Project/ scenario name:

Comparative Analysis of Deep Learning Models for Automated Bone Fracture Detection

Custom scenario description:

The project will conduct an in-depth research study on automated bone fracture detection using standard deep learning models applied to medical X-rays. The focus is on exploring and analyzing various algorithms, such as convolutional neural networks (CNNs), to understand their effectiveness in identifying fractures. The research will evaluate and compare these models based on accuracy, speed, robustness, and their ability to reduce false positives and negatives in fracture detection. This study will provide valuable insights into the strengths and limitations of different deep learning models, contributing to the advancement of AI-driven diagnostics in medical imaging.

Objective/ vision:

1. Perform a detailed comparative study of existing deep learning models for bone fracture detection.
2. Assess the accuracy, efficiency, and reliability of different models using medical X-ray datasets.
3. Determine which model performs best in terms of fracture detection accuracy, minimizing false positives and negatives.
4. Offer recommendations and insights on which models are most suitable for real-world fracture detection applications.

Users of the system:

- Healthcare Providers
- Medical Researchers

Functional requirements:

a. Acquisition of medical images (X-rays).
b. Conduct a comparative study of different existing deep learning models to evaluate their performance.
c. Define and apply appropriate metrics (e.g., accuracy, precision, recall, F1 score) to assess the performance of the models.
d. Generate comprehensive research reports that include detailed findings, model comparisons, and recommendations for further improvements

Non-functional requirements:

a. Ensure the research framework can scale to handle large datasets for more comprehensive analyses.
b. Optimize the models to ensure efficient training and evaluation, reducing computational costs.
c. Ensure that the research methods and results are reproducible by other researchers in the field.

d. Provide thorough documentation of the research process, methodologies, and results to facilitate further research and replication.

Optional Features:

a. GUI for Comparison Visualization: If time permits, develop a simple GUI to help visualize the comparison results of different models, making it easier to interpret performance metrics and analysis.
b. Fracture Type Classification: Optionally, explore the capability of the models to classify different fracture types (e.g., greenstick, spiral, transverse), adding an extra layer of analysis.

Technologies to be used:

a. CNN models (Densenet121, ResNet50, EfficientNetB0, VGG16), TensorFlow, Keras for developing the models.
b. Image Preprocessing: Data Augmentation.

Tools to be used:

a. Development Tools: Python 3.11.8, TensorFlow, Keras for deep learning development.
b. Medical Imaging Software: image processing tools.

Team size: 3 Members

Final deliverable must include:

a. In-depth analysis of various deep learning models (e.g., DenseNet121, ResNet50) for bone fracture detection, evaluating accuracy, speed, and robustness
b. Comparison of models using accuracy, precision, recall, and F1 score, highlighting the best performing models
c. Final recommendations and insights on model improvements and real-world applicability

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