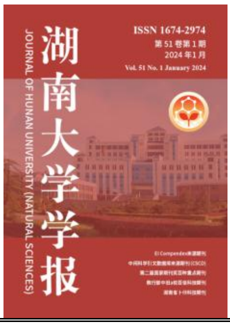

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The Joint Range of Motion Measurement by Comparing a Goniometer and Machine Learning MediaPipe Pose in the Straight Leg Raise Compression Test of Sciatic Nerve Roots

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Abstract: Many human activities, especially movement, rely on all bones, particularly the spine; a disorder or abnormality in the spine results in an abnormal body shape and movement. One of the most common symptoms is low back pain. For most physical examinations of spinal pain, doctors perform the Laseque test, which is the limitation of lifting a straight leg(s), usually associated with the lower back nerve root. The Laseque test is called the straight leg raise test. The joint range of motion in this test is the range between the joint of the left and right legs that is lifted and moves upward, generally measured using a medical stationary device called a goniometer. Measuring with a goniometer is quite complicated because you have to ensure that the patient does not move other body parts when moving the joints to make more accurate measurements and take readings on the goniometer. This research aimed to avoid direct physical contact and minimize transmission using MediaPipe. The straight leg raise test movement can use a computer webcam that detects movement and tracks the position of human body joints supported by the MediaPipe Pose and OpenCV library program packages. A comparison of these measurements indicates that MediaPipe is accurate. Measurements using MediaPipe machine learning solutions are reliable as a tool/device for a doctor's diagnosis and for evaluating the success of therapy in medical rehabilitation.

Keywords: straight leg raise, goniometer, detection, MediaPipe.

透過比較測角儀和機器學習媒体管道直腿姿勢測量關節活動範圍

摘要：人類的許多活動，尤其是運動，都依賴所有的骨骼，特別是脊椎；脊椎疾病或異常會導致身體形狀和運動異常。最常見的症狀之一是腰痛。對於大多數脊椎疼痛的體檢，醫生會進行拉塞克測試，這是抬起直腿的限制，通常與下背部神經根有關。拉塞克測試稱為直腿抬高測試。此測試中的關節活動範圍是左右腿關節抬起並向上移動的範圍，通常使用稱為測角儀的醫療固定設備進行測量。使用測角儀進行測量非常複雜，因為您必須確保患者在移動關節時不會移動其他身體部位，以便進行更準確的測量並在測角儀上取得讀數。這項研究旨在避免直接的身體接觸並最大限度地減少使用媒体管道的傳輸。直腿抬高測試運動可以使用電腦網路攝影機偵測運動並追蹤由媒体管道姿势和开放式计算机视觉庫程式包支援的人體關節位置。這些測量值的比較顯示媒体管道是準確的。使用媒体管道機器學習解決方案進行

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的測量作為醫生診斷和評估醫療復健治療成功的工具/設備是可靠的。
关键词：直腿抬高、測角儀、偵測、媒体管道。

1. Introduction

Many human activities, especially motion, rely on bones, especially the spine. A disorder or abnormality in the spine results in abnormal body shape and movements. The disorders can relate to ligaments and muscles and disorders related to joints and nerve bearings, such as herniated nucleus pulposus (HNP). The most commonly affected structures in the spine are the lower neck and spine, which cause pain. Spinal pain can spread to the thighs, calves, and toes. One of the most common symptoms is low back pain (LBP) [1-3]. For most physical examinations for spinal pain, doctors perform the Laseque test, which is the limitation of lifting a straight leg(s), usually associated with the lower back nerve root. The Laseque test is called the straight leg raise test (SLRT). Based on research [4, 5], the straight leg raise test can be carried out while the patients are in the supine or sitting position, although the test carried out in the supine position has a higher sensitivity to lumbar disk herniation. In the supine position, the SLR test result is positive after being defined by pain extending from 30° to 70° of hip flexion. Rezkallah and Gharib [6] explained that one of the most essential physical examination tests for the clinical diagnosis of lumbar disk herniation is the straight leg raise, which plays a critical role in the patient's diagnosis. Under normal circumstances, it can tolerate 90° flexion of the hip joint with the knee fully extended without pain, except with some stiffness in the hamstrings. At 30° of hip flexion, the nerve root begins to enter the foramen, and with compression of the nerve root, pain is felt during the distribution of the sciatic nerve, which is called sciatica. This pain reduplication is considered SLR-positive. The SLR test is helpful in 85-90% of cases showing lumbar disk herniation [7].

