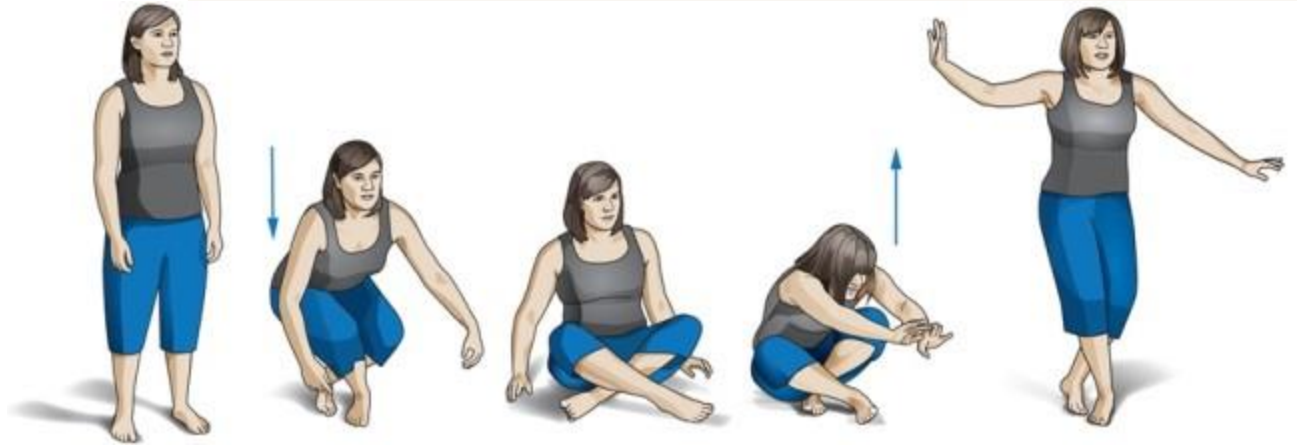


Can you pass this test?



Can you sit and rise without using your hand?



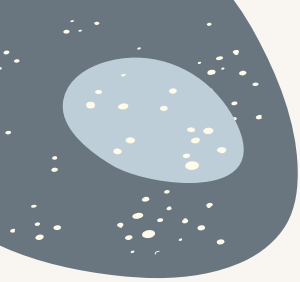
Simple sit-and-rise test predicts how long you'll live



01

INTRODUCTION





Main Muscle Groups Used

Sit-and-Stand

Legs

Thighs

Back Muscles

Squats

Legs

Thighs

Back Muscles

Squat - King of All Exercises

Squatting could be the answer to living longer, says expert - try sitting test at home

One study, involving 2,000 people, proved that the ability to sit and rise from the floor was linked to living longer.

By **FIONA CALLINGHAM**

17:44, Wed, Jan 11, 2023 | UPDATED: 17:47, Wed, Jan 11, 2023

Backed by European Journal of Preventive Cardiology

Repeated Mentions of Same topic over time

How to live longer: One exercise that could add years to your life expectancy

SITTING for long periods of time, and general inactivity, can lead to a number of health problems. Therefore, to increase our life expectancy and lead healthier lives, the NHS advises that we exercise regularly, at least 150 minutes a week, and reduce sitting time.

By **HARRIET WHITEHEAD**

10:38, Sun, Sep 19, 2021 | UPDATED: 10:38, Sun, Sep 19, 2021

How do people learn squat?

