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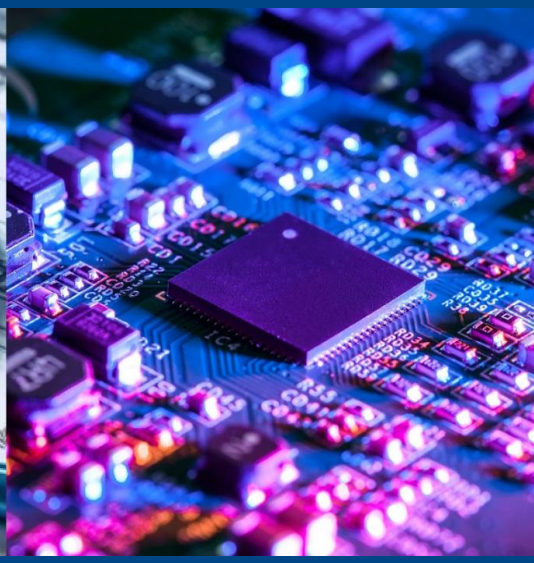
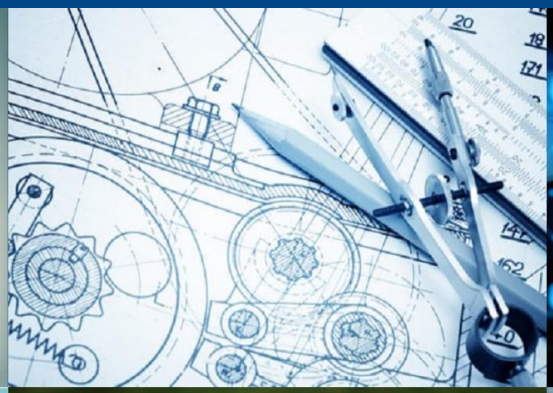
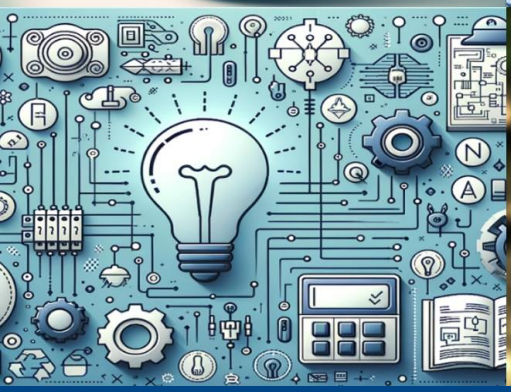


# International Journal of Multidisciplinary Research in Science, Engineering and Technology

*(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)*



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# AI in Precision for Animal Health Care Diagnostics

**G Sabareesan, Dr.Anbarasan.C**

III B.Sc., Department of Computer Science with Data Analytics, Dr. N.G.P Arts and Science College, Coimbatore, India

Department of Computer Science with Data Analytics, Dr. N.G.P Arts and Science College, Coimbatore, India

**ABSTRACT:** Veterinary healthcare faces significant challenges in promptly identifying animals that require immediate medical attention. Traditional methods, which rely on manual evaluation of health records and symptoms, are often slow, subjective, and prone to error. Recent advances in deep learning have enabled the development of automated systems that can rapidly assess the urgency of veterinary visits based on animal health data. However, these systems encounter challenges such as poor data quality, imbalanced representation of urgent cases, and limited augmentation strategies. They are also computationally demanding and may not be viable for real-time use in resource-constrained environments. Furthermore, traditional machine learning techniques require extensive human intervention in feature extraction, which can hinder performance on unseen cases. To address these issues, our system employs advanced data preprocessing techniques including normalization, augmentation, and the use of weighted loss functions. A modified DenseNet121 architecture, with fine-tuned layers and dropout regularization, is used to enhance generalization. The model is trained and validated on a well-structured dataset of animal health records, ensuring reproducibility with fixed random seeds. Visualization methods such as confusion matrices and performance charts are used to interpret the model's effectiveness.