The joint range of motion (ROM) is the range between the joint of the left leg and the right leg that is lifted and moves upward, which can generally be measured using a medical stationary device called a goniometer. ROM is one of the primary measures for assessing joint dysfunction and diagnosing musculoskeletal deficits or disorders. Determining ROM is an essential component of physical evaluation because it enables the identification of joint and muscle limitations and possible risk of injury. According to [8], it is also used as a reference to understand the progress of recovery during the rehabilitation program. In rehabilitation, doctors, physical therapists, osteopaths, and other healthcare professionals commonly use a goniometer to measure joint ROM [9-12]. Shamsi et al. [13] compared the assessment method of the SLR test using an instrument called a goniometer, flexometer, or tape measure. However, with the recent increase in the use of new technologies such as virtual reality (VR), augmented reality (AR), and computer and smartphone applications in the rehabilitation field, new methods, including smartphone-based goniometry, are becoming available [14, 15]. Some researchers performed joint measurements using methods other than a goniometer and compared their measurements to a goniometer. Goniometers commonly measure the range of motion of the musculoskeletal system. It was developed using a smartphone goniometry application and analyzed as reliably as a universal goniometer. Therefore, this application helps evaluate the ROM of the knees [16].

The development of optical motion capture technology provides an alternative solution for measuring ROM in real time, where this technology can detect the movement of the joints of the human body. Research on the comparative study of precision in mutual joint angle calculations uses the Kinect and motion capture optical methods by taking the movement of three joints: shoulder, hip, and knee, but angle calculations are not accurate and do not diagnose a disease state [17]. Kinect sensors can build different applications for health, such as measurement in sports, patient monitoring, patient body movements, and others, as in research [18, 19].

This research applies Kinect to measure shoulder ROM in shoulder adhesive capsulitis (AC). Measurement of ROM is essential for evaluating and diagnosing shoulder adhesive capsulitis (AC); however, measuring using a goniometer is inconvenient and sometimes unreliable. Kinect has gained attention as a new motion detection device that is unobtrusive and easy to calculate. Shoulder ROM measurements using Kinect show much better conformity than those with the goniometer [20].

Estimating human poses is an emerging problem in computer vision that has exposed many challenges and consequences in the past and is now almost a global issue. Analyzing human activities is profitable in many fields, such as video surveillance, biometrics, assisted living, and home health monitoring. User poses are detected, and the differences in the angles of the various body joints are calculated [21]. Researchers using object detection have several applications, including retrieval and surveillance. Object counting is a step after object detection becomes more precise and powerful with the help of OpenCV. For object detection and enumeration, OpenCV includes several helpful techniques [22]. There are a variety of object detection applications, including face detection, character recognition, and vehicle calculators, and object detection can be used for various purposes, including capture and surveillance. Different basic concepts used in object detection using OpenCV and Python libraries can increase the efficiency and accuracy of object detection [23]. This study used hand gesture recognition technology to identify object movements recognized by computers as commands. This research aims to avoid direct physical contact and minimize transmission using MediaPipe [24].

Straight Leg Raise tests can detect and record ROM joints and can convey information better because objects can see the position directly by themselves. The application for detecting SLRT motion uses MediaPipe Pose and OpenCV support.

2. Materials and Method

2.1. Straight Leg Raise

The straight leg raise test is performed using the patient in the supine position. The examiner gently raises the patient's leg by flexing the hip with the knee in extension, and the test is considered positive when the patient experiences pain along the lower limb in the same distribution of the lower radicular nerve roots (usually L5 or S1). Furthermore, a positive straight leg raise test is performed when lower limb flexion at an angle lower than 45 degrees causes pain. During the test, if the pain is reproduced during leg straightening, patients usually request that the examiner aborts the maneuver, and by flexing the patient's knee, the buttock pain is usually relieved (Fig. 1).

