Biceps Curl Tracking for Maximum Muscle Activation

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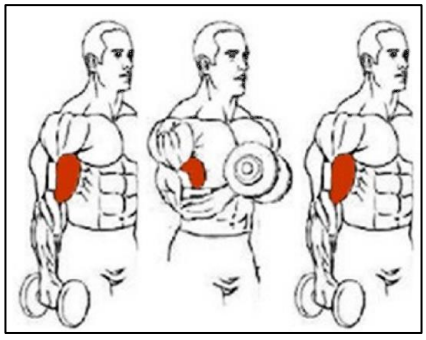
***Abstract*- The biceps curl mainly targets the biceps brachii, brachialis and brachioradialis muscles. The biceps is stronger at elbow flexion when the forearm is supinated (palms turned upward) and weaker when the forearm is pronated. The brachioradialis is at its most effective when the palms are facing inward, and the brachialis is unaffected by forearm rotation. Therefore, the degree of forearm rotation affects the degree of muscle recruitment between the three muscles**

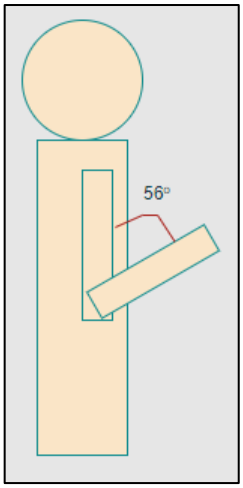
Keywords: biceps curl, deep learning, bicep tracking, mediapipe

I. INTRODUCTION

A biceps curl usually starts with the arm in a fully extended position, holding a weight with a supinated (palms facing up) grip. A full repetition consists of bending or "curling" the elbow until it is fully flexed, then slowly lowering the weight to the starting position. The torso should remain upright instead of swinging back and forth, as doing so transfers the load away from the biceps and onto other muscles, reducing the effectiveness of the exercise. The elbows are also usually kept stationary at the side of the torso, as allowing the elbows to move in front of the weight's center of gravity removes tension on the biceps before full contraction is achieved.



Several variations on the biceps curl by using different equipment, forms, and volume. But the general idea is still to target the biceps activation.
Some typical variations using common equipment that are prevalent among trainers are incline curl, preacher curl, reverse curl and drag curl which can be done using either barbells or dumbbells.



The system can act as a reminder to the patient to stop going up further to reduce the stress force on biceps by showing live angles continuously. Hence, our main contribution is the introduction of wearable-free approach to continuously assess the elbow angles while performing the bicep curl exercise. The system utilizes input features from deep learning-based trackers, which will be fitted to multiple deep belief regressors to assess the elbow angle.

III. LITERATURE REVIEW

The participants in the present study were 15 male and 15 female students attending S University in Busan, Republic of Korea.
The subjects were asked to sit on the measuring chair, and the condyle of the humerus was adjusted to be perpendicular to the axis of rotation of the dynamometer. To avoid using other parts of the body, straps were used to immobilize the chest and the lower legs. Muscle strength and activity were measured at the angles of 56°, 70°, and 84°. After each fixed angle was set, flexion and extension were carried out alternately through isometric exercise, and the muscle strength was measured.
According to Son's18 research, the maximum tension of the muscle is shown when the muscle length is more than 1.2 times longer than at the resting point. Hence, angles were selected that represented a 20% stretch compared with the resting position of the elbow joint.
After examining the differences between the angle, it was apparent that maximum torque value at 56° was higher than at 84°.

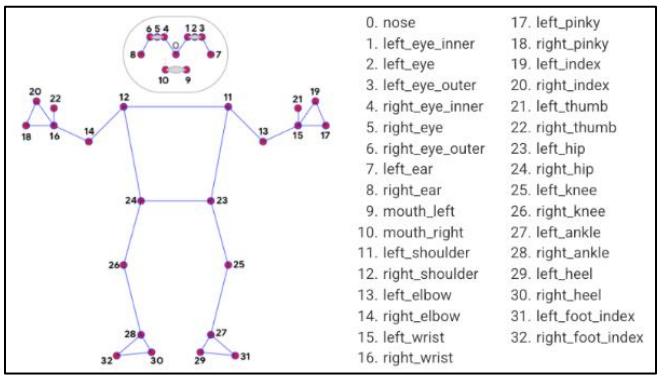
IV. METHODOLOGY

To Track the position of biceps for maximum muscle activation, we need to generate the points for Elbow, Shoulder and Wrists.

