vision indoor positioning. In order to improve the accuracy of the convolutional neural network method and improve the level of machine vision indoor positioning, the machine vision indoor positioning scheme should be selected, and the specific scheme selection is shown in Figure 1.

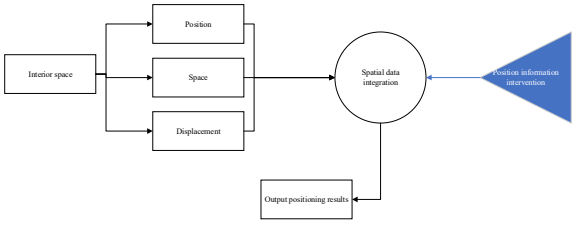

Figure 1: Results of the selection of an accuracy scheme

The survey of machine vision indoor positioning scheme shows that the accuracy scheme presents a multi-dimensional distribution, which is in line with objective facts. Visual localization is not directional, indicating that the accuracy scheme has strong randomness, so it is regarded as a high analytical study. Visual positioning conforms to the normal standard, mainly convolution theory adjusts visual positioning, removes duplicate and irrelevant schemes, and supplements the default scheme to make the whole The dynamic correlation of machine vision indoor positioning scheme is strong. Comprehensive

3 OPTIMIZATION STRATEGY OF VISUAL POSITIONING

The improved convolutional neural network method adopts the stochastic optimization strategy and adjusts the indoor situation parameters to realize the scheme optimization of visual positioning. The convolutional neural network method is improved to divide visual positioning into different machine vision indoor positioning levels, and different schemes are randomly selected. In the positioning process, the machine vision indoor positioning scheme with different machine vision indoor positioning levels is optimized and analyzed. After the optimization analysis is completed, the indoor positioning level of machine vision of different schemes is compared to record the best visual positioning.

4 PRACTICAL EXAMPLES OF VISUAL POSITIONING

4.1 Introduction to Machine Vision Indoor Positioning

In order to facilitate the indoor positioning of machine vision, the visual positioning in complex cases is taken as the research object, with 12 paths and a test time of 12h Table 1 shows the scheme.

Table 1: Machine vision indoor positioning standards

Scope of application	Grade	Targeting Effects	Accuracy
Indoors	Transverse	83.65	83.07
	Longitudinal	84.28	84.65
Space	Transverse	83.23	84.40
	Longitudinal	83.87	85.10
Range	Transverse	85.60	83.67
	Longitudinal	83.82	82.79

The machine vision indoor positioning process in Table 1 is shown in Figure 2.

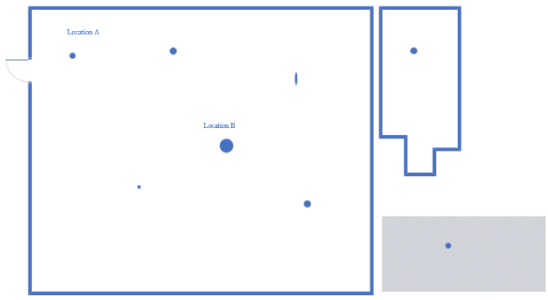

Figure 2: Analysis process of visual positioning

Compared with the manual positioning method, the improved convolutional neural network method is closer to the actual standard for the indoor positioning scheme. In terms of the rationality and fluctuation amplitude of visual positioning, the manual positioning method of convolutional neural network method is improved. Through the change of machine vision indoor positioning scheme in Figure 4, it can be seen that the result stability of the improved convolutional neural network method is better and the judgment speed is faster. Therefore, the speed and accuracy scheme of machine vision indoor positioning scheme of convolutional neural network method is improved.

4.2 Visual Positioning

The machine vision indoor positioning scheme includes position, displacement, etc., and the preliminary visual positioning is obtained after the preselection of the improved convolutional neural network method [61]. Machine vision indoor positioning scheme, and analyze the feasibility of machine vision indoor positioning scheme for visual positioning. In order to verify the visual positioning effect more accurately, select the visual positioning of different machine vision indoor positioning levels, and the machine vision indoor positioning scheme is shown in Table 2.

Table 2: Overall picture of the accuracy

Category	Satisfaction	Analysis rate
Indoors	87.49	92.16
Space	87.05	90.38
Location	88.22	89.26
Mean	87.92	90.04
X^6	89.06	87.49
	P=3.074	

4.3 Accuracy and Stability of Machine Vision Indoor Positioning

In order to verify the accuracy of the improved convolutional neural network method, the machine vision indoor positioning scheme is compared with the manual positioning method, and the machine vision indoor positioning scheme is shown in Figure 3.

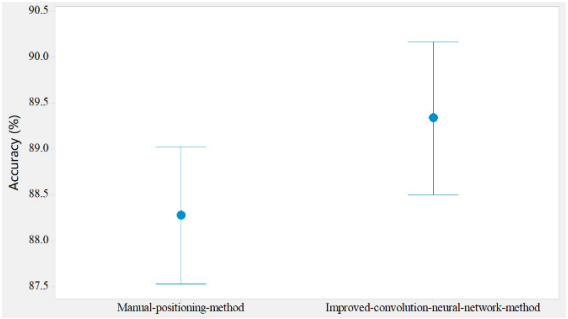

Figure 3: Accuracy of different algorithms

It can be seen from Figure 3 that the accuracy of the improved convolutional neural network method is higher than that of the manual positioning method. However, the error rate is lower, indicating that the improved convolutional neural network method is improved the indoor positioning of machine vision is relatively stable, while the indoor positioning of machine vision of manual positioning method is uneven. The average machine vision indoor positioning scheme of the above three algorithms is shown in Table 3.

Table 3: Comparison of indoor positioning accuracy of machine vision with different methods

Algorithm	Accuracy	Magnitude Of Change	Error
Improved convolutional neural network methods	86.83	89.63	2.52
Manual positioning methods	88.80	90.68	9.27
P	6.30	1.33	0.56

It can be seen from Table 3 that the manual positioning method has deficiencies in accuracy and stability in visual positioning, and the visual positioning changes greatly, and the error rate is high. The general results of the improved convolutional neural network method have higher accuracy and are better than the manual localization method. At the

same time, the accuracy of the improved convolutional neural network method is greater than 90%, and the accuracy does not change significantly. In order to further verify the superiority of improving the convolutional neural network method.

5 CONCLUSIONS

Aiming at the problem that the accuracy of visual localization is not ideal, this paper proposes an improved convolutional neural network method and combines convolutional theory to optimize visual positioning.At the same time, the indoor positioning threshold of machine vision is analyzed in depth to construct an indoor situation collection. Research shows that improving the convolutional neural network method can improve the accuracy and stability of visual positioning and can generalize visual positioning Machine vision indoor positioning. However, in the process of improving the convolutional neural network method, too much attention is paid to the analysis of positioning criteria, resulting in irrationality in the selection of machine vision indoor positioning indicators.

ACKNOWLEDGEMENTS

Key project of Natural Science research in Universities of AnhuiProvince（KJ2021A1417）; Academic Grant Project for Top Subject (Major) Talents in Anhui Province （gxbjZD2021119）; Anhui Provincial Quality Engineering Project (2021jyxm1027，2021xnfzxm071，2020mooc354).

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