INTEL UNNATI INDUSTRIAL TRAINING PROGRAM-2024

About Me:-

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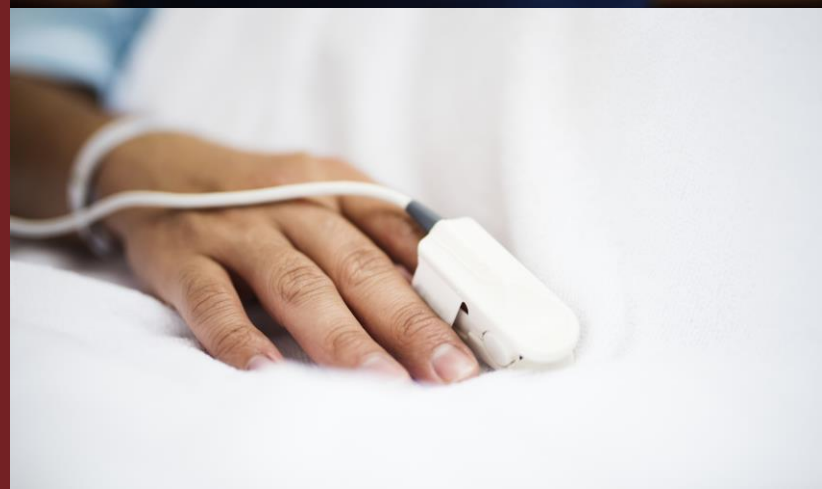
INNOVATIVE MONITORING SYSTEM FOR TELEICU PATIENTS USING VIDEO PROCESSING AND DEEP LEARNING

PROBLEM STATEMENT

The current TeleICU systems require remote healthcare professionals to monitor a limited number of ICU patients due to the complexity of real-time patient monitoring, which restricts scalability and efficiency. This project aims to develop a scalable solution that allows one professional to monitor multiple ICU patients simultaneously, thereby reducing the burden on healthcare resources. Key challenges include creating a dataset using sources like Hollywood series, processing high-quality real-time video footage, and ensuring narrow error margins critical for ICU patient care. The proposed solution involves training deep learning models to identify individuals (e.g., nurse, intensivist, family member, patient) and patient activities, measuring prediction times, and assessing detection accuracy over live video. The project will culminate in a detailed report outlining the problem, technical approach, and results, contributing to improved remote healthcare monitoring.



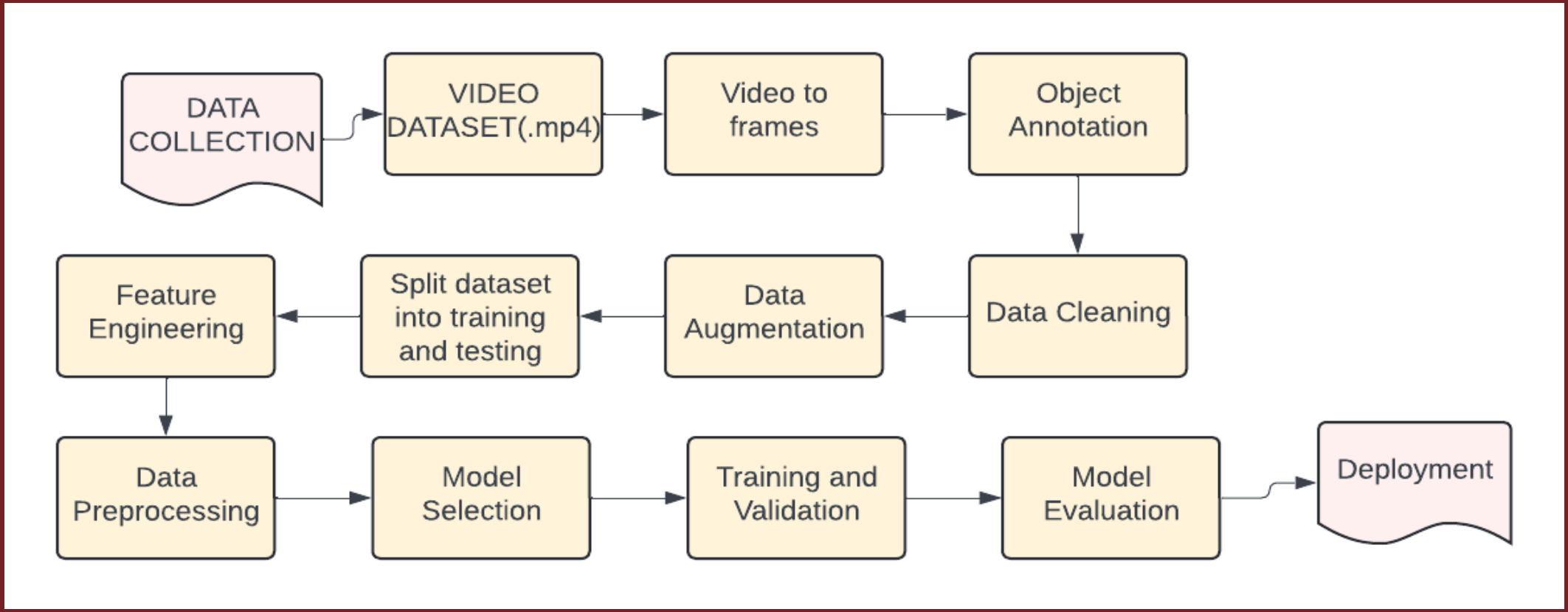
UNIQUE IDEA BRIEF (SOLUTION)

