

A black and white photograph showing two women in a gym setting, both on stationary bicycles. The woman in the foreground is leaning forward, pedaling. The woman behind her is smiling. The background shows other gym equipment and a window.

RIDE RIDE REVOLUTION

DSI39 | SHEILA KOO

A black and white photograph of two women in a gym, both wearing tank tops and shorts, exercising on stationary bicycles. They are looking forward, focused on their workout. The background shows other gym equipment and a window with bright light coming through.

INTRODUCTION

INTRODUCTION

WHAT IS SPIN?



**aka RHYTHMIC
CYCLING**

POWER+FLOW



Weights

Resistance knob

Clip-on pedals

BENEFITS



PHYSICAL
HEALTH



MENTAL
HEALTH



LOOK FIT

A black and white photograph of a woman with dark hair tied back, wearing a dark tank top and shorts, exercising on a stationary bike in a gym. She is leaning forward, looking down at the bike's handlebars. The gym has other equipment and windows in the background.

20% GLOBAL FITNESS MARKET

did spin classes in 2019 (LesMills, 2019)

NUMBERS
NUMBERS



2ND MOST POPULAR

Group exercise in Singapore (Virgin Active, 2022)

NUMBERS
NUMBERS



45,000
members

Revolution Singapore (Chiew, 2022)

NUMBERS
NUMBERS

CHALLENGES

r/xxfitness

How do I improve my coordination for rhythm-based indoor cycling class?

For background information, I can dance on beat just fine, but apparently not on a stationary bike...

when the moves get complicated (fast paced off and on saddles, upper body involved) my legs tend to go out of beat and I feel like I can only catch up with one half of my body and not the other.



2 yr. ago

I've been spinning for YEARS now and I still struggle to stay in rhythm. I was definitely born with two left feet. But exercise is exercise! As long as you're not hurting yourself I'd say just enjoy the music and enjoy moving your body!

My legs felt like lead and I struggled to keep on the beat in the first class. Psycle is all about cycling to the rhythm and I just couldn't seem to find it.

RISK OF RHABDOMYOLYSIS

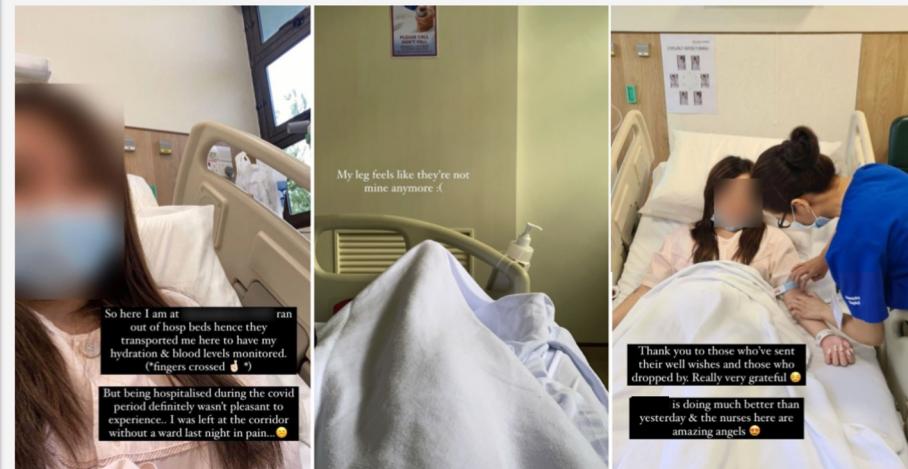
rhabdomyolysis noun
rhab·do·my·ol·y·sis

A breakdown of muscle from extreme physical exertion. Can cause kidney failure and death.

2 S'pore women hospitalised with potentially fatal muscle breakdown after a spin class

Rhabdomyolysis, a condition where muscles are injured or overworked and start to break down, may ultimately lead to kidney failure and even death.

Nigel Chua | February 28, 2021, 12:03 PM



A black and white photograph showing two women from the side, exercising on stationary bicycles in a gym setting. They are wearing athletic tank tops and shorts. The woman on the left is smiling towards the camera, while the woman on the right looks forward.

PROBLEM STATEMENT

Though spin has become an **increasingly popular** workout, some are resistant to try it as they find the complexity intimidating.

Those who tried might find it **tough to catch the beat while getting the choreography right**.

Some who were unable to withstand the intensity of spin suffered from rhabdomyolysis, which can be fatal.

Solution: Gamify spin using machine learning to encourage spinning at own learning pace

OBJECTIVES

01
GET THE MOVES RIGHT

Predict whether the rider's
choreo move is correct

02
RIDE ON THE BEAT

Predict whether the rider is
riding to the beat

WORKFLOW

01

DATA
COLLECTION

02

DATA CLEANING

03

EDA,
FEATURE ENGINEER/
SELECTION

04

MODELLING

05

DEPLOYMENT

A black and white photograph of a woman in a gym, smiling while leaning forward on a stationary bike. She is wearing a dark sports bra and light-colored leggings. The background shows gym equipment and a window.

01

DATA COLLECTION

DATA COLLECTION

FILMING

MEDIPIPE

LIBROSA

'I Want It That Way'
(1 verse + 1 chorus)



Coordinates



Tempogram Ratio



A black and white photograph of a woman in a gym, smiling while leaning forward on a stationary bike. She is wearing a dark sports bra and light-colored leggings. The background shows other gym equipment and a window.

02

DATA CLEANING

DATA CLEANING

CHECK
NULL

CHECK
DATA TYPE

CHECK
DUPLICATES

None

All floats except
'choreo' moves

None

DATASETS

01
COORDINATES

9,368 rows

02
BEATS

251 rows



REGULAR



PULSE



PUSH



SEXY
CORNERS



03

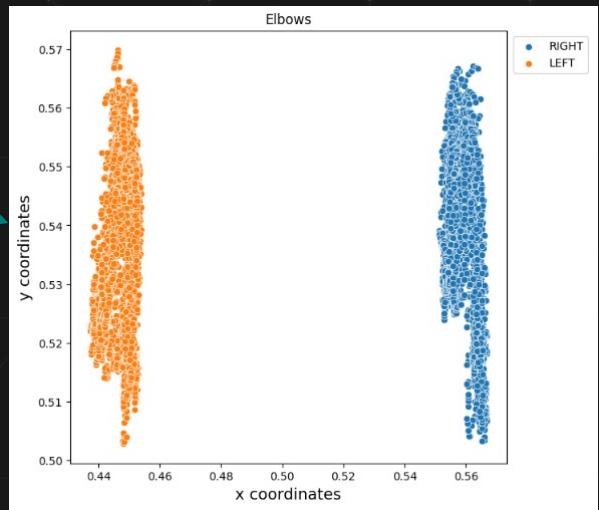
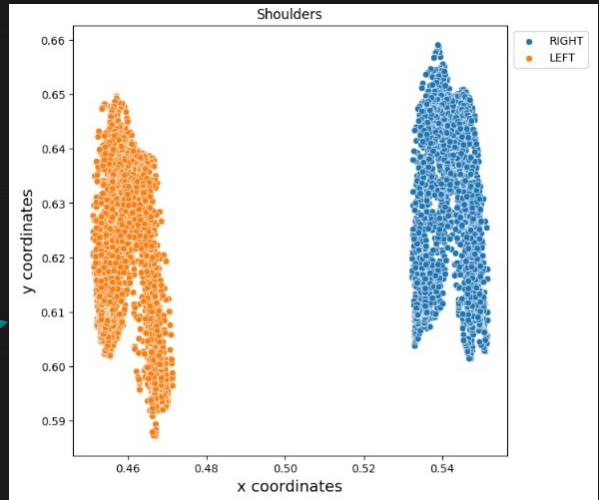
EDA, FEATURE ENGINEER/ SELECTION



