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Research Article

Dog Bite Detection and Hybrid Recovery Mechanism to Ensure Human Safety using Deep Learning

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ABSTRACT

Introduction: Dog bites are a serious public health issue that cause medical complications and require immediate interventions. Human decisions regarding the severity of the bites are subjective and unreliable, thereby leading to uneven treatment outcomes. An automatic dog bite detector and a novel approach to severity classification enhance the speed and efficiency of response. By pre-processing input data and executing machine learning methods, severity of the dog bites' wounds is classified into minor, moderate, and severe. Personalized medical treatments are facilitated by the system, enhancing patient care and public safety. Interfacing with veterinary clinics, healthcare centers, and emergency response teams ensures immediate assessment and treatment. Clinical effectiveness and workability will be tested in a pilot study to develop a more systematic and evidence-based approach towards handling dog bite cases.

Objectives: Detection and classification of severity of dog bites enhance efficacy and response rate. Machine learning categorization of the bite as minor, moderate, and severe enhances timely and proper medical intervention and helps enhance treatment result. Integration of the system in veterinary clinics and health centers is directed towards quick assessment and response. Clinical efficacy of the planned intervention will be assessed through pilot studies to aim at applying systematic and evidence-based methods in an attempt to provide effective treatment of dog bites and community safety.

Methods: Dog bite detection and severity classification employ a systematic process of preprocessing, feature extraction, and classification for precise estimation of dog bite severity. Preprocessing normalizes the datasets through resizing, pixel normalization, and data augmentation. Feature extraction employs CNN for wound features and ResNet-50 with residual connections for improved accuracy. Hybrid architecture CNN-ResNet50 classifies wounds, detects severity, and suggests treatments. Through integration, it facilitates feature learning, reduces diagnostic error, and increases speed of medical response, thereby facilitating timely and uniform treatment of dog bites.

Results: Dog Bite Diagnosis and Classification System gives real-time evaluation, accurate diagnosis, and sufficient treatment. It reduces human error, indexes emergency cases, and optimizes healthcare resources. It allows for remote AI-facilitated consultations, optimizes accessibility, especially in rural regions. It is available to all the population, offering protection, timely response, and medical reliability.

Conclusions: Dog Bite Detection and Classification System uses deep learning, the integration of CNN and ResNet-50, to effectively detect and classify dog bites in vet images. Through improved diagnostic precision, less work for veterinarians, and faster decision-making on the treatment, it guarantees effective medical intervention. AI-led innovation transforms veterinary diagnosis, establishing a new benchmark in animal care by improving accuracy, speed, and quality of treatment.

Keywords: Early detection, timely intervention, veterinary care, severity grading, dog bite detection.

INTRODUCTION

Dog bites are the most frequent public health disease and that also in the urban communities where stray dogs are in abundant numbers. The incidents are not only the physical injuries but may have very serious psychological, social and economic effects. The victims of canine attacks may be the ones suffering from post-traumatic stress disorder, fear, or become periodically fearful of the animals, and it will heavily affect their lifestyle. Apart from this, neglected dog bites not adequately cared for and unintentionally left untreated can increase to serious illnesses like infections, tissue damage, tetanus, or rabies, which is a lethal condition unless immediately treated. The social cost of dog bites exhausts the medical system to necessary to provide immediate response, dressing up the wounds, and in worst cases, costly and lengthy recuperation. Since payment in case of dog bites is governed by visual testing methods, it is the more diversified diagnostic method. Further, AI has now emerged as the technology that will redefine the face of medicine totally and thus, new diagnostics and treatment methods will now have top-of-the-line solutions. Within dog-bite treatment, AI is reflecting change from vague and subjective point to extremely specific, science-driven item identification and triage.

It is time-consuming and probable treatment might be postponed as a result of this, particularly in areas of shortage of medical personnel or in areas with great patient throughputs Artificial Intelligence has established itself as a change maker in medicine, bringing forth innovative solutions to various issues which have been faced by conventional practices in dog bite treatment and identification. The application of AI in the diagnosis of dog bite injuries not only assists in arriving at a dependable diagnosis but also transcends the mind-wandering process, and also standardization of the diagnostic process through information gathered is noteworthy. Deep learning and computer vision advancements have made it possible for AI systems to process sophisticated biomedical images, thus equipping them with the capability to perform specialized functions like wound identification, severity grading, and accurate infection prediction.

These abilities would potentially revolutionize the current process of medical-savvy dog bite treatment and with time, the possibility of necessity for manual intervention would be brought down to zero, hence the mistake could also be minimized.

The system suggests a multimodel deep learning model combining the Convolutional Neural Networks (CNNs) and the pre-trained ResNet50 architecture. The structure is best explained in order to examine veterinary images, locate dog bite wounds, and score the severity of such wounds. With these strengths, ResNet50 can perform well with auto-extracting features with high accuracy and stability.

OBJECTIVES

Dog Bite Classification and Detection System aims to improve accuracy and efficiency in the detection of dog bite wounds and their classification through artificial intelligence. Deep learning models such as Convolutional Neural Networks (CNNs) and ResNet50 offer automated wound detection, classifies the severity of the injury, and infection estimation. The system reduces manual verification, reduces diagnosis errors, and enables timely medical treatments. Wound grading to mild, moderate, and severe helps physicians treat the wounds in the correct manner, preventing complications such as infection and rabies. The system further helps veterinary clinics and hospitals by automating the diagnosis, improving optimum utilization of resources, and enabling teleconsultation. Standardization of the diagnostic process enables improved access to healthcare services, particularly in low-resource environments. Lastly, Dog Bite Detection and Classification System transforms veterinary and medical practice through rapid evaluation, improving patient care and improving public health and safety.