Fig. 1 Straight leg raise [25]

2.2. Machine Learning MediaPipe Pose

MediaPipe Pose is a machine learning (ML) solution for high-fidelity body pose tracking, inferring 33 3D landmarks and background segmentation masks across the body from RGB video frames using BlazePose research, which also supports API Detecting ML Kit Pose. Current cutting-edge approaches rely mainly on the desktop environment as well as on most mobile phones, modern desktops/laptops, Python, and even the web. Using a detector, the pipeline first places the person/pose region-of-interest (ROI) in the frame. The tracker subsequently predicts pose landmarks and segmentation masks in the ROI using the cropped frame as input [24]. These are examples of body and face pose estimation using different landmarks. The human pose estimation method uses 33 landmarks [26].

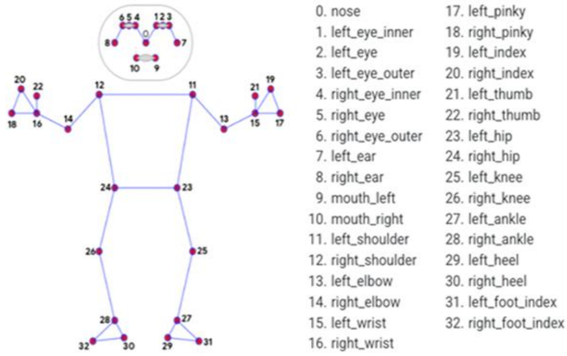

Fig. 2 The landmark model in MediaPipe Pose predicts [26]

2.3. OpenCV

OpenCV (Open Source Computer Vision Library) is an application peripheral interface (API) developed by Intel that can be used for many image processing and computer vision applications. OpenCV makes it easy to process images captured by a webcam camera in analog and then converted to digital for processing using a computer. Using OpenCV, object detection in images that are identified or improved in image quality can be performed quickly and in real time. OpenCV was officially launched in 1999, and the project was initially an Intel/OpenCV that automatically uses appropriate IPP libraries at runtime if that library is installed. OpenCV contains over 500 functions that span many areas of vision, including factory product inspection, medical imaging, security, user interface, camera calibration, stereo vision, and robotics [27].

2.4. Measure the Distance between Two Joints

Vectors are common tools for describing distances and directions. In its application, vectors always occupy space. To describe vectors in space, you can use a coordinate system to explain the magnitude and direction of the vectors. If you treat vectors as points in space, each vector defines a point in 3D. Each point has x, y, and z coordinates in a 3D Cartesian coordinate space that describe an object both one-dimensionally and two-dimensionally. The 3D Cartesian coordinates have 3 coordinate axes, namely the x, y, and z axes, as shown in Fig. 3.

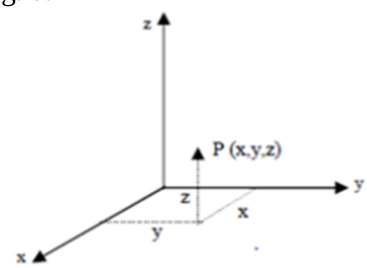

Fig. 3 Image of 3D Cartesian coordinates [28]

Calculation of the SLR angle, the skeleton taken, which is expressed in the vector, is the hip center–left knee and hip center–right knee joints. The coordinates of the vector are only Y and Z, and the 3D conversion is then carried out into 2D. The vector that represents the known leg length can be the length of the projected leg that lifts upwards, namely y, then the angle between the two legs formed is θ, and then based on the trigonometry formula by finding the tangent.

The trigonometry formula is:

$$\tan \theta = y/x \quad (1)$$

The arctan2 function is used, i.e., returns the arc tangent or inverse tangent of the specified x and y coordinates. The arc tangent is the angle from the x-axis to the line containing the origin (0, 0) and the point with coordinates (number_x, number_y). In most math library implementations, arctan2 returns a value between $+\pi$ and $-\pi$, an angle between 0 and 90 degrees. Fig. 4 shows calculations for two vectors [29-31].