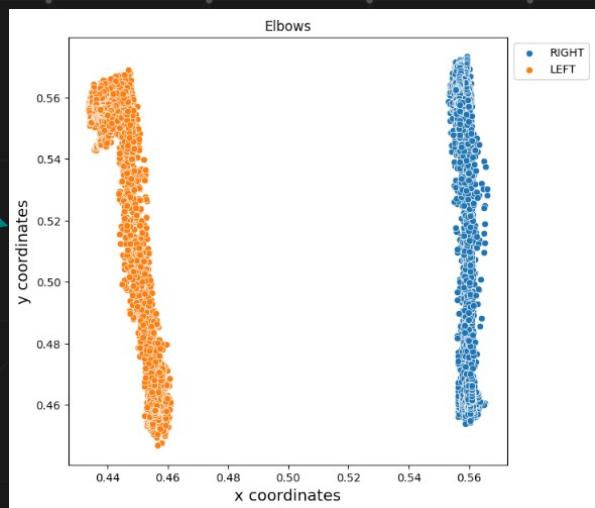
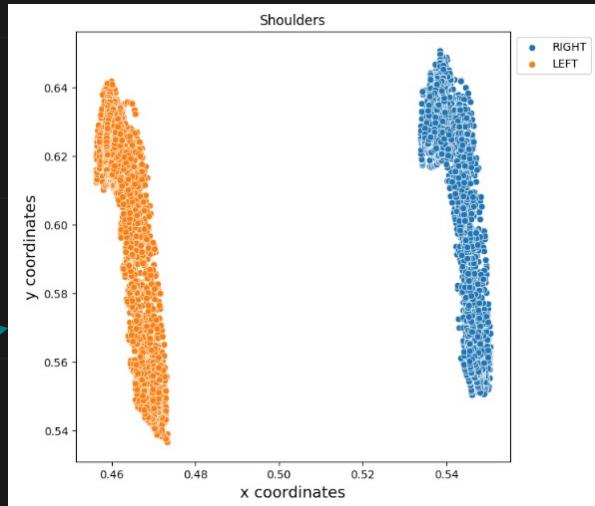
SECTION A: CHOREOGRAPHY

SECTION A
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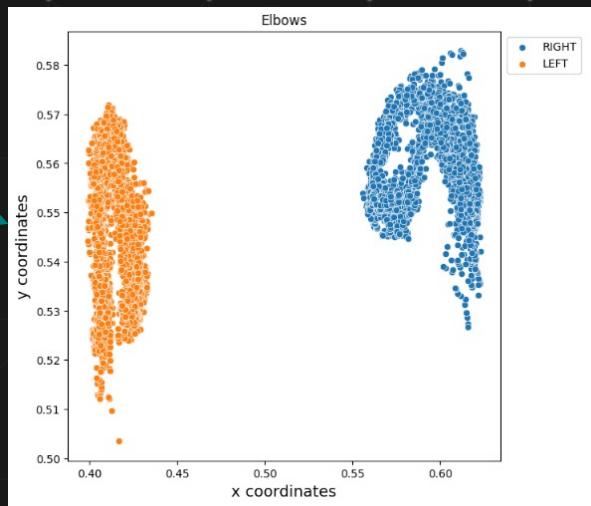
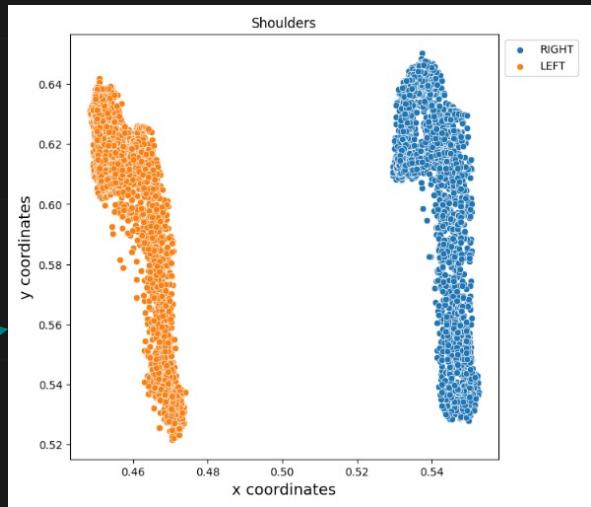
REGULAR



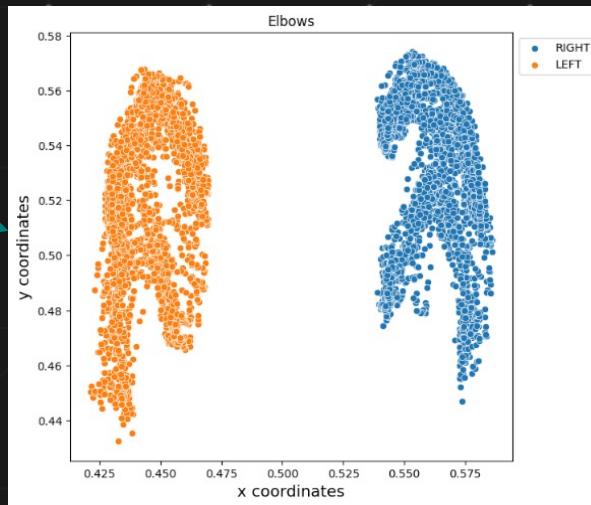
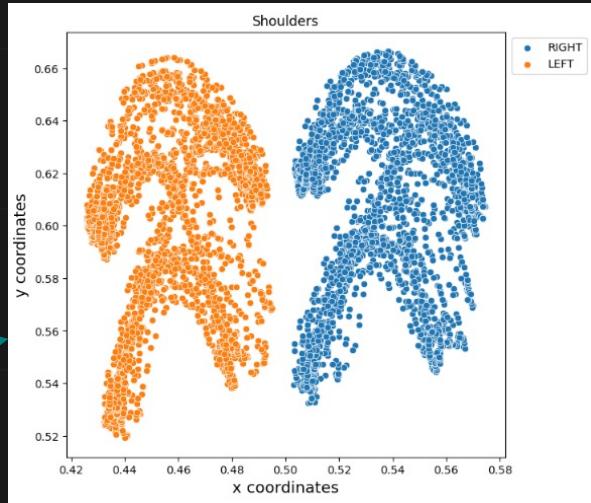
PULSE