Personal Trainer

Pro: Customised Training Plan, Varied Benchmarking

Con: **Expensive**

Learn from Online Video

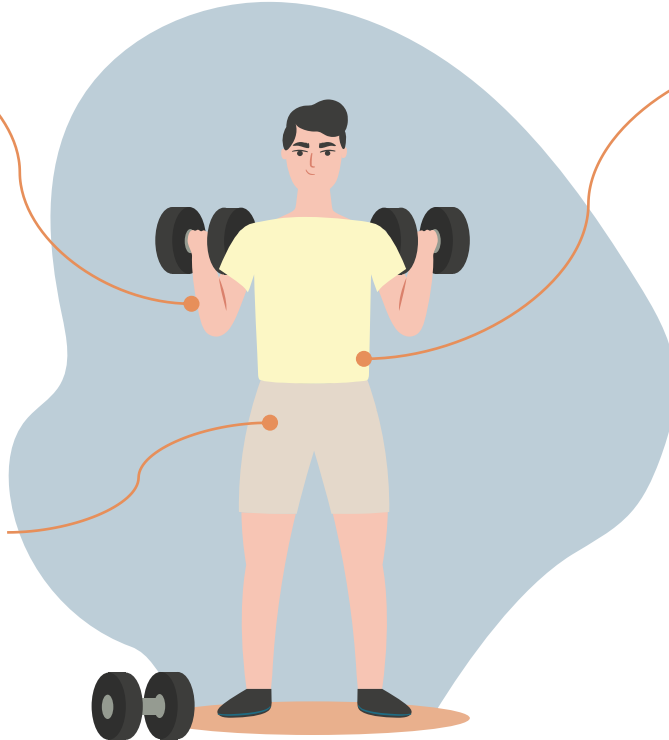
Pro: Free of Charge

Con: **No feedback**

Fitness App

Pro: General Self Management Strategies

Con: **Some are free but does not have specialised feature for squats**





Popular Videos to Squat

How To Squat Properly: 3 Mistakes Harming Your Lower Back (FIX THESE!)

3.3M views • 3 years ago

Tom Platz Explains How Most People Do The Squat Wrong

2.7M views • 4 months ago

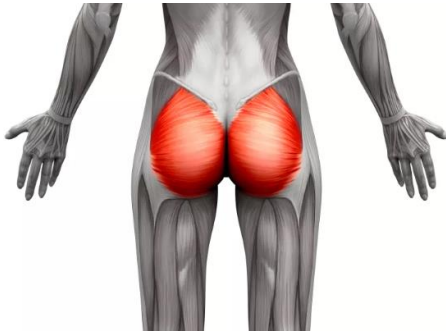
Stop Squatting Like This (AWFUL!!)

3.1M views • 4 years ago

> 10 millions
views

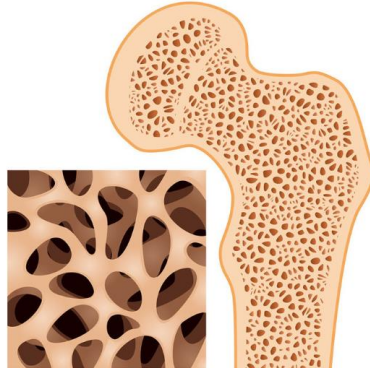
The BENEFITS of Squats

Strengthen Core Muscle Group



Glutes and quadriceps

Boost Bone Mineral Density



Adds strengths to your skeleton, mainly **lower body**

Sustain Body Functionality



The ability of sit-and-rise may predict your chance of dying early

The CONs of doing WRONG SQUATS

Back Injury



Knee Injury



Does not Strengthen muscle





02

PROBLEM STATEMENT



The project aims to...

Empower individuals to improve their health and fitness by

- (i) learn how to do a correct squats independently;
- (ii) assess their squat count;
- (iii) improve their squat form.



03

DATA COLLECTION/CLEANING



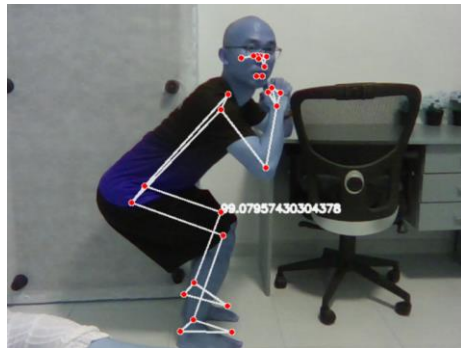
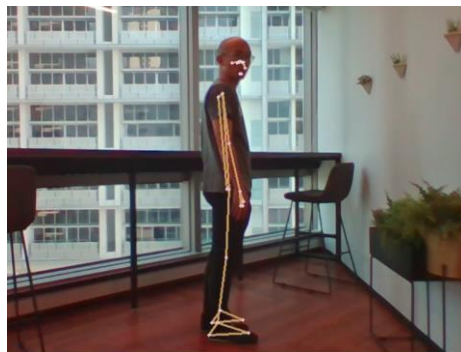
Data Collection