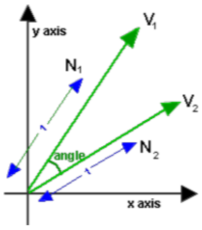

Fig. 4 Arctan2 of 2 vectors to obtain angle [30]

In this study, the SLRT angle can be calculated as follows in Fig. 5 with the assumptions:

[Ax, Ay] = Foot coordinates
[Bx, By] = Hip coordinates
[Cx, Cy] = Projected leg coordinates

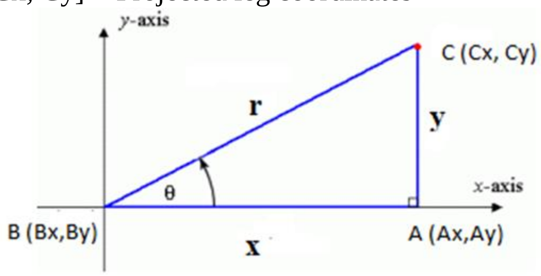

Fig. 5 Vectors used to calculate the SLRT angle (The authors)

Because r and x have the same leg length, we need to find the angle between x and r using (1):

x1 = Ax – Bx; y1 = Ay – By
x2 = Cx – Ax; y2 = Cy – Ay
Angle1 = arctan2 (x1, y1)
Angle2 = arctan2 (x2, y2)
SLR angle = degrees (Angle2 – Angle1)

Calculation of the angle with the function arctan2 aims to obtain the radians of the line formed by the two vectors. For a better understanding of angles, it converts radians to degrees.

2.5. Method

MediaPipe uses real-time ML solution for live and streaming media. ML offered by MediaPipe includes face detection, face mesh, iris, hands, pose, holistic, hair segmentation, object detection, box tracking, and instant motion tracking. Of the many ML solutions offered by MediaPipe, this study focuses on using OpenCV and MediaPipe to recognize two human legs when performing SLR movements.

The first thing to do after both feet are detected by the webcam camera is to use the computer to provide landmarks on the feet. The process of building these landmarks is based on landmarks, a model created by ML MediaPipe and OpenCV. OpenCV captures SLRT videos, and MediaPipe Pose detects email poses (skeleton) according to landmarks.

After extracting and converting the MediaPipe Pose estimate into readable parameters easily, angle measurement can be performed. Given that we all have different body shapes and body lengths, the main parameters taken from MediaPipe's Pose Estimation will be the angles of the main body landmarks and the required distance between some landmarks such as the distance between two hands [29]; our research is a distance of two legs in SLR movement. The image with the MediaPipe will become the skeleton until we obtain the x, y, z coordinates of each joint (left leg joint and right leg joint. This coordinate calculation will be converted into a vector of the left leg and a vector of the right leg according to their respective landmarks and then calculated to find the angle.

For more details, this description is uses the flow block and its accompanying pseudocode (Fig. 6).

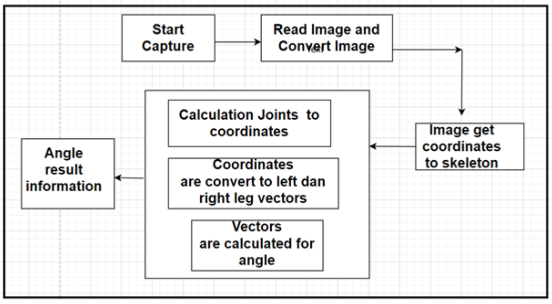

Fig. 6 Methodological step block (The authors)

The block describes from pose detection to generating large angles on the computer screen and is accompanied by pieces of pseudocodes for each step.

1. Start capture.

The first step in taking a pose is to prepare a laptop that has a webcam so that it can detect the movement of the pose.

In this study, the distance that can be captured is about 2.5–3 m from the patient's bed in a clinic room that has good lighting. The goniometer is stationary for manual measurement after completion of poses and stored in the database.