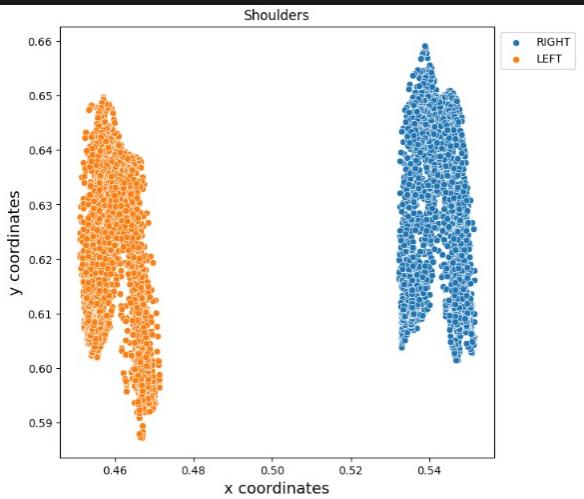
PUSH



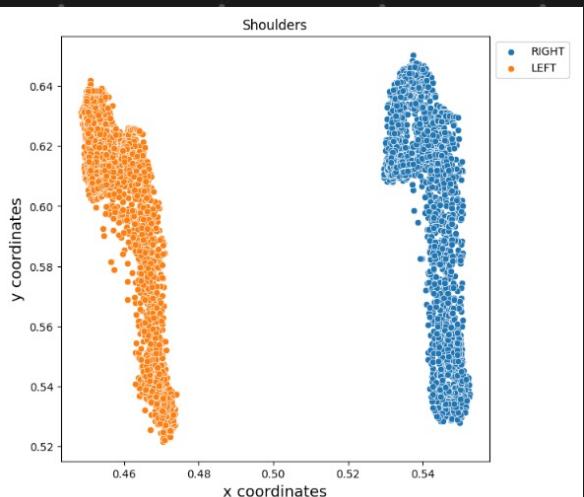
SEXY CORNERS



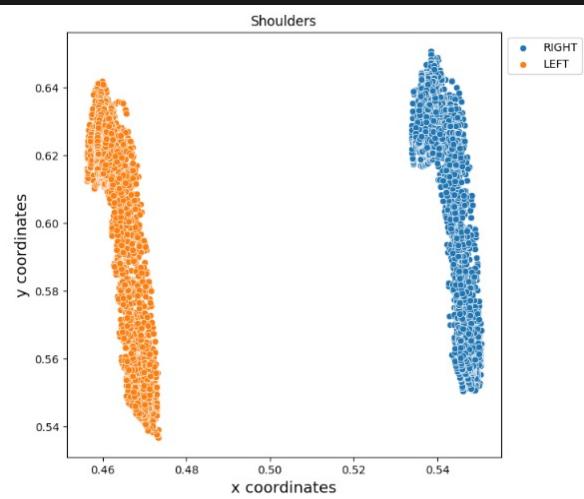
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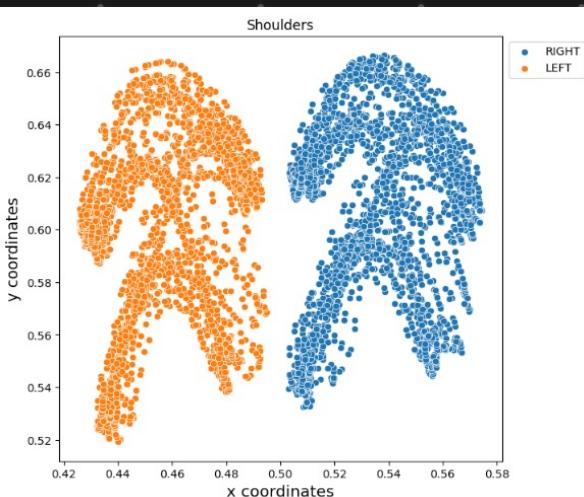
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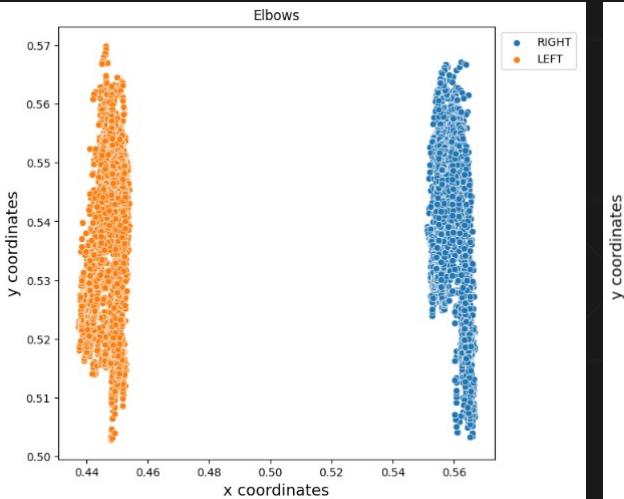
PULSE



