

Functional document

1. Introduction

Sprint 3 focuses on the integration, deployment, and validation of the AI-driven gait analysis system in real-world clinical and rehabilitation environments. Building on the model developed in previous sprints, this phase ensures the system is robust, user-friendly, and seamlessly embedded within clinical workflows. The objective is to provide medical professionals with an accessible, accurate, and efficient tool for post-knee replacement gait assessment and ongoing patient monitoring.

2. Goal

The goal of Sprint 3 is to operationalize the gait analysis platform-deploying the trained MobileNetV2-LSTM model, establishing user-facing interfaces, and validating the system with end users. This sprint aims to streamline the workflow for clinicians, enable secure and scalable deployment, and ensure the system delivers actionable insights to support patient rehabilitation and clinical decision-making.

3. Demography

Users:

- Medical Professionals: Physiotherapists, orthopedic surgeons, rehabilitation specialists utilizing the deployed system for routine patient assessment.
- Healthcare IT Staff: Responsible for system integration, maintenance, and support.
- Medical AI Researchers: Evaluating system performance and proposing enhancements based on real-world data.

Location:

- Hospitals, clinics, and rehabilitation centers equipped with video-based motion tracking and IT infrastructure.
- Facilities in both urban and resource-limited settings, leveraging cloud or local deployment as appropriate.

4. Business Processes

1. System Integration and Deployment

- Package the trained model and application for deployment on hospital servers or cloud platforms.
- Integrate the system with hospital management systems (HMS), electronic health records (EHR), and rehabilitation tools via secure APIs.
- Configure user authentication and access control for different clinical roles.

2. User Interface and Workflow Implementation

- Develop a web-based or desktop interface for clinicians to upload, manage, and analyze gait videos.
 - Provide real-time feedback and batch processing options for various clinical scenarios.
 - Ensure intuitive navigation, visualization of gait parameters, and exportable reports.
3. Clinical Validation and User Acceptance Testing
 - Conduct pilot testing with clinicians and patients to validate system usability, reliability, and clinical relevance.
 - Collect feedback on workflow integration, result interpretation, and user experience.
 - Refine system features based on user input and observed performance.
 4. Continuous Improvement and Maintenance
 - Monitor system usage, performance, and error logs to identify areas for optimization.
 - Implement a feedback loop for clinicians to suggest improvements or report issues.
 - Schedule regular updates to the model and software, incorporating new data and user feedback.
 5. Compliance and Security
 - Ensure ongoing compliance with healthcare data privacy regulations (HIPAA, GDPR).
 - Maintain secure data storage, encrypted communications, and audit trails for all system interactions.

5. Features

1. Seamless Integration
 - Plug-and-play compatibility with existing hospital IT infrastructure and cloud platforms.
2. User-Friendly Interface
 - Simple video upload, automated analysis, and clear visualizations for clinical interpretation.
3. Automated Reporting
 - Generation of detailed, exportable reports summarizing gait assessment, progress trends, and clinical recommendations.
4. Real-Time and Batch Processing
 - Support for both immediate feedback during patient visits and batch analysis for research or retrospective studies.
5. Role-Based Access Control

Customizable user permissions for clinicians, IT staff, and researchers.

6. Continuous Learning

System adapts and improves with ongoing data collection and clinician feedback.

7. Robust Security

End-to-end encryption, secure authentication, and compliance with all relevant data protection standards.

6. Authorization Matrix

| Role | Permissions and Access Description |
|---------------------------|---|
| Physiotherapist | Can upload patient gait videos, view analysis results, and generate/export clinical reports for assessment and follow-up. |
| Orthopedic Surgeon | Authorized to upload videos, review results, and export reports for diagnosis and treatment planning. |
| Rehabilitation Specialist | Permitted to upload gait data, access results, and create/export reports for patient rehabilitation tracking. |
| IT Administrator | Manages system configuration, user accounts, technical troubleshooting, and oversees software/model updates. |
| Medical AI Researcher | May access anonymized data, system logs, and model outputs for evaluation and research, subject to data governance. |
| System Supervisor | Has oversight of all system activities, reviews logs, approves updates, and ensures compliance with institutional policies. |

7. Assumptions

- The deployment environment meets hardware and software prerequisites.
- Hospital IT teams are available for integration and support.
- End users receive adequate training on system operation and interpretation.
- Data privacy and security protocols are strictly followed.
- Sufficient network bandwidth is available for cloud-based deployments.
- The system is tested with diverse patient profiles to ensure generalizability.
- Feedback from clinical users is actively solicited and incorporated.
- Ongoing technical support and model maintenance are provided.