2. OpenCV reads input from the webcam and converts it into an image.

cap = cv2.VideoCapture(inputVideo)

3. MediaPipe processes the image into a skeleton

so that it obtains the x, y, and z coordinates of each joint.

While True = ret, frame = cap.read()
If ret:
rawVideoWriter.write(frame)
# store raw video
frameRGB =
cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
Results = pose.process(frameRGB)

4. The following is the processing of joint points into angles where the left knee, right knee, and hip center coordinates are calculated. Coordinates are converted into left and right leg vectors. The two vectors, left and right, are calculated to find the angle.

4.1. Calculation of joint to coordinates.

Def calcAngle (poseLandmarks):
x = 0
y = 1
mp_pose = mp.solutions.pose.poseLandmark =
mp_pose. PoseLandmark
#Get point format: (X, Y)
hipCenterY =
poseLandmarks.landmark[poseLandmark.
RIGHT_HIP].y
hipCenterX =
poseLandmarks.landmark[poseLandmark.
RIGHT_HIP].x
if poseLandmarks.landmark[poseLandmark.
LEFT_HIP].y < poseLandmarks.landmark
[poseLandmark. RIGHT_HIP].y:
hipCenterY=
poseLandmarks.landmark[poseLandmark.
LEFT_HIP].y
hipCenterX=
poseLandmarks.landmark[poseLandmark.
LEFT_HIP].x
hipCenter = [hipCenterX, hipCenterY]
kneeRight = [poseLandmarks.landmark[
poseLandmark.
LEFT_KNEE].x, poseLandmarks.landmark[
poseLandmark.
LEFT_KNEE].y]
kneeLeft = [poseLandmarks.landmark[
poseLandmark. RIGHT_KNEE].x,
poseLandmarks.landmark[
poseLandmark. RIGHT_KNEE].y]

4.2. Coordinates are converted to left and right vectors.

Create vectors
vectorRightKnee = [hipCenter[x] kneeRight[x],
hipCenter[y] - kneeRight[y]] # vector
pointing from knee_right to hip_center
vectorLeftKnee = [hipCenter[x] kneeLeft[x],
hipCenter[y] - kneeLeft[y]]
# vector pointing from knee_right to hip_center
vectorRightKnee = [hipCenter[x] kneeRight[x],
hipCenter[y] - kneeRight[y]]
# vector pointing from knee_right to hip_center
vectorLeftKnee = [hipCenter[x] kneeLeft[x],
hipCenter[y] - kneeLeft[y]]
vector pointing from knee_right to hip_center

4.3. Vectors are calculated for the angle.

#calc radian
rad = abs
math.atan2(vectorRightKnee[x],
vectorRightKnee[y]) –
math.atan2(vectorLeftKnee[x],
vectorLeftKnee[y]);
#convert radian to degree
degree = rad * (180 / math.pi)
return round (degree, 1)

5. Angle result information.

If you want to display the angle on the screen, use the following code:

If result.pose_landmarks:
mpDraw.draw_landmarks(frame,
results.pose_landmarks,
mpPose. POSE_CONNECTIONS) angle =
_util.calcAngle(results.pose_landmarks)
resultAngle = ‘Angle : ‘ + { :.if}.
Format(angle) + ‘degrees’

Determine if there is pain or not and if there is pain that relates to the sciatic nerve:
def is sciatic nerve angle, and if angle ≥ 30 and ≤ 70, it is pain = True:
return True
return False.

3. Results and Discussion

The following is the image displayed when starting Start capture, where before recording and starting the capture, you are asked to fill in the identity data with detailed data: name, gender, date of birth, address and test location then saved as a SLRT database. Fig. 7 shows the raw image capture and Fig. 8 shows the image of the SLRT pose detection result.

