

An AI based Upper Limb Training Assistance System for Preventing Sarcopenia

Chi-Huang Shih, Sheng-Wei Huang*

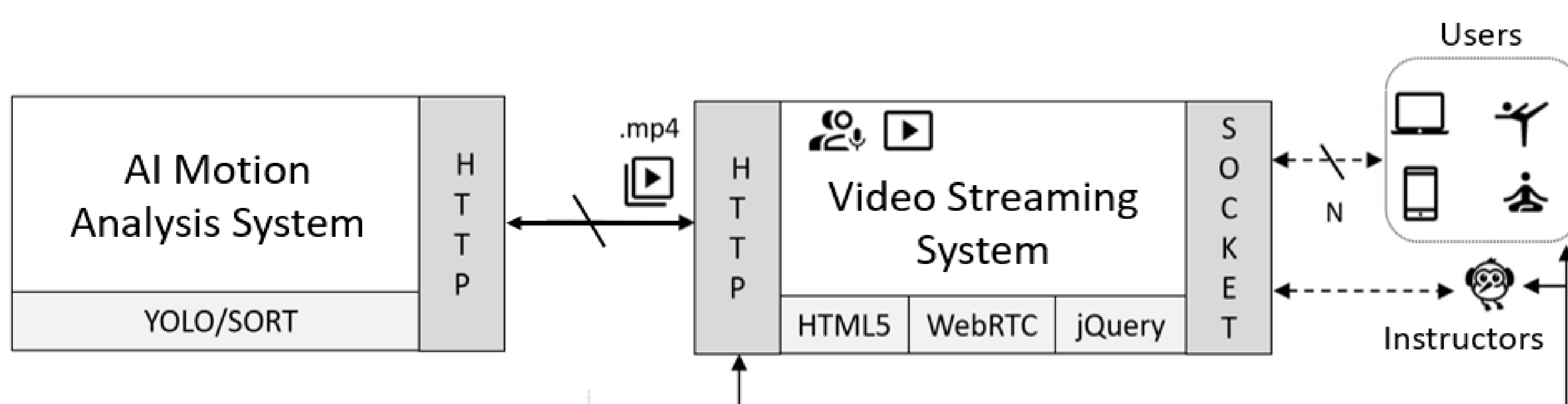
✉ sw Huang@ncut.edu.tw (*Corresponding Author)

