Innovative Monitoring System for TELE ICU Patients Using Video Processing and Deep Learning

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PROBLEM STATEMENT

In the context of TELE ICU, where remote monitoring is essential, these challenges are further exacerbated by the limitations of existing systems. Current TELE ICU solutions often struggle with:

- Inadequate real-time monitoring capabilities.
- High dependency on human intervention and potential for errors.
- Limited ability to analyze comprehensive data effectively.
- Delays in alerting healthcare providers about critical patient conditions.
- Difficulties in managing and interpreting large volumes of patient data.

SOLUTION

The "Innovative Monitoring System for TELE ICU Patients Using Video Processing and Deep Learning" aims to revolutionize patient care by providing continuous 24/7 observation through advanced video processing. The system delivers alerts for abnormal behaviors and critical events, ensuring prompt medical intervention. Detailed analytics support decision-making and optimize patient care by providing comprehensive data analysis . By automating routine monitoring tasks, the solution reduces the workload on medical staff, allowing them to focus on delivering high-quality care. Designed for scalability and cost-effectiveness, our system can efficiently accommodate a larger number of patients, significantly improving patient safety, response times, and overall healthcare delivery in TELE ICU settings.

FEATURES OFFERED

- Continuous monitoring of patient activities using video processing.
- Detection of abnormal behaviors and interactions with healthcare professionals.
- Improved patient safety and optimized healthcare response times.
- Enhanced capacity for a single health care professional to monitor multiple patients simultaneously.
- Automatic recording of patient data, including movements and interactions, providing a detailed log for medical review.
- Authorized personnel can access the monitoring system remotely, enabling continuous oversight even when not physically present in the ICU.

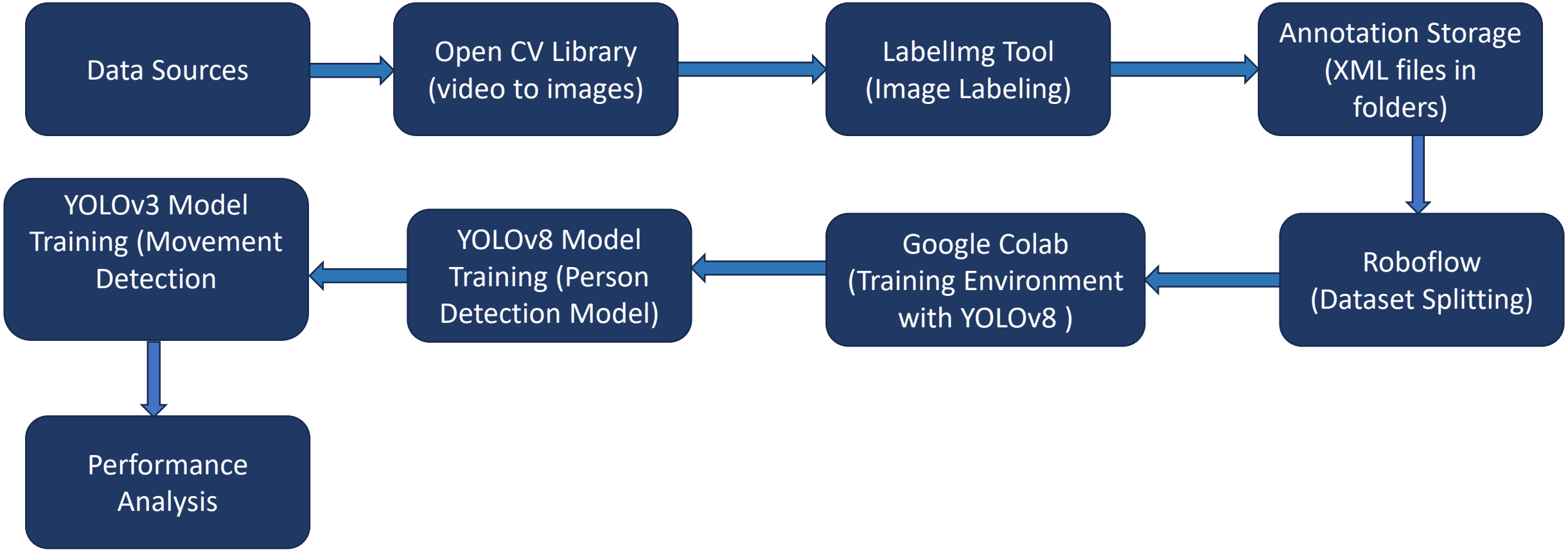
EXTENSION OF THE PROJECT(MOVEMENT DETECTION APPROACH)