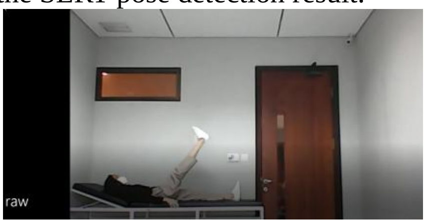

Fig. 7 SLRT movement raw image (The authors)


Fig. 8 SLRT pose detection image (The authors)

The sciatic nerve root compression test in SLR in real time starts from image capture until the SLR skeleton is detected. The degree obtained and the patient in performing SLR movements can be recorded directly. To determine the angle, it is necessary to know how strong and high the patient can lift one leg up. When the patient stops lifting the leg, the data will be recorded in accordance with the angle formed between the two legs. The analysis was adjusted to standardized points that were calculated as the presence of a stretched sciatic nerve root and as part of the sciatic nerve root compression test. In data collection, 20 objects whose movements were recorded, the SLR angle was calculated automatically using algorithms and the skeleton on landmarks in MediaPipe Pose, as shown in Fig. 9 (a) and (b) as detected SLR pose images.

(a)

(b)

Fig. 9 SLR poses detected by 10 respondents (The authors)

Table 1 is the result of reporting in the database containing information on the identity of the respondent (patient), the angle of ROM formed, and the presence or absence of pain. Identity in the form of name, place, and date of birth is not included in Table 1 for confidentiality.

Table 1 SLR data recording results (The authors)

Number	Test date and time	Test place	Gender	Angle	Pain
1	01/09/2022 10:02	UPDT Lubuk Jambi	Male	79.2	FALSE
2	01/09/2022 10:05	UPDT Lubuk Jambi	Male	70.3	FALSE
3	01/09/2022 10:13	UPDT Lubuk Jambi	Female	43.8	TRUE
4	01/09/2022 10:17	UPDT Lubuk Jambi	Female	55.9	TRUE
5	01/09/2022 10:21	UPDT Lubuk Jambi	Female	88.5	FALSE
6	01/09/2022 10:26	UPDT Lubuk Jambi	Female	82.1	FALSE
7	01/09/2022 10:29	UPDT Lubuk Jambi	Female	94.4	FALSE
8	01/09/2022 10:35	UPDT Lubuk Jambi	Female	62.2	TRUE
9	01/09/2022 10:41	UPDT Lubuk Jambi	Female	109.1	FALSE
10	01/09/2022 10:44	UPDT Lubuk Jambi	Female	66.4	FALSE
11	01/09/2022 10:46	UPDT Lubuk Jambi	Female	87.3	TRUE
12	01/09/2022 10:47	UPDT Lubuk Jambi	Female	119	FALSE
13	01/09/2022 10:49	UPDT Lubuk Jambi	Female	34.2	FALSE
14	01/09/2022 10:53	UPDT Lubuk Jambi	Female	95.7	FALSE
15	01/09/2022 11:03	UPDT Lubuk Jambi	Female	73.5	FALSE
16	01/09/2022 10:08	UPDT Lubuk Jambi	Male	71	FALSE
17	01/09/2022 10:11	UPDT Lubuk Jambi	Male	80.8	FALSE
18	01/09/2022 11:28	UPDT Lubuk Jambi	Female	90.6	FALSE
19	01/09/2022 11:06	UPDT Lubuk Jambi	Female	45.5	TRUE
20	01/09/2022 11:04	UPDT Lubuk Jambi	Female	92.4	FALSE

The next analysis determined the accuracy of the SLR results, namely the angle. SLR results to be compared with the use of manual angle measurement, i.e., a goniometer. The second comparison supports the evidence of a sciatic nerve root compression test using a webcam and MediaPipe Pose to determine accuracy.

After automatic data collection using a computer, manual measurements used a goniometer under the supervision of a doctor.

SLR data retrieval used computer measurements captured by a webcam. After detecting a large angle, the patient holds the SLR position for manual data retrieval using a goniometer. Fig. 10 shows the measurement method using a goniometer.

Fig. 10 Measurement using a goniometer (The authors)

Measurements with a goniometer are longer than pose detection measurements and allow the patient to hold the leg elevated. This measurement is also a joint that should not move much and requires careful reading of the stationary goniometer.

Table 2 shows the results of angle measurements comparing the computer and manual angle measurements (goniometer), the results of the difference, and the percentage of the difference between the two measurements.