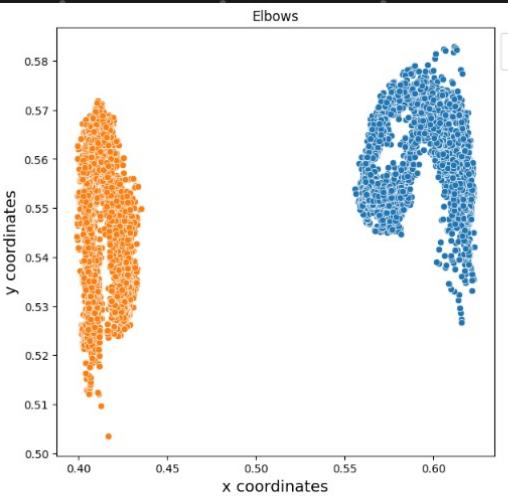
**SEXY
CORNERS**



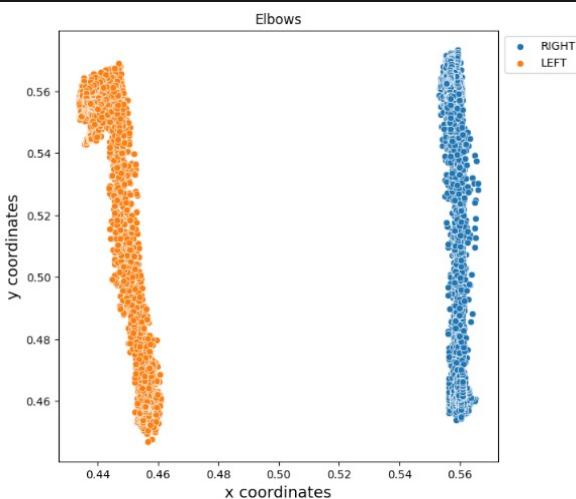
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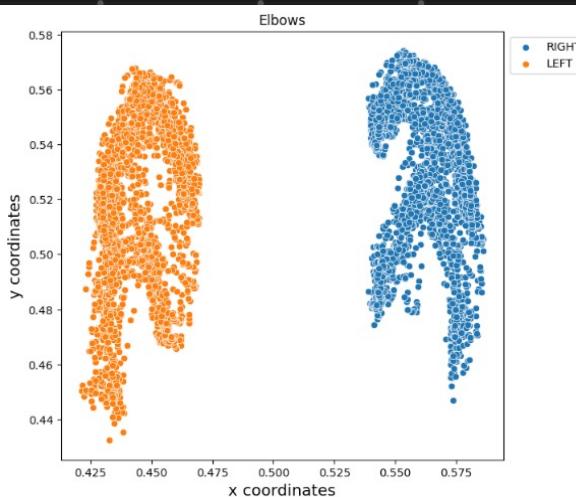
PUSH

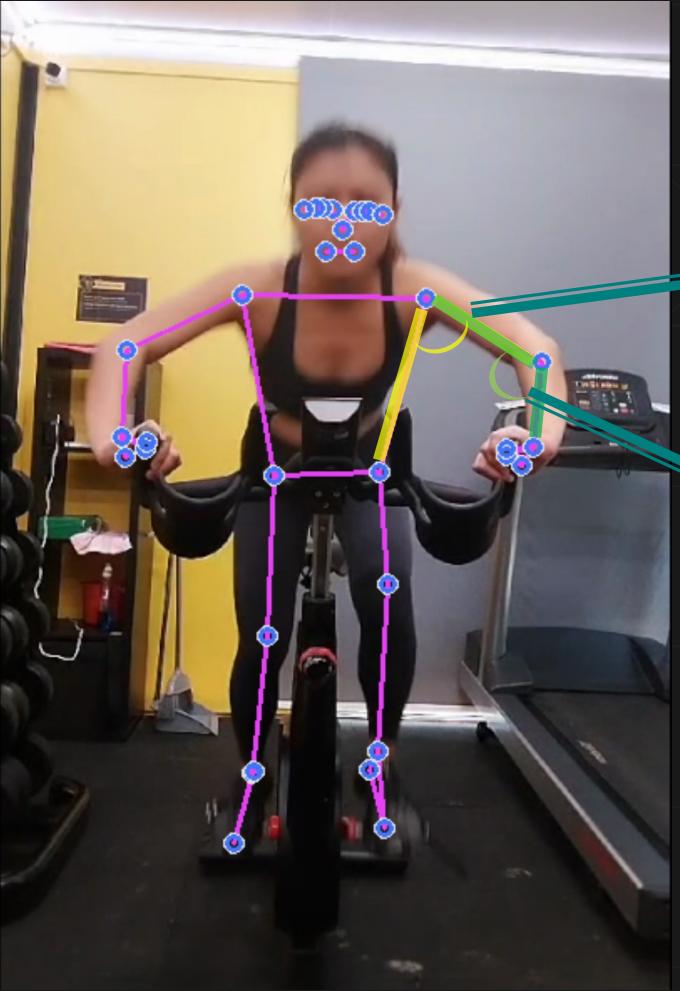


PULSE



SEXY CORNERS



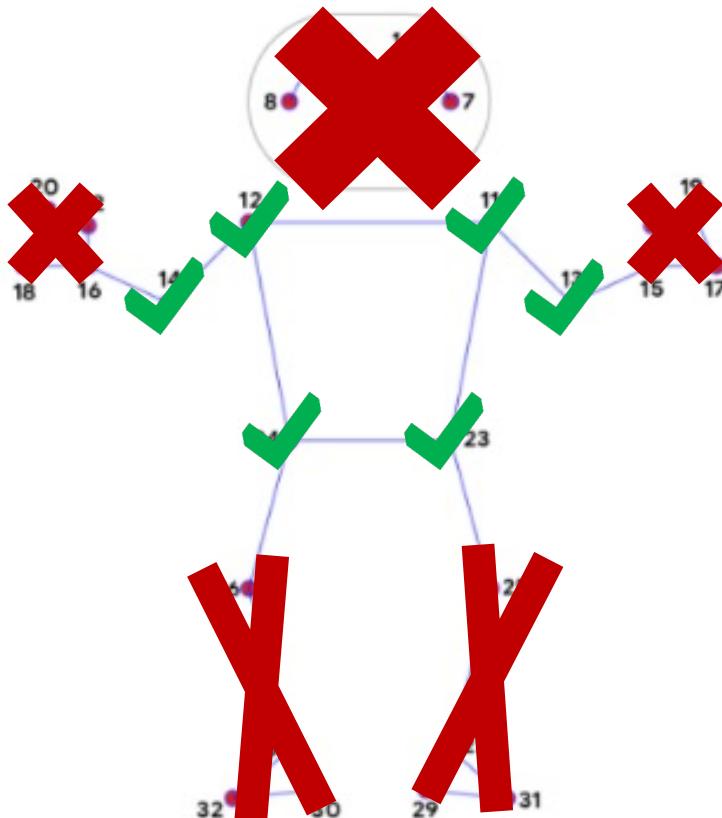


angle_RIGHT_SHOULDER

angle_RIGHT_ELBOW

FEATURES

Pose Landmarks



135



91



24



33



22



24

Remove facial
features

Remove small landmarks
and v-coordinates

Create dummies

Remove left coordinates
(collinear with right)