METHODS

Dog Bite Detection and Classification System uses supervised deep learning methods to detect wounds accurately and classify wounds. It starts with preprocessing where raw image data sets are cleaned to be readable in order to apply the best in machine learning. Some of the activities carried out include loading the data set, resizing images into a compatible size, pixel normalization, and executing some of the data augmentation operations like rotation, flipping, and scaling. These optimizations enable the model to generalize over images of various wounds. Although feature extraction, Convolutional Neural Networks (CNNs) form the foundation of detecting key wound features like color gradients, shape, and texture. ResNet-50 replaces CNN for applying residual connections, which aid in learning

extremely deep networks. The inclusion enhances the capability of capturing even such subtle details like wound texture, edges, redness, and irregular contours for enabling proper severity classification.

Classification is performed by categorizing as dog bite wounds or normal using the hybrid CNN-ResNet50 model and to high accuracy. Convolutional layers, residual blocks, and fully connected layers are utilized with the mapping of wounds to moderate, minor, and severe classes. Symptom-based suggestions are then given by the system after classification for medical treatment assistance. With the integration of CNN and ResNet-50, the system provides precise and real-time wound analysis with low error and facilitates effective decision-making with well-educated judgments in medical fields. The dog bite detection and classification model is viable for healthcare resource application, improves response to therapy, and improves veterinary and emergency care, resulting in improved patient outcomes and improved diagnostic accuracy.

ARCHITECTURE

The architecture is for building a deep learning-based system for dog bite severity classification. It is a pipeline sequence of data acquisition, preprocessing, feature extraction, classification, and solution deployment for clinical use. They are the image acquisition of a heterogeneous data set of high-resolution images of dog breeds and severities of dog bites, with the pipe configuration of data acquisition and preprocessing. The techniques involved include resizing, noise removal, normalization, and data augmentation. This ensures consistency in the data, which helps with the feature learning without training under unstable conditions with respect to setup and other parameters. The data set is split into train and test sets utilized to achieve maximum accuracy from the model. The CNN retrieves low-level features whereas ResNet50 is able to learn better through residual connections. This allows for training deeper networks without worrying about performance degradation from training with zero residual connections. Bag normalization, dropout, and hyperparameter search assist in the improvement of classification accuracy while preventing overfitting quality.

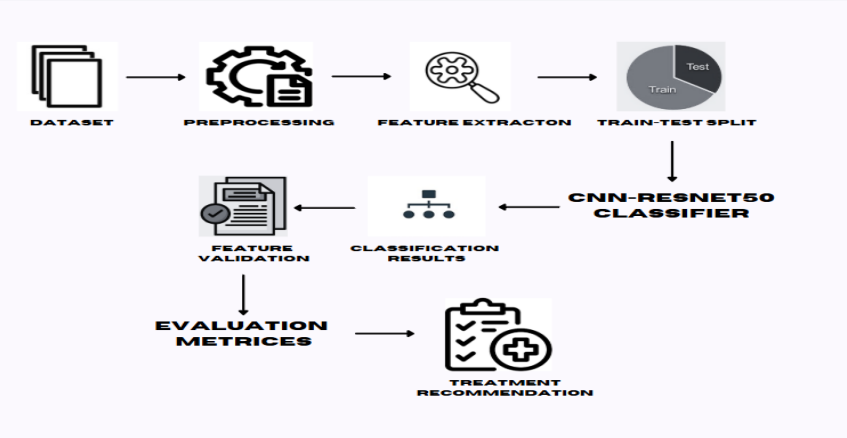

Figure 1:Architecture Diagram

RESULTS

Dog Bite Detection and Classification System uses hybrid deep learning for real-time high-accuracy wound detection and classification to enhance veterinary diagnostics. Use Cnn for feature extraction and ResNet-50 for hierarchical learning, it provides accurate severity estimation with effective utilization of healthcare resources and prevention of misdiagnosis. Remote consultation and prompt decision-making reduce veterinary care expenses, enhance the precision of diagnostic outcomes, and establish a new standard for high efficiency and high reliability in assessing animal health status.

DISCUSSION

Dog Bite Detection and Classification System improves veterinary diagnosis by hybrid deep learning that combines CNN and ResNet-50 to perform accurate wound examination. Automated feature extraction and classification reduce the risk of human error, maximize healthcare resources, and enable real-time evaluation to provide timely intervention. Remote consultations are enabled by this system, improving access, particularly in underserved and

remote communities. Reducing misdiagnosis and enhancing decision-making, it's a new standard in veterinary medicine, unlocking AI-driven medical innovation in animal health diagnosis.

The system complements the preprocessing methods like data augmentation and pixel normalization to provide good-quality input to deep learning models. CNN draws features of wounds and learns through residual connections by ResNet-50 without suffering from the vanishing gradient problem. It provides precise diagnosis and planning of treatment through bite severity classification. Reducing emergency consultation and veterinarian workload, it promotes effective use of healthcare resources. This strategy advances contemporary veterinary diagnostics, allowing standardised, evidence-based medical decision-making to improve patient care.

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