Table 2 Presentation of a comparison of the results of automatic and manual angle measurements (The authors)

No.	Test date and time	Test place	Gender	Angle	Goniometer	Difference	%
1	01/09/2022 10:02	UPDT Lubuk Jambi	Male	79.2	78	1.2	1.54
2	01/09/2022 10:05	UPDT Lubuk Jambi	Male	70.3	72	1.7	2.36
3	01/09/2022 10:13	UPDT Lubuk Jambi	Female	43.8	46	2.2	4.78
4	01/09/2022 10:17	UPDT Lubuk Jambi	Female	55.9	58	2.1	3.62
5	01/09/2022 10:21	UPDT Lubuk Jambi	Female	88.5	90	1.5	1.67
6	01/09/2022 10:26	UPDT Lubuk Jambi	Female	82.1	80	2.1	2.62
7	01/09/2022 10:29	UPDT Lubuk Jambi	Female	94.4	95	0.6	0.63
8	01/09/2022 10:35	UPDT Lubuk Jambi	Female	62.2	61	1.2	1.97
9	01/09/2022 10:41	UPDT Lubuk Jambi	Female	109.1	105	4.1	3.90
10	01/09/2022 10:44	UPDT Lubuk Jambi	Female	66.4	64	2.4	3.75
11	01/09/2022 10:46	UPDT Lubuk Jambi	Female	87.3	89	1.7	1.91
12	01/09/2022 10:47	UPDT Lubuk Jambi	Female	119	117	2	1.71
13	01/09/2022 10:49	UPDT Lubuk Jambi	Female	34.2	33	1.2	3.64
14	01/09/2022 10:53	UPDT Lubuk Jambi	Female	95.7	93	2.7	2.90
15	01/09/2022 11:03	UPDT Lubuk Jambi	Female	73.5	75	1.5	2.00
16	01/09/2022 10:08	UPDT Lubuk Jambi	Male	71	73	2	2.74
17	01/09/2022 10:11	UPDT Lubuk Jambi	Male	80.8	82	1.2	1.46
18	01/09/2022 11:28	UPDT Lubuk Jambi	Female	90.6	89	1.6	1.80
19	01/09/2022 11:06	UPDT Lubuk Jambi	Female	45.5	47	1.5	3.19
20	01/09/2022 11:04	UPDT Lubuk Jambi	Female	92.4	90	2.4	2.67

The trial was carried out at the Lubuk Jambi Community Health Center, Riau Province, with medical supervision and consent from the patients.

The result is that the total percentage is 90.28%. The average error is calculated by 50.87% divided by the number of objects studied, namely 20 (2.54%), meaning that the level of accuracy of the SLR angle measurement with a computer is 100% – 2.54% = 97.46%.

In calculating and finding the angle of 2 joints, it is known that in the MediaPipe, there is no center hip joint, but there are left and right hips [26], so to find the hip joint point used is the farthest one from the left and right knee points, this is the most accurate point based on testing, when compared to finding the median of the two points.

4. Conclusion

This research succeeded in detecting SLR skeletons using ML MediaPipe Pose and OpenCV. Using OpenCv was mainly for capturing video results meanwhile MediaPipe was for pose (skeleton) detection.

All processes of the poses of the two legs were successfully detected, obtaining information on the angle size. However, there are problems if the webcam camera range is too close to the object. The results of the detection of two legs do not appear to be in the correct position of the SLR and impact the calculation of the angle and information on the angle results.

This study tested only 20 patients at the clinic location. The measurement results show a more accurate 97.46%, which proves that measurements with webcam capture supported by OpenCV and MediaPipe Pose are reliable as a medical diagnosis tool. Therapy can also be helpful in medical rehabilitation and, in the future, tested by increasing data collection on respondents/patients with symptoms of low back pain.

Based on a comparison of the measurement results between a goniometer and a webcam, we found that with a webcam, it is faster and more accurate to calculate angle sizes. Our research is more reliable, easy, and affordable than previous studies.

SLR pose detection measurement can be helpful in medicine to replace the manual goniometer and automatically measure the SLR angle as basic information for the sciatica root compression test for low back causes.

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