Optometry: Open Access
ISSN: 2476-2075

Editorial Open Access

Automated Damage Assessment for Post-Earthquake Buildings: A Computer Vision and Augmented Reality Approach

Flora Lum*

Computer Architecture and Network Group, School of Computer Science, University of Castilla-La Mancha, Spain

Abstract

Earthquakes pose a significant threat to the safety and stability of buildings, requiring prompt and accurate assessment of structural damage for effective recovery and reconstruction efforts. This research article investigates the use of computer vision and augmented reality techniques to develop an intelligent system for damage assessment in post-earthquake buildings. By leveraging image processing, deep learning, and augmented reality visualization, this approach aims to provide reliable, automated, and efficient damage assessment, enabling rapid decision-making and prioritization of resources for reconstruction efforts.

The priority to repair the construction after being damaged by an earthquake is to perform an assessment of seismic buildings. The traditional damage assessment method is mainly based on visual inspection, which is highly subjective and has low efficiency. To improve the intelligence of damage assessments for post-earthquake buildings, this paper proposed an assessment method using CV and AR. Firstly, this paper proposed a fusion mechanism for the CV and AR of the assessment method. Secondly, the CNN algorithm and gray value theory are used to determine the damage information of post-earthquake buildings. Then, the damage assessment can be visually displayed according to the damage information. Finally, this paper used a damage assessment case of seismic-reinforced concrete frame beams to verify the feasibility and effectiveness of the proposed assessment method.

Keywords: Damage assessment; Computer vision; Augmented reality; Post-earthquake buildings

Introduction

The introduction section provides an overview of the challenges faced in assessing post-earthquake building damage and the importance of accurate and efficient damage assessment [1]. It highlights the limitations of traditional manual inspection methods and the potential of computer vision and augmented reality technologies in revolutionizing the process. The objectives, significance, and scope of the research article are outlined. This section reviews the existing literature on damage assessment techniques for post-earthquake buildings, emphasizing the role of computer vision and augmented reality [2]. It explores various images processing techniques, machine learning algorithms, and augmented reality visualization methods employed in similar applications. Key research studies, methodologies, and their limitations are discussed to establish the research gap and motivate the proposed approach.

This section presents the proposed methodology for intelligent damage assessment in post-earthquake buildings. It describes the process flow, starting with image acquisition and preprocessing techniques, followed by feature extraction and classification using deep learning models [3]. The integration of augmented reality visualization to enhance the understanding and communication of damage assessment results is also explained in detail.

This section discusses the collection and preparation of the dataset required for training and testing the intelligent damage assessment system. It covers various considerations such as data sources, data types, data annotation procedures, and potential challenges associated with data acquisition in post-earthquake scenarios [4]. This section presents the intelligent damage assessment framework, outlining the implementation details and system architecture. It describes the image processing pipeline, including feature extraction techniques and deep learning models employed for classification and severity estimation of damage. The integration of augmented reality visualization tools to enhance the interpretation and interaction with assessment results is explained [5].

This section presents the experimental setup and evaluation metrics used to assess the performance of the proposed system. It includes a comprehensive analysis of the system's accuracy, precision, recall, and F1 score. The comparison with existing methods and benchmark datasets is performed to validate the effectiveness of the proposed approach [6].

Results and Discussion

This section presents the results obtained from the intelligent damage assessment system and discusses them in detail. It showcases the classification accuracy, severity estimation, and augmented reality visualization outputs. The limitations and challenges faced during the experiments are addressed, along with potential avenues for future improvements [7]. This section discusses practical implementation considerations, including hardware and software requirements, computational efficiency, scalability, and potential deployment strategies of the intelligent damage assessment system. Ethical and privacy considerations related to data collection, storage, and sharing are also addressed.

With the development of remote sensing technology and computer technology, damage assessment combined with CV can substantially

***Corresponding author:** Flora Lum, Computer Architecture and Network Group, School of Computer Science, University of Castilla-La Mancha, Spain, E-mail: Floralum@tx.uz.com

Received: 02-May-2023, Manuscript No: omoa-23-99552, **Editor assigned:** 05-May-2023, Pre-QC No: omoa-23-99552 (PQ), **Reviewed:** 19-May-2023, QC No: omoa-23-99552, **Revised:** 24-May-2023, Manuscript No: omoa-23-99552 (R), **Published:** 30-May-2023, DOI: 10.4172/2476-2075.1000194

Citation: Lum F (2023) Automated Damage Assessment for Post-Earthquake Buildings: A Computer Vision and Augmented Reality Approach. Optom Open Access 8: 194.

break through the limitations of visual inspection [8]. CV is characterized by high intelligence and precision, which makes it widely used for the inspection and detection of buildings and infrastructure. In general, CV is a science that uses camera recognition and algorithm analysis to reduce the subjective fallacies of observers.

