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Deep Learning

Implementation of Deep Learning using the Convolutional Neural Network (CNN) Method to Improve Attedance List

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A B S T R A C T

Efficient and accurate employee attendance recording is a vital aspect of human resource management, including within the Faculty of Computer Science and Information Technology, Universitas Muhammadiyah Sumatera Utara (FIKTI UMSU). This study focuses on enhancing the efficiency of the attendance system through the application of Deep Learning techniques, particularly the Convolutional Neural Network (CNN), which serves to automatically detect and recognise faces from visual data. The web-based application developed in this research employs programming languages such as Python, HTML, PHP, CSS, and JavaScript, with MySQL as the database system, and is designed to support two user roles: administrator and end-user. The findings indicate that the implementation of the CNN method enables real-time image processing, reduces the potential for fraud in manual attendance, and improves the accuracy and efficiency of attendance recording. Based on testing, the application functions effectively, provides a user-friendly interface, and is capable of delivering reliable automated attendance documentation.

INTRODUCTION

Universitas Muhammadiyah Sumatera Utara (UMSU) is a private campus located in Medan. Every employee who wants to fill in the attendance schedule must come and fill in the attendance list via the attendance machine. With the attendance list filled in every day, employees will receive their full salary every month, therefore the attendance list is very important to be implemented properly. The Convolutional Neural Network (CNN) method is one of the techniques used for object classification in images. CNN is included in the Deep Learning method that has a high level of accuracy, as shown in the research of Syulistyo et al. entitled Particle Swarm Optimization (PSO) for Training Optimization on Convolutional Neural Network (CNN), which successfully classifies handwritten digits with good results. Based on previous studies, it can be concluded that facial recognition-based attendance recording is suitable for use as an automatic attendance system. Therefore, this study applies facial recognition-based attendance recording using the CNN method[1,2,3].

The use of computers has facilitated various tasks related to data and information processing. In this context, researchers are utilizing computer technology to support FIKTI UMSU in managing attendance lists so that employees can fill in attendance more efficiently. One branch of computer science that can be applied in this field is Deep Learning, which requires precise methods to manage attendance data to improve the efficiency of the attendance system at FIKTI UMSU.

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Conducted research on a facial recognition-based employee attendance system using Deep Learning via the CNN method. The results showed that the developed application was capable of running in real time with a facial detection time of between 60 and 66 milliseconds [4,5]. Meanwhile, research by [6,7] on designing a facial recognition application using CNN for employee attendance recording showed that the system could recognize a person's face at a range of 1.2 meters with 69% accuracy.

Based on the evidence of the successful application of the CNN method in various previous studies, this study also adopts the method to improve the efficiency of attendance in the FIKTI UMSU environment. The functions of CNN in this study include: detecting employee faces through images or videos (for example from cameras in classrooms) so that attendance can be identified automatically without manual input; recognizing facial identities by matching the detection results with a registered facial database; automating the attendance process so that it does not require manual signatures or card scanning, which in turn increases efficiency and reduces the potential for fraud; and processing visual data in real-time, utilizing the efficient and accurate capabilities of CNN in image analysis.

This research resulted in an attendance management application with two user types: admin and user. The admin acts as the data manager for FIKTI UMSU, while the user is the staff member who fills in the attendance. The application was developed using web programming with MySQL as the database. The implementation of Deep Learning with the CNN method is expected to improve the efficiency of attendance registration at FIKTI UMSU.

METHOD

CNN Method

Convolutional Neural Networks are algorithms that fall into the category of Deep Learning. These algorithms are developed from the Multi-Layer Perceptron (MLP) architecture and are specifically designed for processing visual data or images. CNNs are widely used in object detection and recognition in images [8,9].