Define Class for
machine

Rest

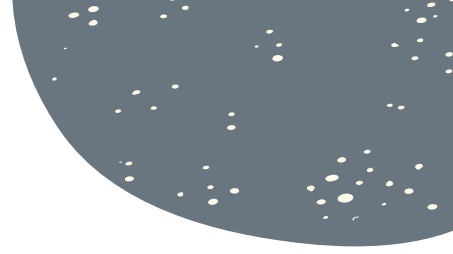
Down

Position for Camera

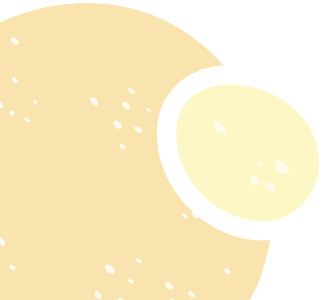


Translate to
coordinates

class	x1	y1	z1	v1
Rest	0.486392	0.188268	-0.24306	0.996174
Rest	0.486806	0.188292	-0.2314	0.996431
Rest	0.487946	0.188323	-0.20695	0.996615
Rest	0.488427	0.188332	-0.21359	0.996844
Rest	0.48896	0.188376	-0.20884	0.997067
Rest	0.489001	0.188686	-0.20675	0.997234
Rest	0.489174	0.189138	-0.20926	0.997411
Rest	0.489673	0.189173	-0.21545	0.997547
Rest	0.490136	0.189178	-0.2255	0.997679
Rest	0.492659	0.1899	-0.21833	0.997722
Down	0.378678	0.382289	-0.10707	0.998461
Down	0.379418	0.382027	-0.09737	0.998491
Down	0.381334	0.378812	-0.12439	0.998578
Down	0.38151	0.378898	-0.11637	0.998634
Down	0.3815	0.378964	-0.11558	0.99865
Down	0.384365	0.380257	-0.092	0.998664
Down	0.388948	0.381082	-0.17439	0.998757




Data Collection vs Data Cleaning Trade-Off



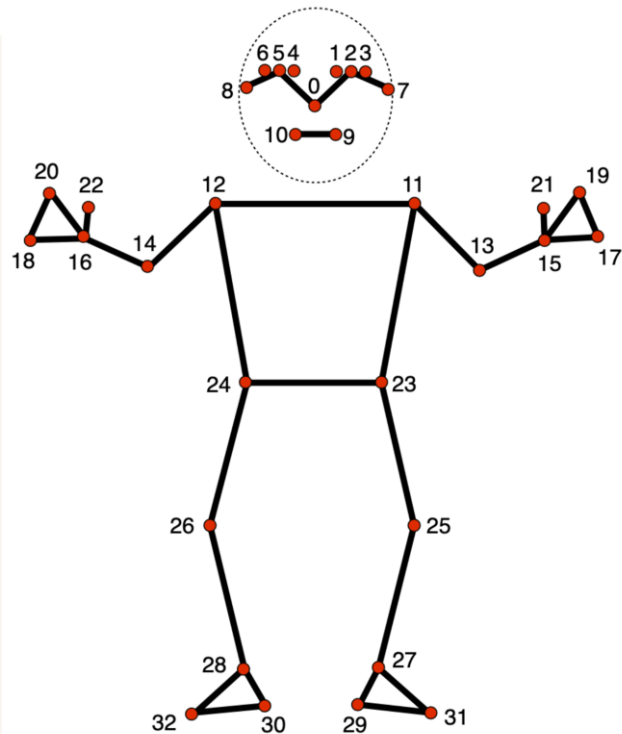


04

EXPLORATORY DATA ANALYSIS (EDA)