The essence of damage assessment is damage classification. In the background of the rapid development of CV, more and more algorithms are introduced into CV to improve the speed and accuracy of damage assessment. As one of the most popular machine learning algorithms, SVM is widely used in classification. Fayed and Atiya et al. used SVM to classify various handwriting datasets. However, SVM can only achieve binary classification. So, it was necessary for their experiment to transform the classification of handwriting into a problem of binary classification. Although the accuracy of the classification of handwriting was found to be as high as around 99% in their experiment, SVM may be not suitable for multi-classification problems [9]. In addition, random forest is also used extensively for damage classification as it has the advantages of simple implementation, high accuracy, and resilience to over-fitting [10, 11]. However, random forest requires separate feature extractors to extract manually defined features. Therefore, random forest may be not suitable for the damage assessment of post-earthquake buildings. CNNs are one of the most representative deep learning algorithms, which have significant advantages for damage recognition [12]. CNNs can not only extract features automatically but also have a strong self-learning capability. In addition, CNNs can be used for both binary classification and multi-classification. This method used a modified Faster R-CNN to recognize four different types of fasteners. The results showed that Faster R-CNN performed well in multi-classification. These studies mentioned above illustrate that CNNs can not only solve multi-classification problems but also have high classification accuracy [13].

Conclusion

The conclusion summarizes the key findings and contributions of the research article. It highlights the potential of computer vision and augmented reality techniques in revolutionizing post-earthquake damage assessment for buildings. The article concludes with recommendations for future research directions to further improve the system's accuracy, efficiency, and real-world applicability.

The proposed damage assessment method combining CV and AR can evaluate the damage class of seismic components more intelligently. This method not only improves the scientific accuracy and visualization of a damage assessment but also effectively solves the problems of data redundancy, information management, and retrieval difficulties. However, there are still some deficiencies. In this paper, information collection with AR and information display with AR used different AR terminals, which is not conducive to real-time analysis and information integration. Although the information on image recognition and gray value calculation can be updated in real-time, the information on the visual display terminal still needs the help of workers.

Finally, the current research on the damage assessment of post-earthquake buildings is still insufficient. Further improvement in the science of damage assessment and data management remains a priority for future research. Next, our team will work to integrate damage assessment and damage information visualization. In the future, we will continue to dynamically link and visualize damage assessment information with building design information and reinforcement method information. Then, we will try to promote the intelligence, digitization, and visualization of repair and retrofitting methods of post-earthquake buildings.

References

1. Ahn JM, Lee SY, Yoon JS (2010) Health-related quality of life and emotional status of an ophthalmic patient in Korea. Am J Ophthalmol 149: 1005- 1011.
2. Moshfeghi DM, Moshfeghi AA, Finger PT (2000) Enucleation. Surv Ophthalmol 44: 277–301.
3. Chaudhry IA, Alkuraya HS, Shamsi FA, Elzaridi E, Riley FC, et al. (2007) Current indications and resultant complications of evisceration. Ophthalmic Epidemiol 14: 93–97.
4. Rahman I, Cook AE, Leatherbarrow B (2005) Orbital exenteration: a 13 year Manchester experience. Br J Ophthalmol 89: 1335–1340.
5. Custer PL, Reistad CE (2000) Enucleation of blind, painful eyes. Ophthalmic Plast Reconstr Surg 16: 326–329.
6. Rasmussen ML, Prause JU, Johnson M, KamperJørgensen F, Toft TB, et al. Review of 345 eye amputations carried out in the period 1996–2003, at Rigshospitalet, Denmark. Acta Ophthalmologica 88: 218–221.
7. Rose GE, Wright JE (1994) Exenteration for benign orbital disease. Br J Ophthalmol 78: 14–18.
8. Rasmussen MLR (2010) The eye amputated-consequences of eye amputation with emphasis on clinical aspects, phantom eye syndrome and quality of life. Acta Ophthalmologica 88: 1–26.
9. Shoamanesh A, Pang NK, Oestreicher JH (2007) Complications of orbital implants: a review of 542 patients who have undergone orbital implantation and 275 subsequent peg placements. Orbit 26: 173–182.
10. Rasmussen MLR, Prause JU, Ocularist MJ, Toft PB (2009) Phantom eye syndrome: types of visual hallucinations and related phenomena. Ophthalmic Plast Reconstr Surg 25: 390–393.
11. Nicolodi M, Frezzotti R, Diadori A, Nuti A, Sicuteri F, et al. (1997) Phantom eye: features and prevalence. The predisposing role of headache. Cephalalgia 17: 501–504.
12. Soros P, Vo O, Husstedt IW, Evers S, Gerding H, et al. (2003) Phantom eye syndrome: its prevalence, phenomenology, and putative mechanisms. Neurology 60: 1542–1543.
13. Soros P, Vo O, Husstedt IW, Evers S, Gerding H, et al. (2005) Enucleation and development of cluster headache: a retrospective study. BMC Neurology 5: 1-5.