Deep Learning

Deep Learning is a branch of machine learning that utilizes artificial neural network architecture with multiple layers to deeply learn data representations. This method is designed to mimic the human brain's pattern recognition and information processing, enabling complex data analysis, such as facial recognition, natural language processing, object detection, and speech recognition. Deep Learning's primary advantage lies in its ability to automatically extract features from raw data without the need for extensive feature engineering, resulting in high performance across a wide range of applications [10,11].

In its implementation, Deep Learning utilizes layered nonlinear transformations that enable the system to process data from a low level of abstraction to a higher level. Various architectural models have been developed, such as Convolutional Neural Networks (CNN) for image processing, Recurrent Neural Networks (RNN) for sequential data, and Generative Adversarial Networks (GAN) for generating new data. Advances in computing technology and the availability of large amounts of data have encouraged the widespread application of Deep Learning in various fields, from healthcare and transportation to finance and even intelligent systems based on the Internet of Things (IoT) [12,13].

Python

Python is an interpreter-based programming language that is flexible and can be used in various paradigms, including object-oriented programming, function-based programming, and procedural-oriented programming. In image processing, Python often utilizes the Open Computer Vision (OpenCV) library, which processes and analyzes image data [14,15].

RESULTS AND DISCUSSION

Results

The results of the implementation of Deep Learning using the CNN method to improve attendance efficiency at FIKTI UMSU are:

1. Login Form

   Login form from the implementation of Deep Learning using the CNN method to improve attendance efficiency at FIKTI UMSU:

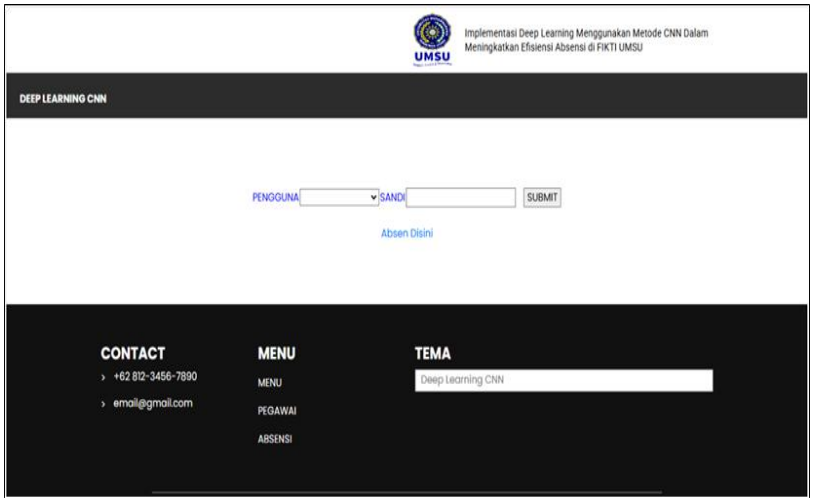

Figure 1. Login Form

2. Menu Form

   Menu Form of Deep Learning Implementation Using CNN Method to Increase Attendance Efficiency at FIKTI UMSU in Figure 2.

Figure 2. Menu Form

3. Employee Form

   Employee Form from the Implementation of Deep Learning Using the CNN Method to Improve Attendance Efficiency at FIKTI UMSU.