Abstract

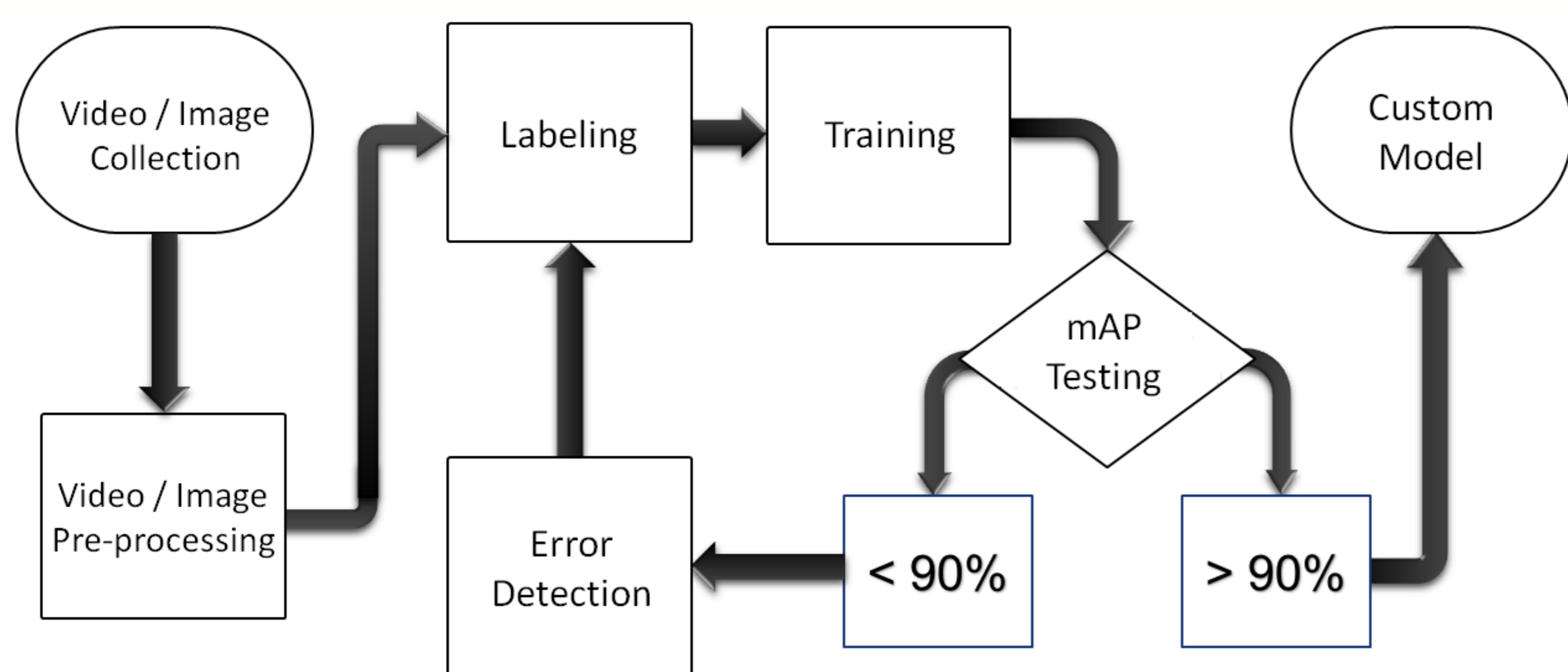
- As people get older, the body shows physiological reduction in function with age and it leads to a reduction in physical activities. This results in muscle atrophy or strength decreasing and eventually causes sarcopenia.
- Exercise has been proven to be one of the most effective means to prevent sarcopenia. However, incorrect exercise postures not only fail to benefit the muscles but also increase the risk of injuries. With the help of fitness instructors, people can ensure that they are doing the exercises correctly and the exercise injuries can be reduced.
- We proposed an AI based upper limb training assistance system with exercise posture recognition which includes three main components:
 - 1) web-based video streaming module;
 - 2) AI function deployment module;
 - 3) automatic motion tracing module.
- According to experimental results, the proposed system can identify lifting exercises for both left and right arms with high accuracy rate of 97.24%.

System Overview

- This system includes an AI motion analysis system and a video streaming system. It can detect users' motion and allows instructor to interact with users as well.