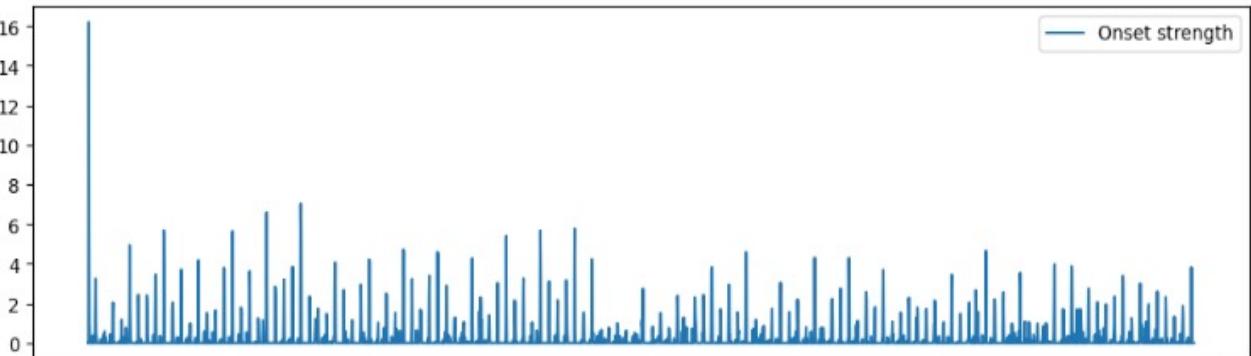
Created angles



SECTION B: TEMPO

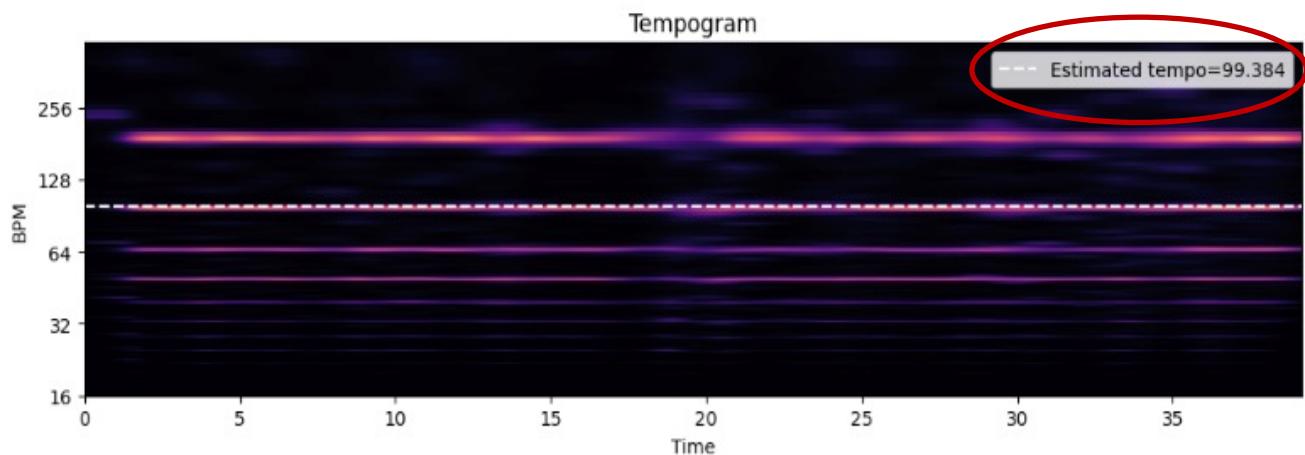
SECTION B

SECTION B



onset strength noun

Measure of how abruptly a sound starts



tempogram noun

- Representation of a music signal
- Peaks of the onset strength are the brightest in the tempogram graph
- Brightest area mark the tempo

'I WANT IT THAT WAY' TEMPO: 99.384 BPM



REGULAR



PULSE



PUSH



SEXY
CORNERS

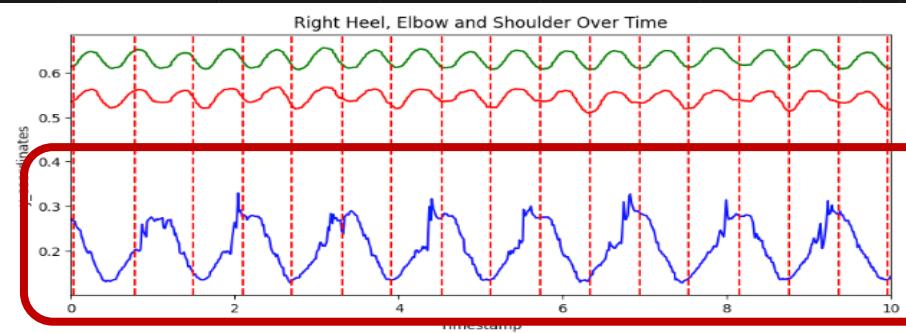
01

PLOT

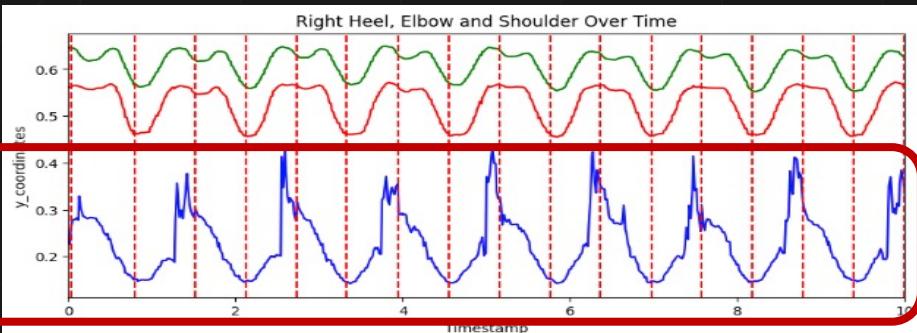
Legend:

- y_RIGHT_SHOULDER (Green)
- y_RIGHT_ELBOW (Red)
- y_RIGHT_HEEL (Blue)