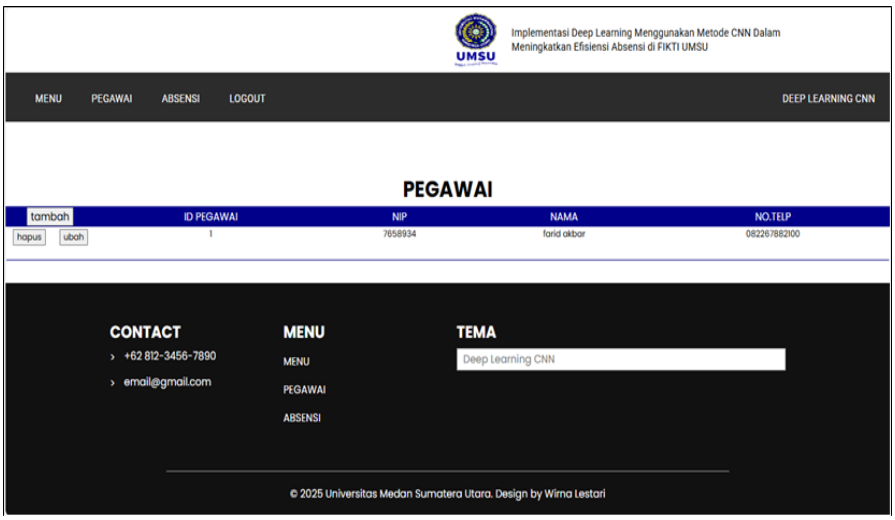

Figure 3. Employee Form

4. Attendance Form

Attendance Form from Deep Learning Implementation Using the CNN Method to Improve Attendance Efficiency at FIKTI UMSU.

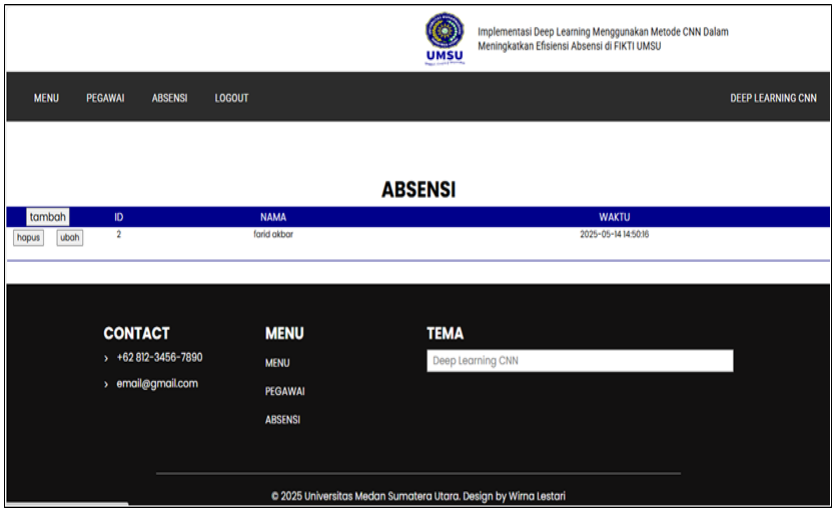

Figure 4. Attedance Form

5. Employee Attendance Form

Employee Attendance Form from Deep Learning Implementation Using the CNN Method to Improve Attendance Efficiency at FIKTI UMSU.

Figure 5. Employee Attedance Form

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Test Results

Based on the results of the application trials, the following conclusions were obtained:

1. The resulting interface matches the initial design.
2. The Convolutional Neural Network method was successfully implemented.
3. The application interface is user-friendly, making it easy for users to use.
4. The application functions well according to its development objectives.
5. No logical errors were found in the application.

CONCLUSION

This study has demonstrated the effective implementation of deep learning using the Convolutional Neural Network (CNN) method to improve the accuracy and efficiency of attendance list management. By leveraging CNN's capability in automatic feature extraction and pattern recognition, the proposed system is able to accurately identify individuals and reduce common issues found in conventional attendance systems, such as manual errors, proxy attendance, and inefficiencies in data recording. The experimental results indicate that the CNN-based approach provides significant improvements in recognition accuracy and processing speed compared to traditional methods.

In addition, the integration of the CNN model into the attendance system enables real-time data processing and centralized attendance management, which enhances data reliability and system scalability. The findings suggest that deep learning-based attendance systems can serve as a robust solution for educational institutions and organizations seeking to modernize their attendance monitoring processes.

Future work may focus on expanding the dataset to improve model generalization, optimizing network architecture for faster computation, and integrating multimodal biometric data to further enhance system performance and security. Overall, this research confirms that CNN-based deep learning approaches offer a promising direction for the development of intelligent and automated attendance management systems.

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