Pre-Trained Joints Detection Model



33

Joints detection points

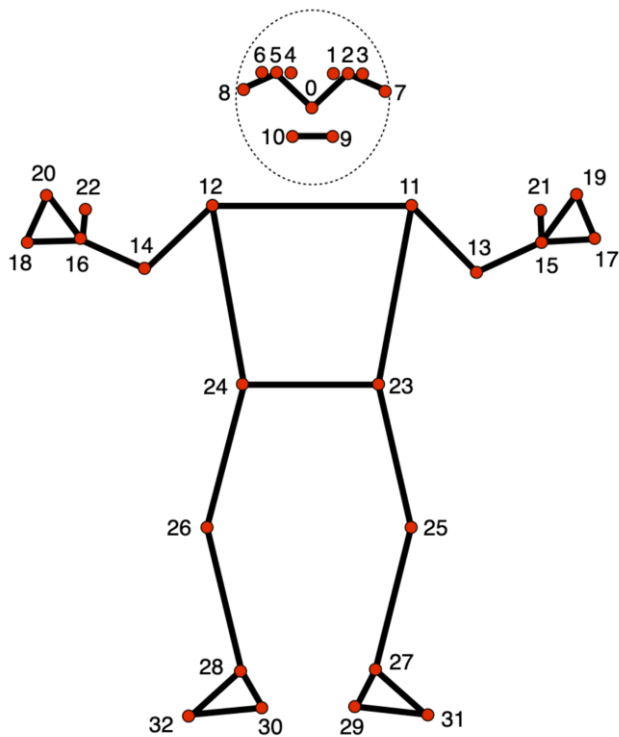
4

Data collection per points

133

Columns of Coordinates
Data & Class

4 Coordinates / Joints



X

Horizontal Coordinates

Y

Vertical Coordinates

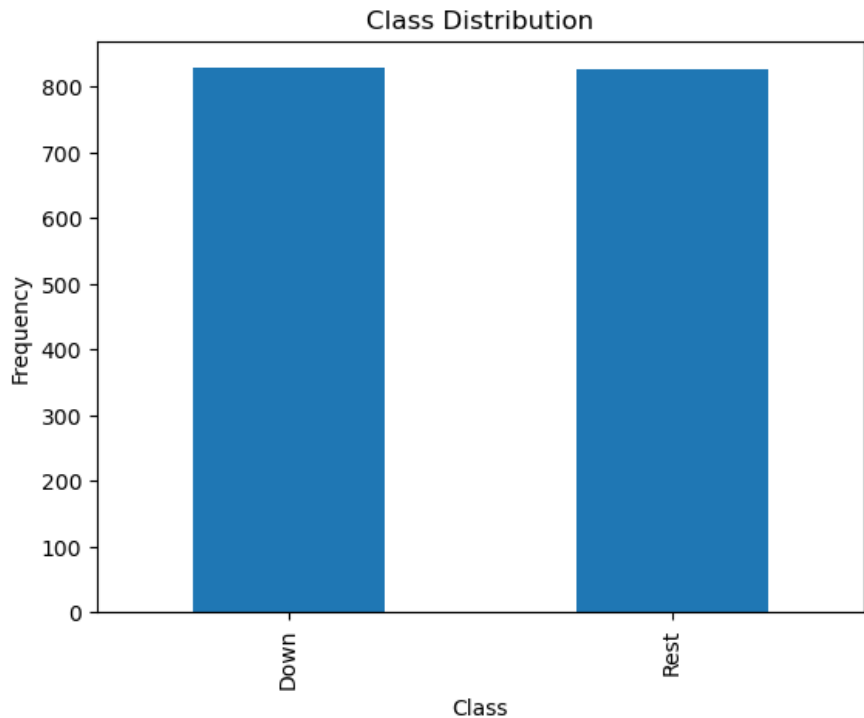
Z

Depth Coordinates

V

How well computer could see the coordinate

Even Class to Avoid Machine Bias



1600 Rows of Coordinates

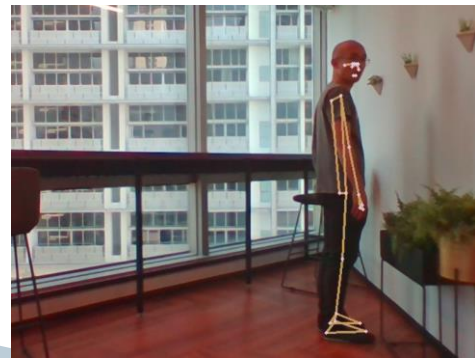
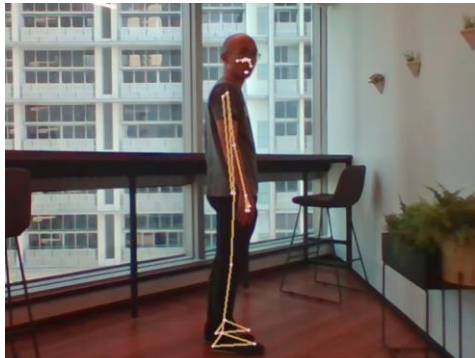
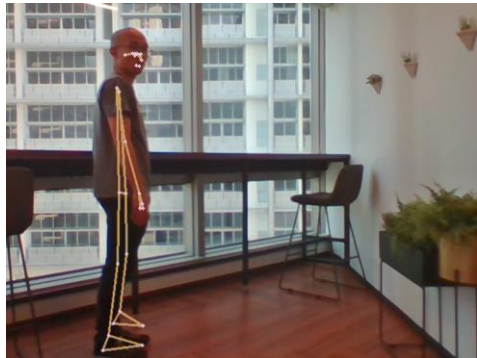
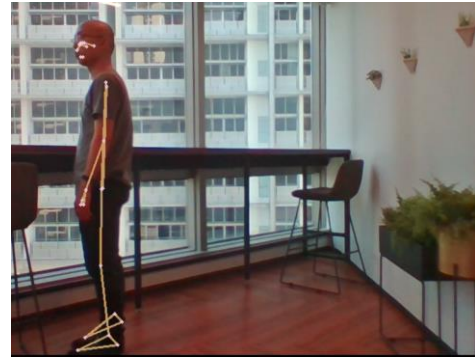
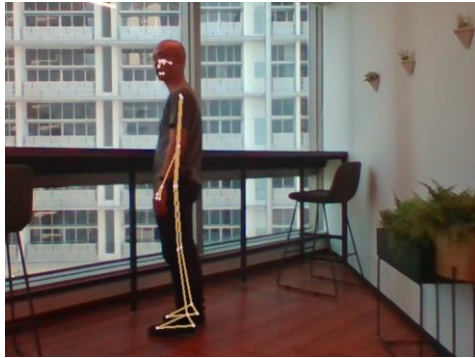
6

Rest States

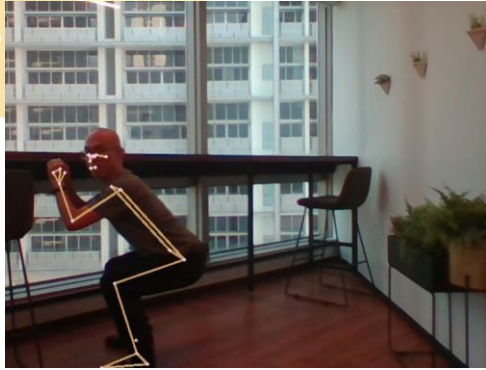
6

Down States

Computer Vision - 'Rest' State

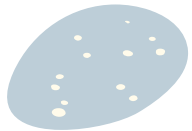


Computer Vision - 'Down' State



05

MODELLING



Modelling Workflow

Model Used

Random Forest