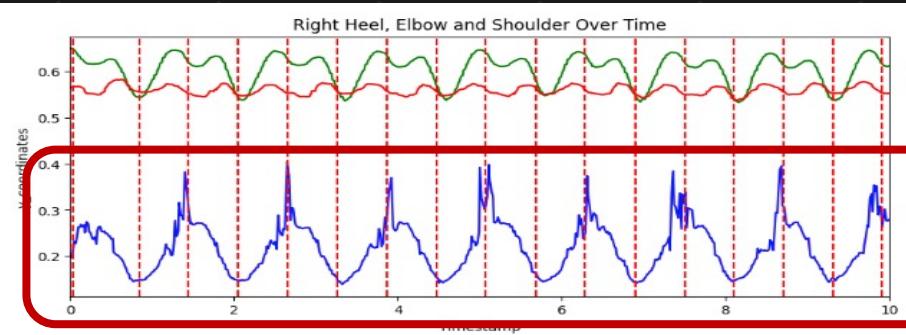
REGULAR



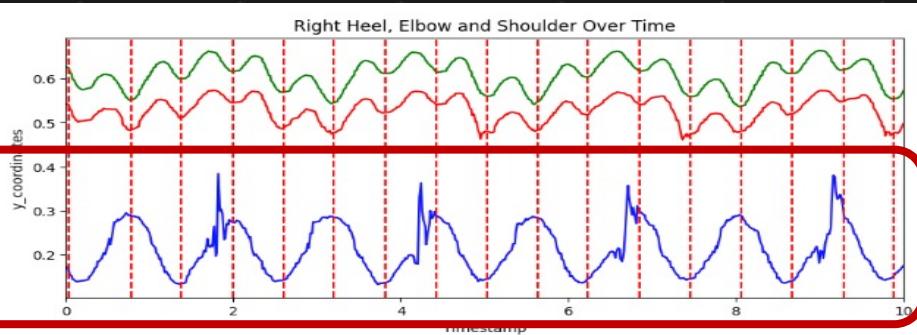
PULSE



PUSH

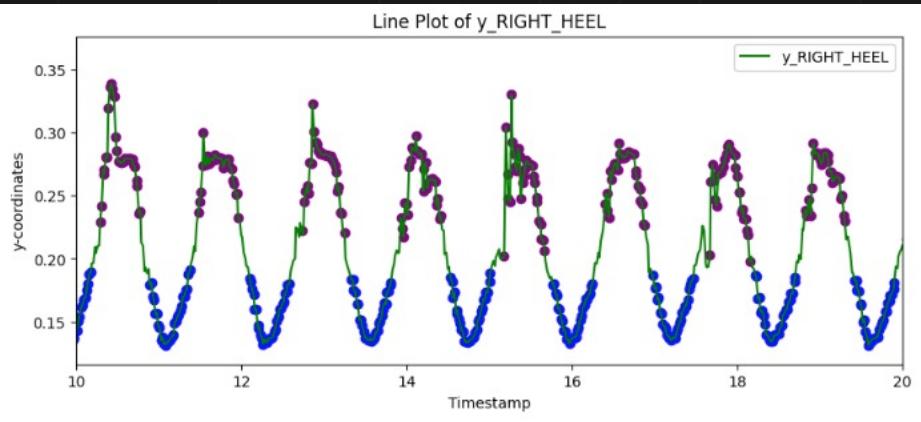


SEXY CORNERS

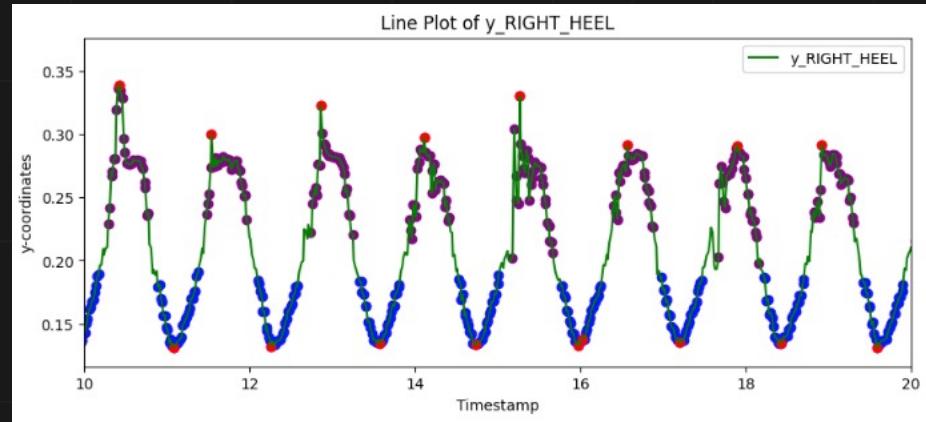


FIND MINIMA & MAXIMA

02

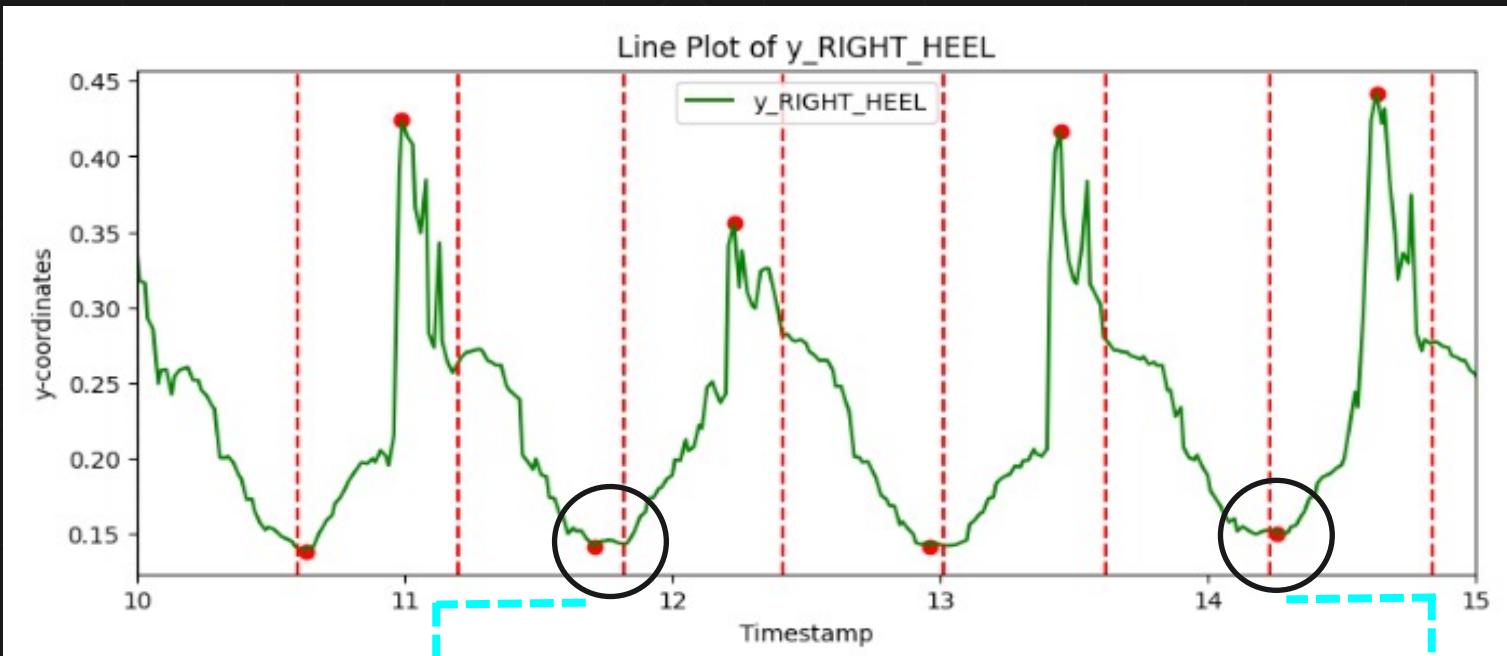


03



MIN/MAX vs BEAT TIME

04



FEATURES

6

Remove choreo,
shoulder and elbow
coordinates

3

Engineer 'time_diff'

4

Create rules for output



Kept minima and
maxima only

A black and white photograph of a woman with dark hair tied back, smiling at the camera. She is wearing a light-colored, long-sleeved athletic top and is leaning forward on a stationary bike. The background shows the interior of a gym with other equipment and people.

