RehabApp – AI-Powered Physiotherapy Coach 🏋️‍♀️

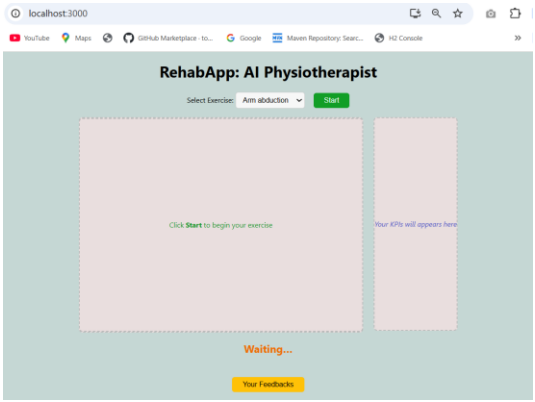
RehabApp is an end-to-end research prototype that:

- 🏋️ **Trains** a lightweight multi-head CNN + Bi-LSTM (PoseQualityNet-KP) on the **REHAB24-6** physiotherapy corpus.
- 📊 **Evaluates** its accuracy, ablation variants, and inference speed.
- 🚀 **Serves** real-time, joint-level feedback through a **FastAPI** back-end and a **React** front-end.

📂 Repository Layout

Path	What's inside
Data/	Contains links and information about the data sources used.
└ Data Source Links.txt	Text file with links/references to the original and processed datasets.
dataprep_model-training_evaluation_Inference-scripts/	Data-prep helpers and the main Jupyter notebook
└model_training_evaluation_and_Inference.ipynb	🔬 Data augmentation, model creation, evaluation, ablation study & inference
└ Data-REHAB24-6_New/	Augmented window tensors & meta-data generated by the notebook
Documentation/	Project documentation, reports, and guides.
└Presentation/	Slides (PDF) and recorded project presentations.
└ Project Report/	Detailed project report (PDF and Latex code)
└ User Guide/	Instructions and guides for using Repo and RehabApp.
rehab-app-backend/	FastAPI service (main.py, model loader, SQLite storage, Dockerfile)
rehab-app-frontend/	React client (pose capture, WebSocket, dashboard UI)
docker-compose.yml	One-shot build & launch for both apps
.gitignore	Ignores editor caches (.vscode/, .qodo/, etc.)

Running the Application:

1. **Clone the repository:**
    - git clone https://github.com/IS06-Jithin/RehabApp.git
2. **Command prompt/terminal navigate to RehabApp folder**
    - cd RehabApp
3. **Build and run with Docker Compose:**
    - docker-compose up --build
4. **Access the application:** Once the build is complete and containers are running:
    - **React Client (Frontend):** http://localhost:3000/ (allow webcam access when prompted)
    - 

5. **Using the App**
    - Select the exercise from the dropdown menu and click the **start** button
    - Perform the **selected Exercise**
    - Pay attention to the **visual/Auditory feedback** and correct yourself
    - Upon completion, click the **Stop** button and review your session summary
    - If you have any feedback on the App's usability, click the feedback button and provide it.

🛠️ Prerequisites

- **Docker & Docker Compose:**
    - **Windows / macOS:** Install Docker Desktop from docker.com.
    - **Linux:** Install the Docker Engine and the docker-compose plugin from your distribution's package manager or follow the official guide.
- **Git:** Download and install from git-scm.com.
- **(Optional) NVIDIA Driver + CUDA:**
    - Needed only if you want to benchmark the model on a GPU. CPU inference works out of the box.

✨ Model at a Glance

Architecture

Block	Details
Frame Encoder	1-D CNN (99 → 128 → 512 channels)
Temporal Encoder	2-layer Bi-LSTM (256 hidden units/direction)
Exercise Embedding	6 → 64 MLP
Prediction Heads	Quality (2-way) • 14-Joint Regression • Exercise ID (6-way)
Total Footprint	**3.41 M parameters (≈ 13 MB)**

Performance Highlights

- 🎯 **91.5% F1-score** on repetition quality assessment.
- 🆔 **99.5% F1-score** on exercise identification.
- 📐 **4.73° Mean Absolute Error** for joint-angle regression.
- ⏱️ **~30 FPS** on a mid-range CPU (or ~7,500 windows/second on GPU).

📄 License

This project is released under the **MIT License**. The dataset media (REHAB24-6) remain under their original license. Please see the REHAB24-6 Zenodo record for details.

✍️ Citation

If you use RehabApp or its components in your research, please cite it as:

```
@misc{rehabapp2025,
  author       = {Jithin Krishnan},
  title        = {RehabApp: AI-Powered Real-Time Physiotherapy Coach},
  year         = {2025},
  howpublished = {\url{https://github.com/IS06-Jithin/RehabApp}}
```