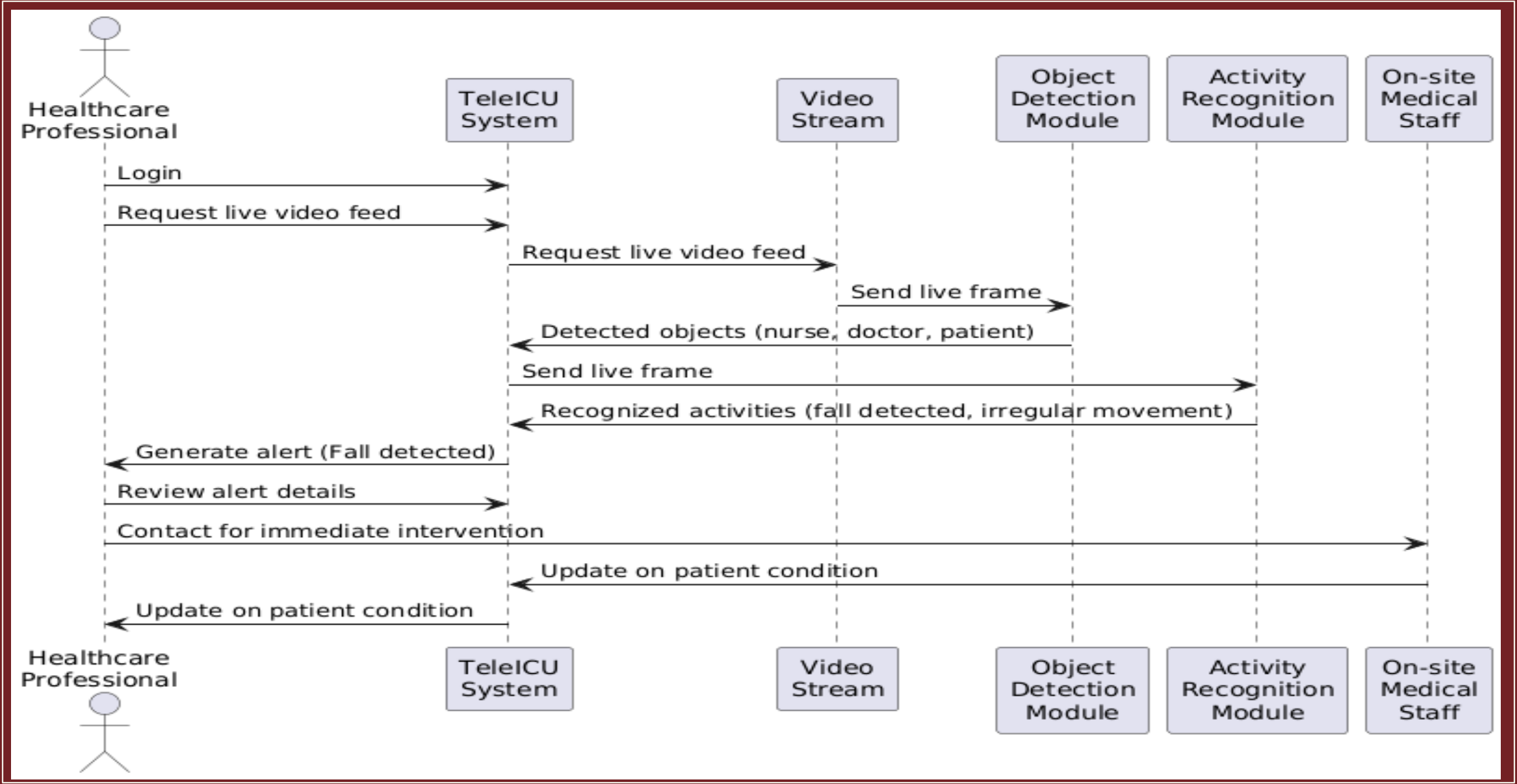
- Current TeleICU models exhibit limitations in scalability due to technical constraints and the complexities of real-time multi-patient monitoring, hindering the ability of a single healthcare professional to effectively oversee a larger number of critically ill patients.
- Curated ICU footage dataset for high-quality, real-time video processing. Implemented ICU-tailored YOLOv8 models for accurate real-time detection and classification of nurses, doctors, family members, and patients. Developed AI models for activity recognition to monitor vital signs, analyze patient movements, and detect emergencies, enhancing proactive patient care.
- Implemented Python-based frameworks like TensorFlow and Keras for end-to-end model development, training, and deployment. Ensured robust data preprocessing to handle real-time ICU video feeds, maintaining high prediction accuracy and minimal error margins critical for patient care evaluation.
- Enabled one healthcare professional to monitor multiple ICU patients simultaneously, reducing resource burden and enhancing operational efficiency. Improved patient care outcomes through timely interventions enabled by real-time monitoring and accurate activity recognition, aligning with clinical standards for high detection accuracy and responsive patient care within ICU settings.
- Moving forward, we'll focus on refining our models based on real-world feedback and data insights. We aim to enhance deep learning applications in ICU settings, exploring new ways to monitor and intervene in patient care. This iterative approach will drive continuous improvement in healthcare delivery and outcomes.