04

MODELLING



SECTION A: CHOREOGRAPHY

SECTION A
SECTION A
SECTION A
SECTION A

MODEL RESULTS

Performance:
Closer to 1, the better

	ACCURACY	PRECISION	RECALL	F1	ROC	TIME (SEC)
(Baseline) RIDGE CLASSIFIER	0.99	0.99	0.99	0.99	0.99	0.017

MODEL RESULTS

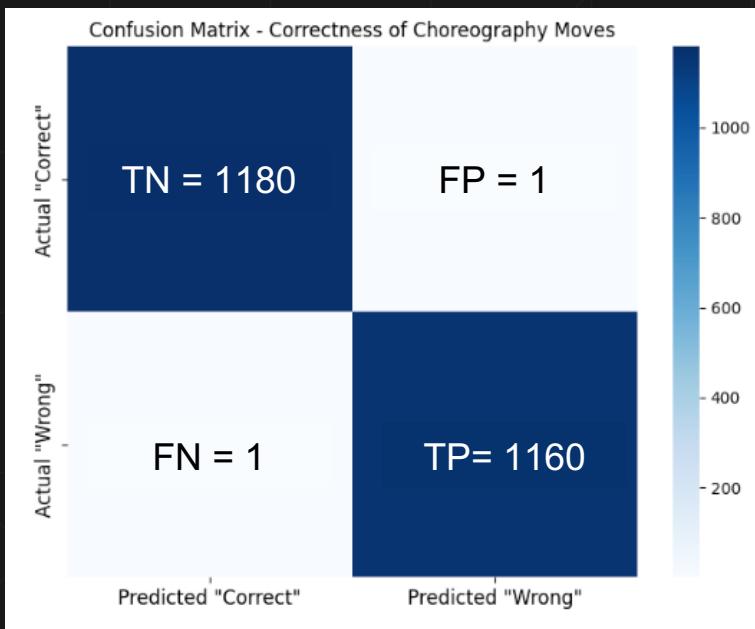
Performance:
Closer to 1, the better

	ACCURACY	PRECISION	RECALL	F1	ROC	TIME (SEC)
(Baseline) RIDGE CLASSIFIER	0.99	0.99	0.99	0.99	0.99	0.017
LOGISTIC REGRESSION	1.00	1.00	1.00	1.00	1.00	0.208
XG BOOST	1.00	1.00	1.00	1.00	1.00	0.332
RANDOM FOREST	1.00	1.00	1.00	1.00	1.00	0.968

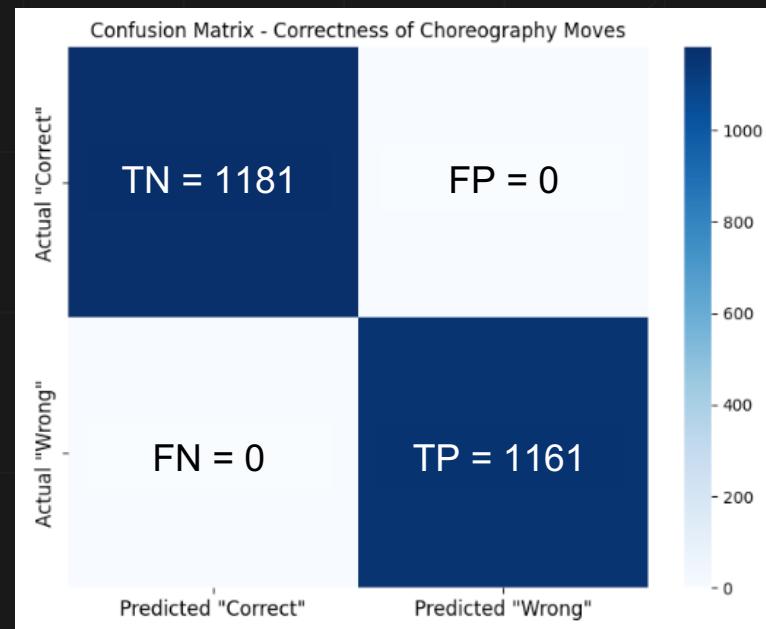
Note: Scores were rounded up to 2 d.p. and arranged in ascending order

CONFUSION MATRIX

XG BOOST



RANDOM FOREST



MODEL SELECTION

Performance:
Closer to 1, the better

	ACCURACY	PRECISION	RECALL	F1	ROC	TIME (SEC)
(Baseline) RIDGE CLASSIFIER	0.99	0.99	0.99	0.99	0.99	0.017
LOGISTIC REGRESSION	1.00	1.00	1.00	1.00	1.00	0.208
XG BOOST	1.00	1.00	1.00	1.00	1.00	0.332
RANDOM FOREST	1.00	1.00	1.00	1.00	1.00	0.968

Reason: Speed is important in spin and the performance does not differ significantly.



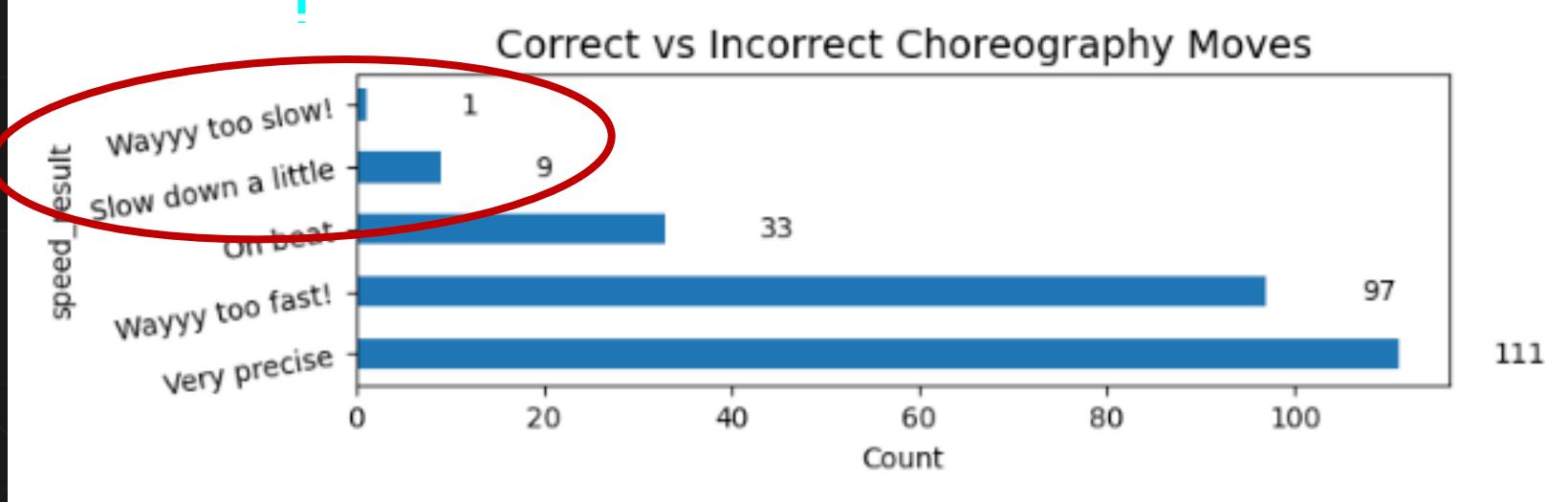
SECTION B: TEMPO

SECTION B

SECTION B

CLASS IMBALANCE

Too small for
upsampling



MODEL RESULTS

Performance:
Closer to 1, the better

	ACCURACY	PRECISION	RECALL	F1	TIME (SEC)
(Baseline) RIDGE CLASSIFIER	0.79	0.33	0.40	0.36	0.027

MODEL RESULTS

Performance:
Closer to 1, the better

	ACCURACY	PRECISION	RECALL	F1	TIME (SEC)
(Baseline) RIDGE CLASSIFIER	0.79	0.33	0.40	0.36	0.027
GRADIENT BOOST	0.97	0.73	0.74	0.74	0.141
RANDOM FOREST	0.98	0.8	0.79	0.79	0.273

