

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

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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

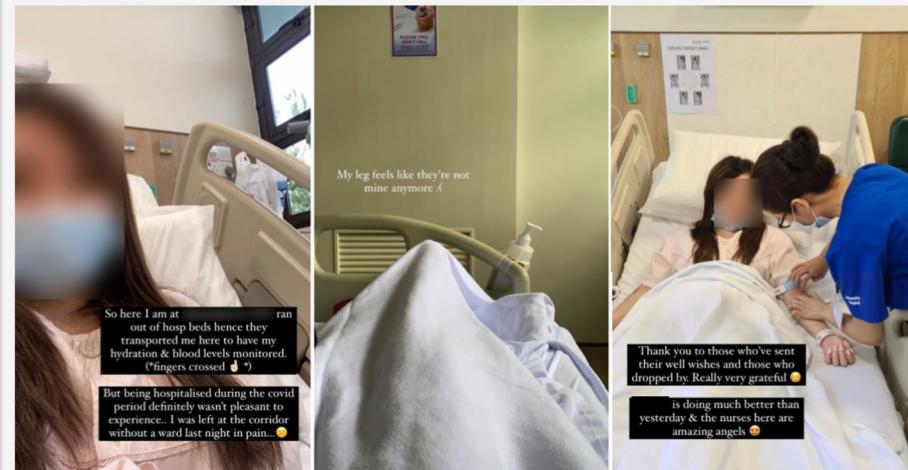
**rhabdomyolysis** noun  
rhab·do·my·ol·y·sis

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

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**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



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 and 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

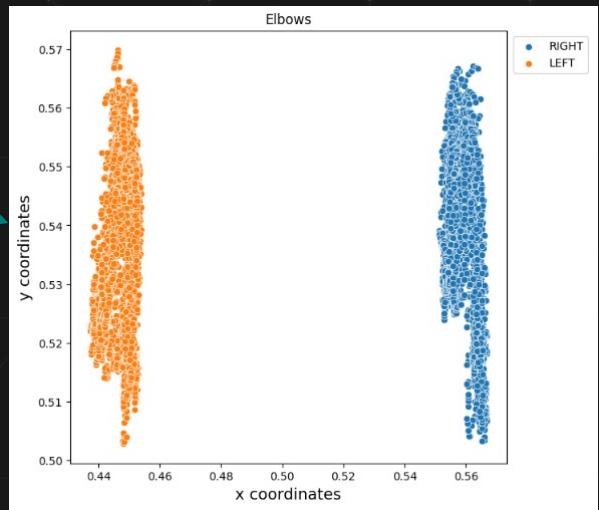
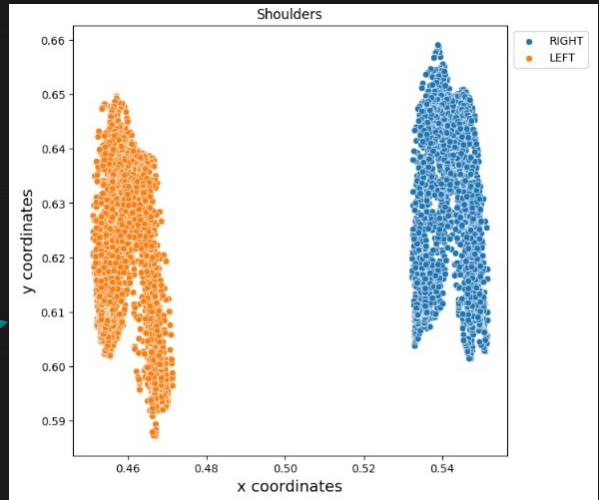
## EDA, FEATURE ENGINEER/ SELECTION



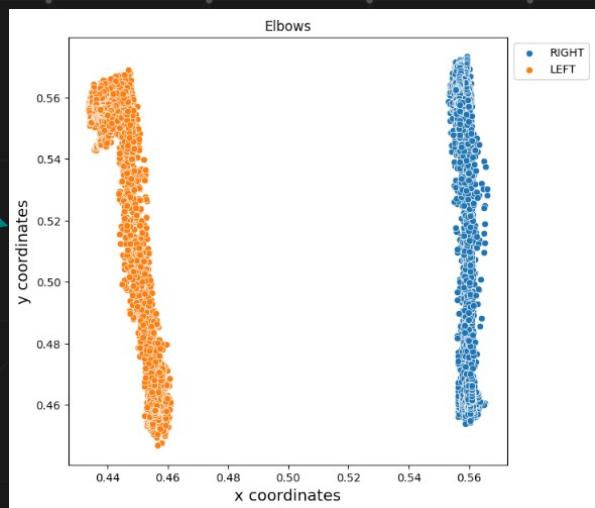
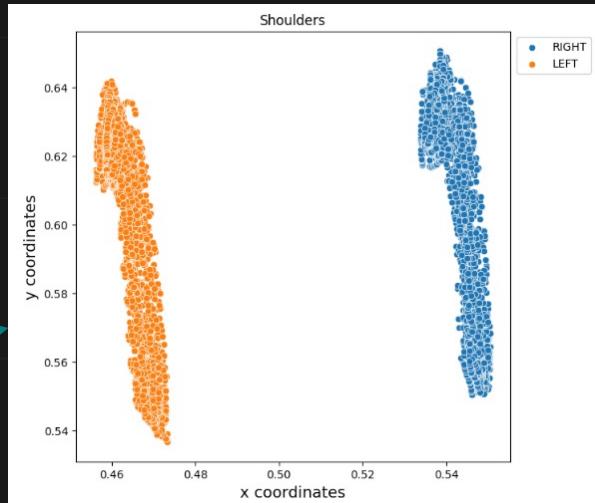
# **SECTION A: CHOREOGRAPHY**

