**CSET-301 AI AND MACHINE LEARNING PROJECT**

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**Project Title: Exercise Correction Using Pose Detection and Machine Learning​**

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**1. Introduction**

The "Exercise Correction" project aims to assist individuals in performing common fitness exercises correctly by leveraging pose detection and machine learning. By analyzing body movements, the system provides real-time feedback to correct improper forms, thereby reducing the risk of injuries and enhancing workout effectiveness.​

**2. Objectives**

* Develop machine learning models to detect and classify correct and incorrect forms of four common exercises: Bicep Curl, Plank, Squat, and Lunge.​
* Implement a web application that utilizes these models to analyse user-submitted workout videos and provide corrective feedback.​

**3. Methodology**

**3.1. Data Collection**

* Due to the scarcity of publicly available datasets containing both correct and incorrect exercise forms, the majority of the data was self-collected.​
* For the Plank exercise, images were sourced from a Kaggle dataset containing various yoga poses. From this, 30 images representing the basic plank were selected.

**3.2. Pose Detection**

* Utilized [MediaPipe](https://mediapipe.dev/) for real-time pose detection to extract key body landmarks from video frames.

**3.3. Model Development**

* Four separate machine learning models were developed, each tailored to detect specific errors in the respective exercises:​
  + **Bicep Curl**: Detects "lean back" errors.​
  + **Plank**: Identifies various form errors.​
  + **Squat**: Classifies different stages and detects form issues.​
  + **Lunge**: Detects "knee over toe" errors.​
* Each model was trained using the extracted pose landmarks as features.​

**3.4. Web Application**

* Developed a web interface using Vue.js (v3) for the frontend and Django for the backend.​
* The application allows users to upload workout videos, which are then analyzed by the corresponding model to provide feedback.​

**4. Results**

* The models were evaluated using confusion matrices and ROC curves to assess their performance in detecting incorrect exercise forms.​
* The web application successfully integrates the models, providing users with actionable feedback on their exercise techniques.​

**5. Technologies Used**

* **Programming Languages**: Python, JavaScript​
* **Libraries and Frameworks**:
  + MediaPipe (Pose Detection)​
  + Vue.js v3 (Frontend)​
  + Django (Backend)​
* **Others**:
  + Docker (Containerization)​
  + Git (Version Control)​

**6. Installation and Usage**

**6.1. Prerequisites**

* Python 3.8.13​[GitHub](https://github.com/NgoQuocBao1010/Exercise-Correction?utm_source=chatgpt.com)
* Node.js 17.8.0​[GitHub](https://github.com/NgoQuocBao1010/Exercise-Correction?utm_source=chatgpt.com)
* NPM 8.5.5​[GitHub](https://github.com/NgoQuocBao1010/Exercise-Correction?utm_source=chatgpt.com)
* Operating System: Linux or macOS (Note: Scripts are written for Linux-based OS and may not work on Windows)​[GitHub](https://github.com/NgoQuocBao1010/Exercise-Correction?utm_source=chatgpt.com)

**7. Limitations and Future Work**

* **Data Limitations**: The dataset primarily consists of self-collected videos, which may not cover the full range of possible incorrect forms.​
* **Model Generalization**: Models may need further training with more diverse data to improve generalization across different body types and environments.​
* **Real-time Feedback**: Currently, the system analyzes pre-recorded videos. Implementing real-time feedback could enhance user experience.​

**8. Conclusion**

The "Exercise Correction" project demonstrates the potential of combining pose detection with machine learning to assist individuals in performing exercises correctly. By providing feedback on common form errors, the system can serve as a valuable tool for fitness enthusiasts seeking to improve their technique and reduce injury risk.​[GitHub](https://github.com/NgoQuocBao1010/Exercise-Correction?utm_source=chatgpt.com)

**9. References**

* [MediaPipe](https://mediapipe.dev/)​[ResearchGate](https://www.researchgate.net/publication/369937564_Real-time_Fitness_Activity_Recognition_and_Correction_using_Deep_Neural_Networks?utm_source=chatgpt.com)
* [Kaggle Yoga Pose Dataset](https://www.kaggle.com/datasets)​
* [Vue.js Documentation](https://vuejs.org/)​[GitHub](https://github.com/NgoQuocBao1010/Exercise-Correction?utm_source=chatgpt.com)
* [Django Documentation](https://www.djangoproject.com/)