First we need to get the Image of the Person. Best results work with the person standing 0.5m from the camera or the person should be visible from head to lower waist with wrist visible.

We will be using pre trained Media Pipe Model which will extract body points.

MediaPipe offers ready-to-use yet customizable Python solutions as a prebuilt Python package.



With the use of OpenCV we will get frames from video and analyse each frame.

Each frame will be first pre processed to get better predicted

Points that will be extracted.

With Each frame passed into the MediaPipe parser, It will return the

Pre defined some what 25 body points. From that we will extract coordinate points for shoulder, elbow and wrist.

To get the best result in Muscle activation we will track the angle In each frame and put down a stop sign when the defined angle is reached. This will prevent muscles to get fatigued with all the extra lifting.

V. ALGORITHM

Open camera
Get frames from video
Analyse each frame
Extract body points
Calculate elbow angle between shoulder and wrist
Show stop sign once the angle hits 56 degrees
Increase tracker count once angle gets 15

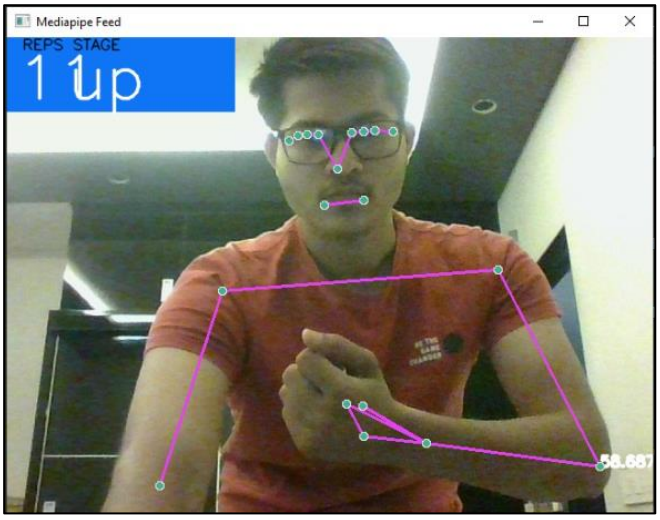
VI. EQUATIONS

Let p define Coordinate Points
Shoulder = p1
Elbow = p2
Wrist = p3
To calculate Angle we will Follow the Formula.

Now, let
x = p2-p1 and
y = p3 – p2
θ = tan^(-1) f_0 x/y
This is the elbow angle between shoulder and wrist.

VII. RESULTS

The resulted Marks are Parsed onto the screen, with continuous monitoring of all the points and analysing each frame, with displaying stop condition on where to stop lifting the Barbell or Dumbbell more to prevent the fatigue of muscles and keep maximum muscle activation while displaying the repetition tracker.



VIII. ACKNOWLEDGMENT

We'd like to thank Professor Param Ahir, our research supervisor, for her guidance and constructive support.

IX. CONCLUSION

A video-based squat angle assessment has been successfully developed for elbow angle measurement. The developed system does not require much interference from the user except for the first frame bounding box, which needs to be taken in an upright posture condition.

Ratio-based features from the trackers are then fed to a set of five regressors with five hidden layers each to produce the lowest mean error angle of 8.64°. This system is suitable to be used in rehabilitation monitoring applications that require the patients to be aware of their bicep curl by notifying the elbow angle bending continuously.

X. FUTURE SCOPE

The system can be further improved by using point-based tracker to track various parts of the body instead of just the head and upper body parts. Other types of regressor can also be explored to improve the elbow angle measurement.

XI. REFERENCES

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