Reason: Random Forest has the best scores and execution time close to that of XG Boost in 'CHOREOGRAPHY'.

A black and white photograph of a woman with dark hair tied back, smiling at the camera. She is wearing a light-colored tank top and dark leggings, and is leaning forward on a stationary bike. The background shows a gym environment with other equipment and windows.

05

DEPLOYMENT

OBJECTIVES

01 GET THE MOVES RIGHT

Predict whether the rider's choreo move is correct

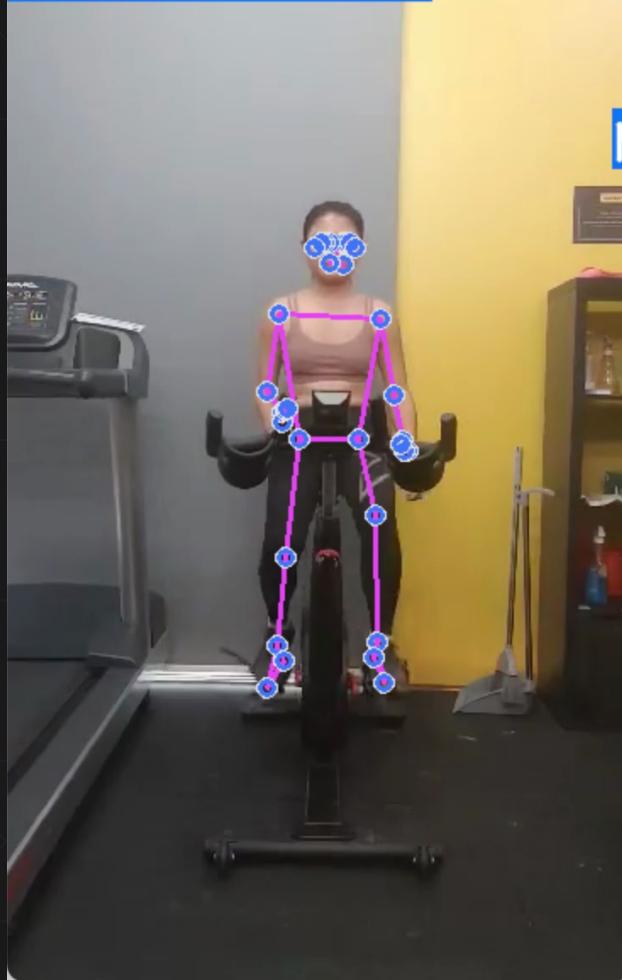
02 RIDE ON THE BEAT

Predict whether the rider is riding to the beat

Live video capture and feedback

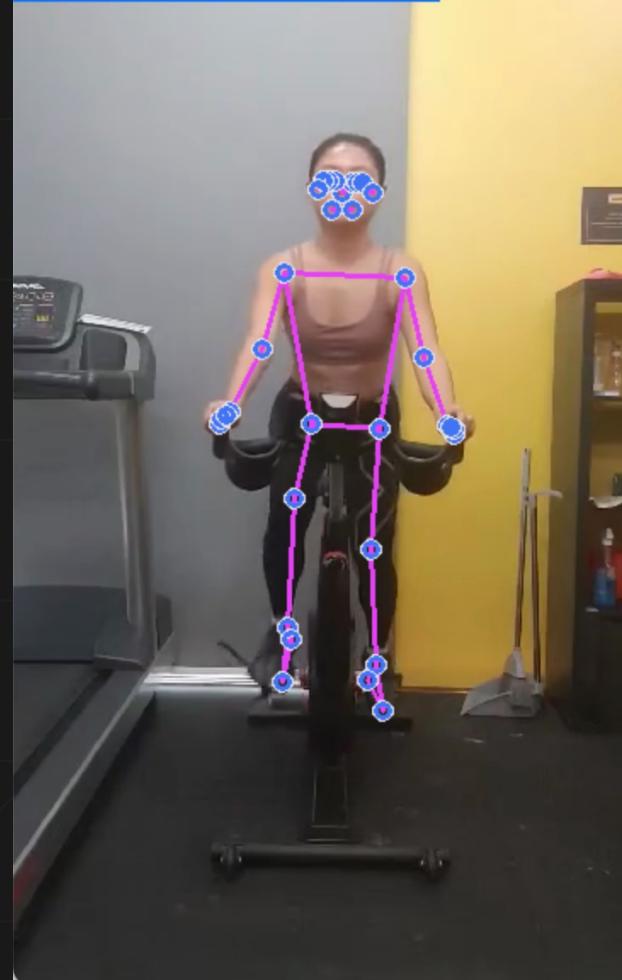
PROB FEEDBACK

0.49 Marvellous!



PROB FEEDBACK

0.96 Poor!



A black and white photograph of a woman with dark hair tied back, smiling at the camera. She is wearing a light-colored, form-fitting tank top and leggings, and is leaning forward on a stationary bike. The background shows the interior of a gym with other equipment and people.

06

CONCLUSION

A black and white photograph of a woman in a gym setting. She is wearing a light-colored tank top and dark leggings, with a white towel draped over her shoulders. She is smiling and looking towards the camera. In the foreground, the front of a stationary bike is visible.

SUMMARY

HIGH MODEL SCORES

Choreo: XG Boost – Accuracy 1.0
Tempo: Random Forest – Accuracy 0.98

PIONEERED A NEW FIELD

Developed a ML model for beat-aligned action prediction

OBJECTIVES MET

Application enables users to pick up spin (choreo and tempo) at their own pace

RECOMMENDATIONS

01

INCREASE COMPLEXITY

- Different songs
- Longer duration of same song
- More moves

02

INCLUDE MORE POOR EXAMPLES

03

USE SENSORS

04

OTHER FEATURES

- Average speed of rider
- Resistance of bike

REFERENCES

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- <https://www.theedgesingapore.com/options/fitness/revolution-has-begun>

THANKS!

Do you have any questions?

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