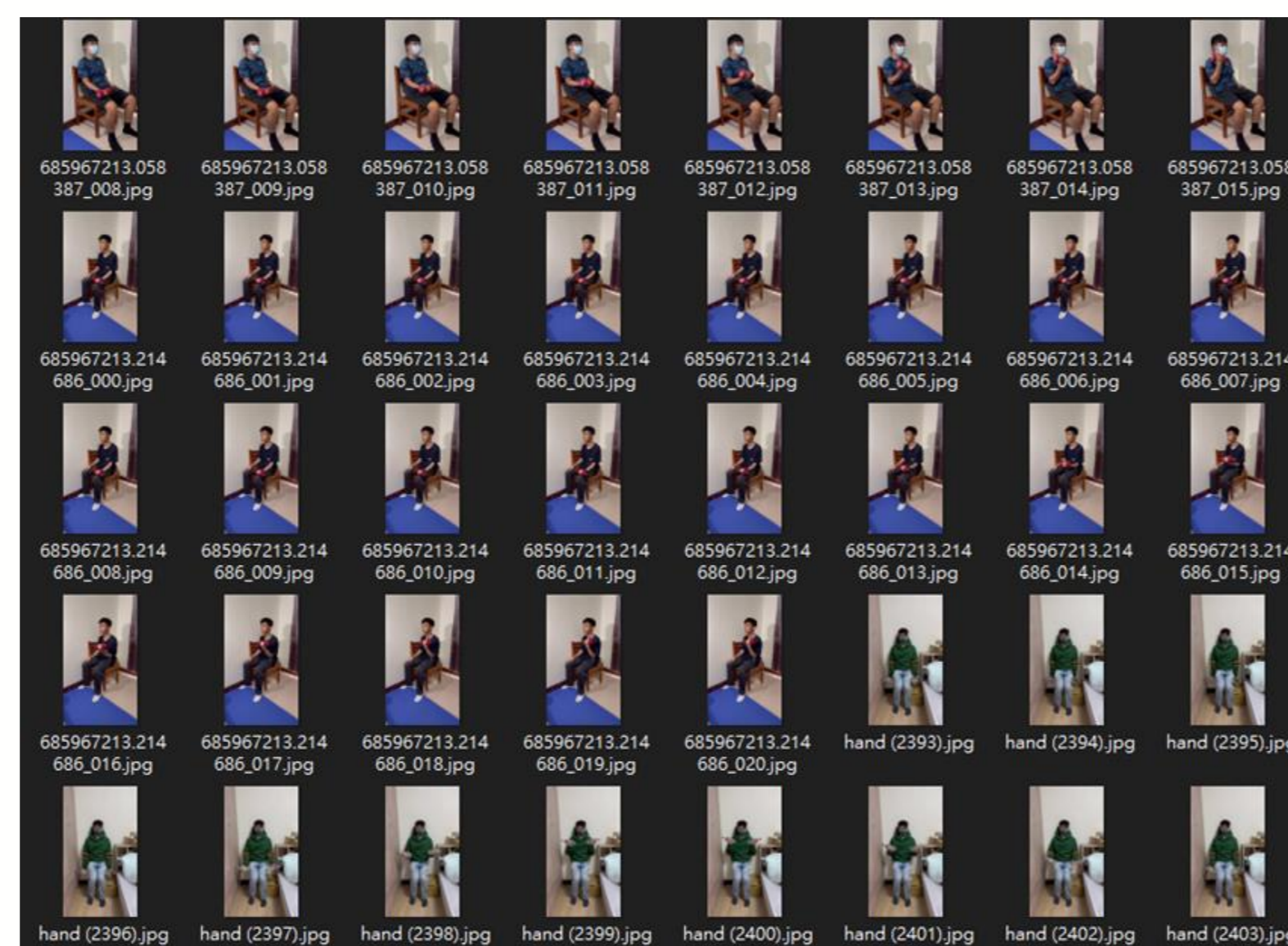
YOLO Training



Training Data Set

- The training data are 3688 images extracted from 20 videos.