Classifier
(RF)

Logistic
Regression
(LR)

XGBoost
Classifier
(XGB)

AdaBoost
Classifier
(ABC)

Hyperparameters Tuning

n_estimators
max_depth
samples_leaf

penalty
C
max_iter

learning_rate
n_estimators
sample_leaf

n_estimators
learning_rate
estimator

Metrics

Train Accuracy

Test Accuracy

Train F1 Score

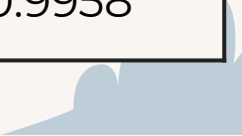
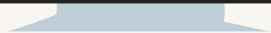
Test F1 Score



MODEL SCORE



	Train Accuracy	Test Accuracy	Train F1 Score	Test F1 Score
Null Model (Baseline)	0.5	0.5	0.5	0.5
Random Forest Classifier	0.9983	0.9960	1.0	0.9957
Logistic Regression	0.9983	0.9960	1.0	0.9958
XGBoost Classifier	0.9965	0.9960	1.0	0.9957
AdaBoost Classifier	1.0	0.9980	1.0	0.9958





06

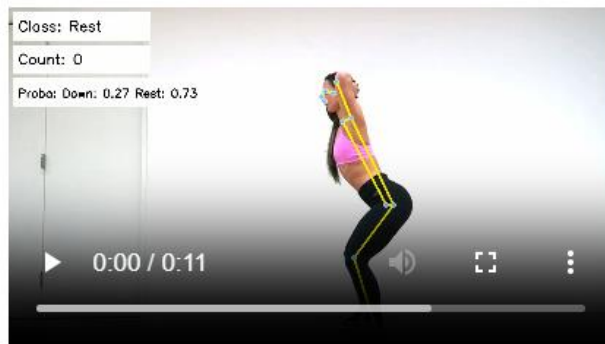
STREAMLIT DEMO





AI Squat Training Assistant Demonstration

The AI Squat Counter computes your squat count for you.