FEATURES OFFERED

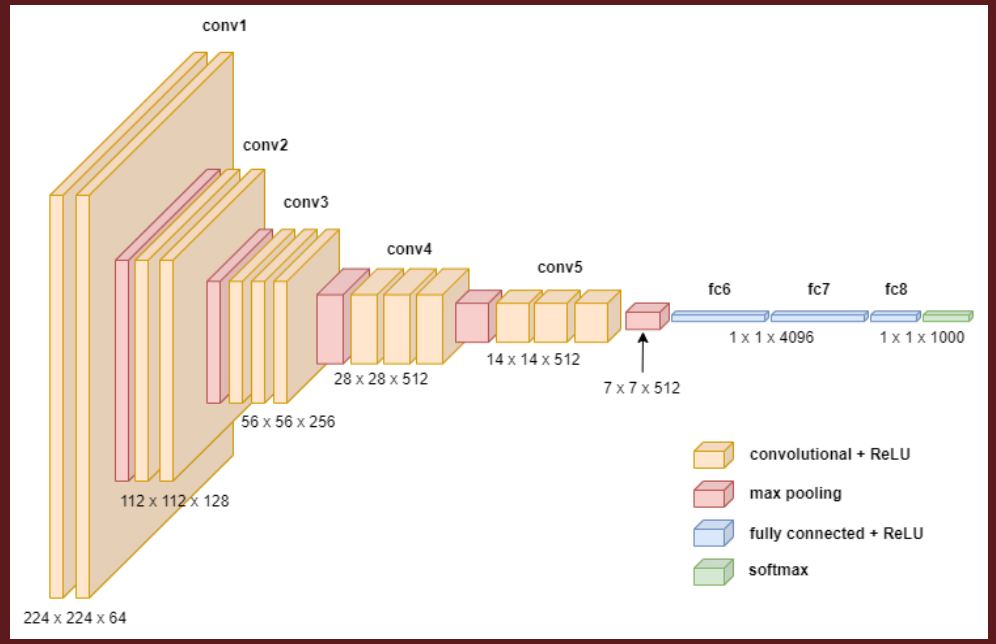
- **Scalable Monitoring:** Efficiently monitor multiple ICU patients per professional.
- **Custom Dataset Development:** Curate ICU-specific data from Hollywood series and real-world footage.
- **Real-time Video Processing:** High-quality analysis of live ICU video feeds.
- **Advanced Object Detection:** Accurate identification of nurses, doctors, patients, and family members using YOLOv8.
- **Activity Recognition:** Detect patient activities during unattended periods for proactive care.
- **Performance Metrics:** Measure prediction times and detection accuracies for clinical precision.
- **Python-Based Implementation:** Utilize TensorFlow and Keras for robust model development.
- **Operational Efficiency:** Optimize resource allocation and streamline healthcare workflows.
- **Patient Care Enhancement:** Improve outcomes through timely interventions and precise monitoring.
- **Continuous Improvement:** Iterative refinement based on real-world deployment and feedback.