	Videos	Images
Train	14	2582
Test	6	1106



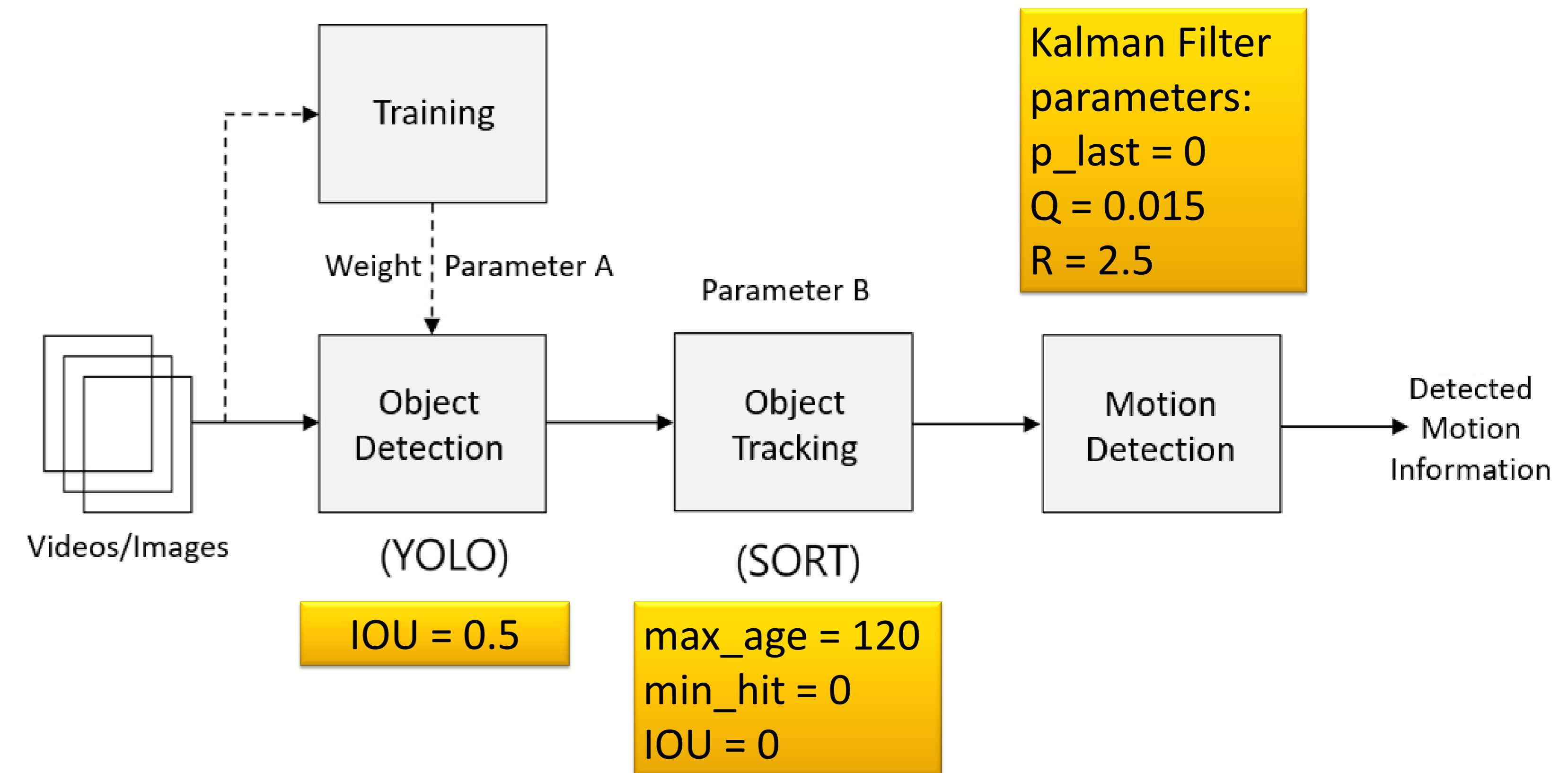
Training Parameters

- max_batch = 4000
- steps = 3200, 3600
- width = 416
- height = 416
- batch = 64

Performance Metrics

- Precision: 100%
- Recall: 97%
- F1-score: 98.4%
- True Positive: 1748
- False Positive: 5
- False Negative: 62
- mAP: 99.19%

Object Detection / Motion Detection



- Motion detection for left and right arms respectively.



Experimental Results

- The experimental results show that our proposed system can identify biceps curls for both left and right arms with high accuracy rate of 97.24%.

Test actions (Body direction)	Actual Times	Detected Times	
		Left Arm	Right Arm
Curl (0°)	16	8	8
Curl (0°)	17	8	9
Curl (0°)	15	8	8
Curl (0°)	20	10	10
Curl (0°)	24	8	11
Curl (0°)	26	13	13
Curl (45°)	22	11	11
Curl (90°)	20	20	0
Curl (90°)	21	0	21