The probability shows the probability of your state.

The AI Squat Enhancer give you feedback on your correct and incorrect squat.



When your squat is incorrect, it will display text to inform you how to improve it.

Squat Counter

Live Version

Live AI Squat Counter

The system will analyze your body posture and keep track of the number of squats you perform.

Instructions:

1. Press start to start the machine camera.
2. Move sufficiently far and side face camera.
3. Press stop when you finish doing squats.



START

SELECT DEVICE

Mobile

AI Squat Counter

The system will analyze your body posture and keep track of the number of squats you perform.

Instructions:

1. Click on Browse File and Upload your video file.
2. The system only accepts mp4, mov and avi file.
3. Click on Download Video if you wish to download the video into your device.

Upload a Video



Drag and drop file here

Limit 200MB per file • MP4, MOV, AVI, MPEG4

Browse files

Upload

Squat Counter

Live Version

AI Squat Training Assistant

The system will analyze your body posture and keep track of the number of squats you perform.

Instructions:

1. Press start to start the machine camera.
2. Move sufficiently far and side face camera.
3. Press stop when you finish doing squats.



START

SELECT DEVICE

Mobile

(Upload Video) AI Squat Training Assistant

The system will analyze your body posture and give feedback to your squat postures.

Instructions:

1. Click on Browse File and Upload your video file.
2. The system only accepts mp4, mov and avi file.
3. Click on Download Video if you wish to download the video into your device.