Enhanced Movement Detection Algorithm: Implemented a more robust movement detection algorithm to accurately monitor patient activity.
Real-time Monitoring: Enabled real-time detection and alert systems for immediate response to abnormal movements.
Multi-object Tracking: Incorporated multi-object tracking to handle multiple patients within the same frame.
Integration with Alert Systems: Integrated with hospital alert systems to notify medical staff promptly.
Customizable Detection Zones: Allowed customization of detection zones to focus on critical areas around the patient bed.
Future Enhancements: Proposed future enhancements, including the use of more advanced deep learning models and additional sensors for comprehensive monitoring.

PROCESS FLOW

1. **Dataset Collection**: Collecting datasets from various reliable sources and converting these videos to sequences of images using the OpenCV library in Python.
2. **Labelling**: Labelling the images by using labelImg and saving the annotations in XML format. The labeled images are stored in their corresponding folders.
3. **Dataset Perparation**: Split the dataset into training and testing sets using Roboflow.
4. **Model Training**: Training a YOLOv8 model for person detection using Google Colab and integrated Roboflow for dataset management. The dataset is split into training, test ing, and validation sets.
5. **Movement Detection and Alarm:** Training a YOLOv3 model to identify abnormal patient movements and sent alarms to medical staff and ensuring timely intervention for potential issues.
6. **Model Selection and Reporting:** Based on comprehensive performance analysis, the YOLOv8 model was selected for its superior detection accuracy and efficiency in real-time processing. Results were compiled into a detailed report showcasing the model's strengths, limitations, and recommendations for future enhancements.

ARCHITECTURE DIAGRAM



TECHNOLOGIES USED

- **OpenCV:** For video processing and image extraction.
- **YOLOv8:** For object detection and classification.
- **YOLOv3**:For detecting abnormal patient movements to trigger an alarm, which can alert medical staff to potential issues.
- **Google Colab:** For model training and computational resources.
- **Roboflow:** For dataset management and organization.
- **TensorFlow and TensorFlow Object Detection API:** For implementing deep learning models.
- **Python Libraries:** Including os, shutil, random, logging, IPython Display, matplotlib, and more.

TEAM MEMBERS & CONTRIBUTIONS

Neha Ann Biju: Dataset collection,Labelling, Model training, Github repository creation
Devatha D: Literature review and research, Dataset collection, Model training research ,Report writing
Nikitha Linto: Dataset Collection,Image extraction,Image Labelling,Presentation Preaparation
Ebin Sebastian: Dataset collection,Structured Dataset ,Labelling, Model training
Sreelakshmi J: Dataset collection , Labelling, Model training research,Report writing

CONCLUSION

The "Innovative Monitoring System for TELE ICU Patients Using Video Processing and Deep Learning" significantly enhances patient care in Intensive Care Units (ICUs). Utilizing advanced video processing and deep learning, the system ensures continuous, real-time monitoring, improving patient safety and healthcare response times. It automates the detection of abnormal behaviors and critical events, reducing the dependency on human intervention. Features like real-time alerts, detailed analytics, and remote access support medical staff in delivering high-quality care efficiently. Designed for scalability, the system can easily accommodate more patients and integrate with existing healthcare systems. Robust security measures protect patient data, ensuring compliance with healthcare regulations. Overall, this innovative monitoring system optimizes ICU operations and supports healthcare professionals, marking a significant advancement in TELE ICU patient care.