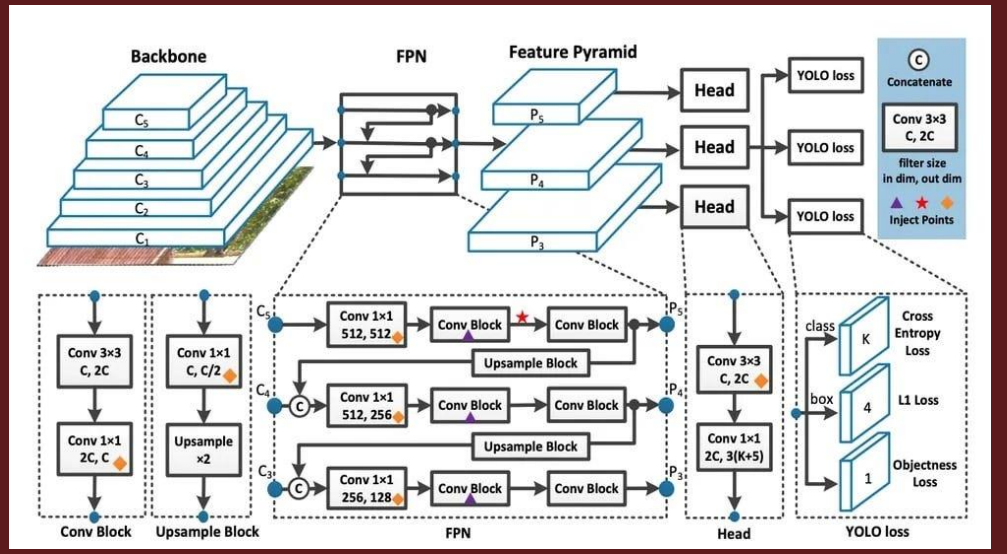
PROCESS FLOW




Healthcare Professional
TeleICU System
Video Stream
Object Detection Module
Activity Recognition Module
On-site Medical Staff
Login
Request live video feed
Request live video feed
Send live frame
Detected objects (nurse, doctor, patient)
Send live frame
Recognized activities (fall detected, irregular movement)
Generate alert (Fall detected)
Review alert details
Contact for immediate intervention
Update on patient condition
Update on patient condition
Healthcare Professional
TeleICU System
Video Stream
Object Detection Module
Activity Recognition Module
On-site Medical Staff

ARCHITECTURE DIAGRAM





TECHNOLOGIES USED

- Video Streaming Protocols (e.g., RTSP, HLS)
- Python
- OpenCV for real-time video processing
- TensorFlow, PyTorch for deep learning frameworks
- Object Detection Models (e.g., YOLO, Faster R-CNN)
- Activity Recognition Models

TEAM MEMBER CONTRIBUTION

Fiona Dash

- Utilized deep learning frameworks like TensorFlow and PyTorch for developing precise models in object detection and patient activity recognition.
- Engineered robust data preprocessing pipelines to optimize model performance and accuracy in real-time video analysis.
- Implemented and fine-tuned algorithms for ICU monitoring, focusing on improving detection capabilities and reducing computational overhead.
- Documented technical processes comprehensively to support project transparency and knowledge sharing.
- Innovated with novel approaches to enhance model efficiency and effectiveness in TeleICU applications, contributing to advanced patient monitoring solutions.

CONCLUSION

In tackling the challenges of real-time ICU patient monitoring, my approach harnessed advanced deep learning techniques within TensorFlow and PyTorch to develop precise models for object detection and patient activity recognition. Through rigorous algorithm optimization, we aimed to elevate the accuracy and responsiveness of TeleICU systems. This effort highlights the transformative impact of technology in healthcare, underscoring our dedication to advancing patient care through innovation and technical expertise

THANK YOU