Upload a Video



Drag and drop file here

Limit 200MB per file • MP4, MOV, AVI, MPEG4

Browse files

Upload



07

MODEL EVALUATION



Streamlit Features \Leftrightarrow Problem Statement

**Instant
Feedback**



**Assess Squat
Count**

**Prescriptive
Feedback**



**Improve Squat
Form**

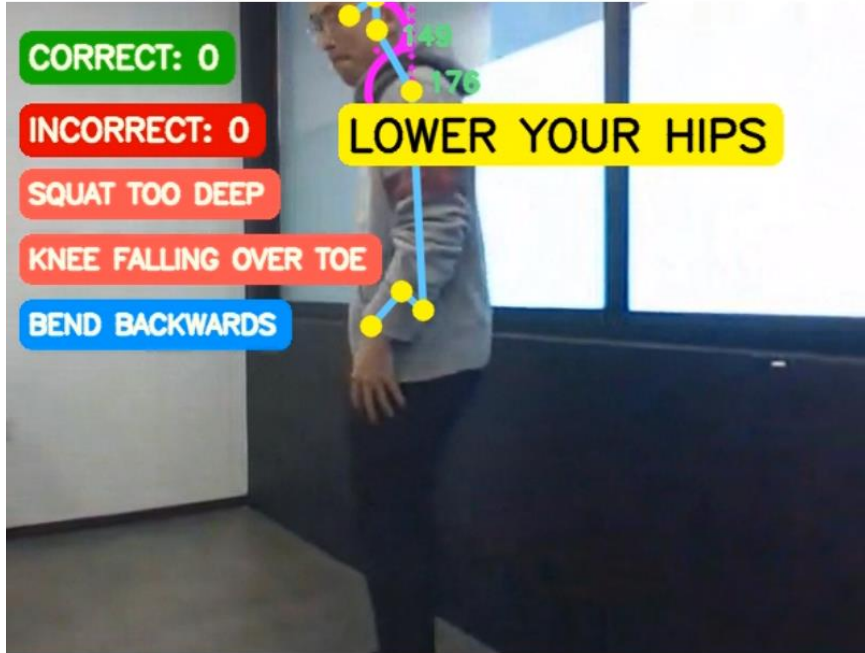
Mobility



**Learn Correct Squat
independently**

4 Prescriptive Messages

AI Squat Training Assistant



Knee Over Toes

Lower Your Hips

Bend Backwards

Bend Forward

Prescriptive Messages \Leftrightarrow Wrong Squat

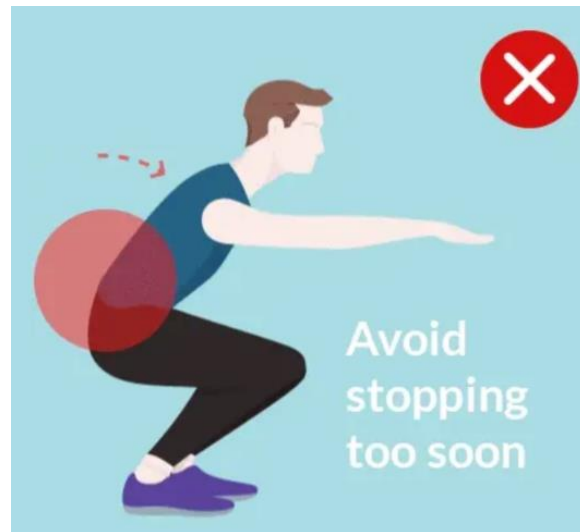
**Bend
Forward/Backwards**



Knee Over Toes



Lower Your Hips



Summary of Product Features

	Product Features			
	Accuracy	Instant Feedback	Prescriptive Feedback	Mobility
Live Counter				
Live Enhancer				
Upload Counter				
Upload Enhancer				

Future Work

Other Exercises

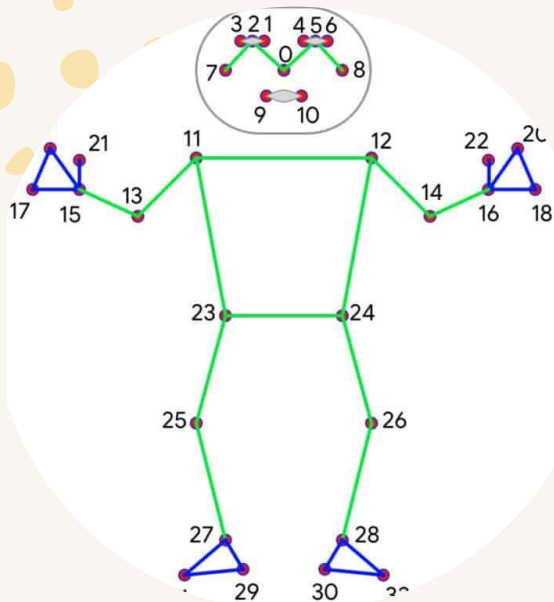
Sit Up and Deadlifts

Sound Effect

When correct squat is performed

Further Training of Model

Train model with different heights of people

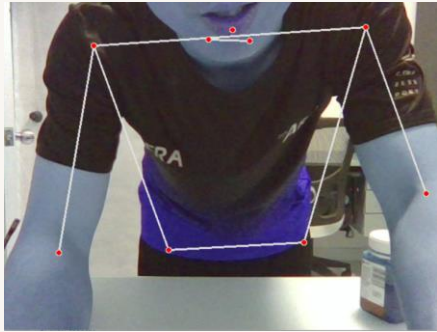


The background features a large, light beige abstract shape in the center. In the top left, there is a cluster of small, light blue dots. In the top right, a dark blue circular shape contains small white dots. In the bottom left, a yellow circular shape with a white outline and small white dots is partially visible.

THANK YOU

Challenges in Data Collection

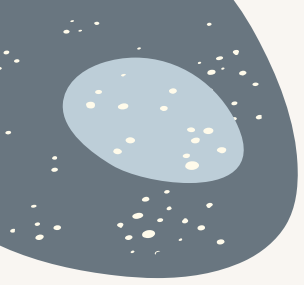
Machine collected data
instantaneously



Insert a 5 seconds
sleep time for me to
be in position

```
import time

# Delay for 5 seconds
time.sleep(5)
```



Challenges in Data Collection



Challenges

**Multiple Detection of Bodies
will confuse Machine**

**Machine collects the data
when I was about to off the
program**

Solutions

**Clear the areas before
data collecting**

Data Cleaning