## I. INTRODUCTION

In veterinary practice, accurately determining which animals require urgent medical attention is critical for ensuring timely treatment and improving overall health outcomes. Traditional diagnostic processes, often based on manual review of animal records and symptoms, can be slow and inconsistent.With the increasing availability of digital veterinary records, there is an opportunity to leverage artificial intelligence (AI) and deep learning to automate the urgency prediction process. Convolutional Neural Networks (CNNs) have demonstrated impressive performance in various classification tasks and offer a promising solution for veterinary diagnostics. Modified architectures, such as DenseNet121, can retain essential feature maps and overcome issues like gradient vanishing.Despite these advances, deep learning models in veterinary diagnostics face challenges, including data imbalance, inconsistent quality of records, and limited data augmentation. Urgent cases are often underrepresented, leading to biased predictions. Effective preprocessing and balanced training methods are therefore critical to improving model performance.

### PROBLEM STATEMENT

Timely identification of animals in need of urgent veterinary care is essential but remains a challenging task. Current methods for assessing urgency rely heavily on manual

interpretation of health records, which can be subjective and inconsistent.

Key issues include:

- Poor quality and inconsistent veterinary data
- Imbalanced class distributions with few urgent cases
- Inadequate data augmentation leading to overfitting
- High computational requirements for traditional deep learning models
- Dependence on manual feature extraction, which limits scalability

These challenges necessitate the development of an automated, efficient, and robust deep learning-based system for predicting the urgency of veterinary visits.

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## II. METHODOLOGY

Our approach follows a structured deep learning pipeline tailored to veterinary diagnostics:

**Data Collection**

- Collect animal health records and symptom datasets in CSV format from veterinary clinics and public databases.
- Ensure the dataset includes a balanced representation of urgent, non-urgent, and routine cases.

**Data Preprocessing**

- Resize and standardize images (if visual data such as X-rays or photos are used) or normalize tabular data.
- Clean the dataset by handling missing values and encoding categorical variables.
- Apply data augmentation techniques (e.g., rescaling, horizontal flipping, and contrast adjustments) to enhance dataset diversity.
- Set batch size and use fixed random seeds to ensure reproducibility.

**Feature Extraction**

- Employ CNN-based layers to extract meaningful features from image data or apply feature engineering techniques on structured data.
- Reduce data redundancy to lower computational costs while preserving essential information.

**Classification**

- Implement a modified DenseNet121 architecture adapted for veterinary data.
- Include layers such as convolution, pooling, flattening, and dense layers with dropout regularization.
- Use an adaptive optimizer and weighted loss functions to address class imbalance.
- Conduct hyperparameter tuning (learning rate, batch size) and perform cross-validation to evaluate performance.

**DISCUSSION**

The modified DenseNet121 model significantly improves the accuracy of predicting veterinary visit urgency. Standardizing and cleaning the data ensures high-quality inputs, while data augmentation techniques address class imbalance and enhance model generalization. CNN-based feature extraction effectively reduces dimensionality without losing critical health indicators. The use of weighted loss functions ensures that the model does not bias toward the more frequent non-urgent cases, thereby improving sensitivity to urgent cases. Visualization tools, including confusion matrices and performance charts, provide clear insights into the model's strengths and areas for improvement.

## III. RESULTS

After extensive training and validation, the system demonstrated:

- High overall accuracy in classifying veterinary urgency levels.
- Strong recall, ensuring that most urgent cases are correctly identified.
- High precision, with minimal false positives.
- A low misclassification rate, as evidenced by the confusion matrix.
- Consistent performance across cross-validation folds, thanks to fixed random seeds. The system is scalable and reliable, making it well-suited for deployment in various veterinary settings, including resource-limited environments.

## IV. CONCLUSION

This project presents a robust deep learning-based system for predicting veterinary visit urgency, addressing key challenges such as data imbalance, poor quality records, and high computational demands. By integrating advanced data preprocessing techniques, a modified DenseNet121 architecture, and effective performance optimization, the system achieves high diagnostic accuracy and generalizability.

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**FUTURE WORK:**

- Expand dataset diversity to further enhance generalization.
- Integrate multimodal data (e.g., combining animal history with sensor data).
- Optimize the model for real-time deployment in clinical settings.
- Explore explainable AI techniques to improve model transparency and trust among veterinary professionals.
- This system has the potential to significantly improve veterinary diagnostics, enabling timely and informed decision-making to enhance animal health outcomes.

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