SECTION A  
SECTION A  
SECTION A  
SECTION A

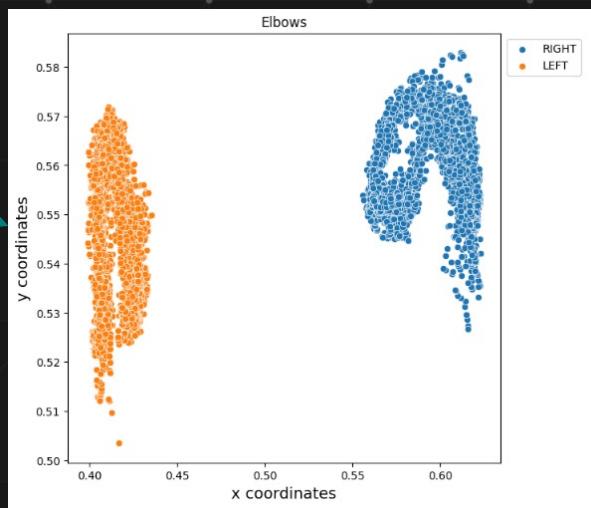
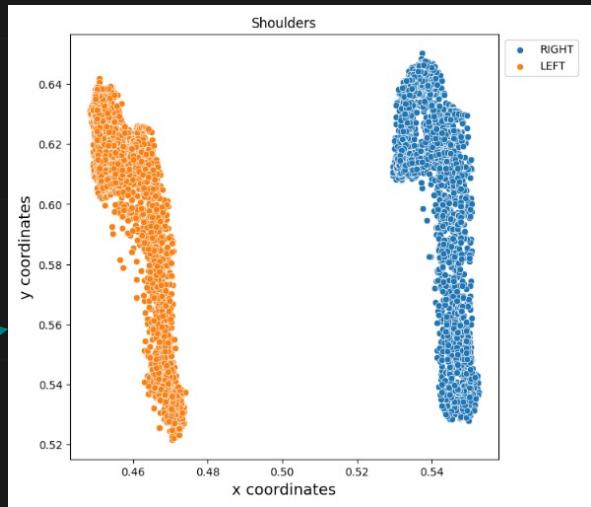
# REGULAR



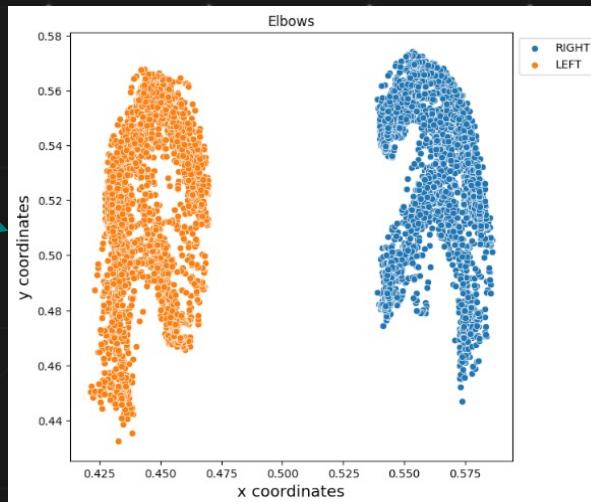
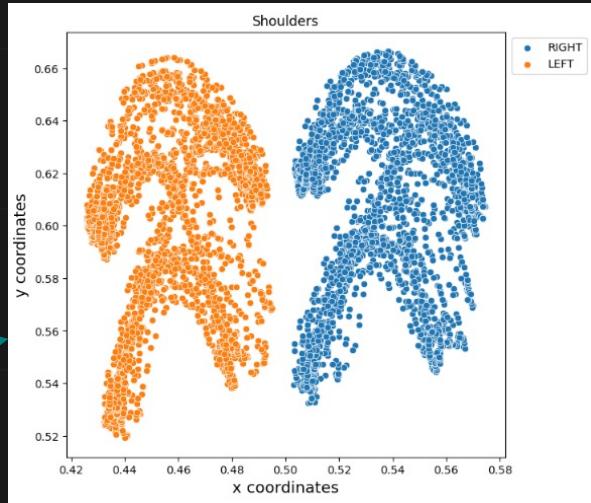
# PULSE



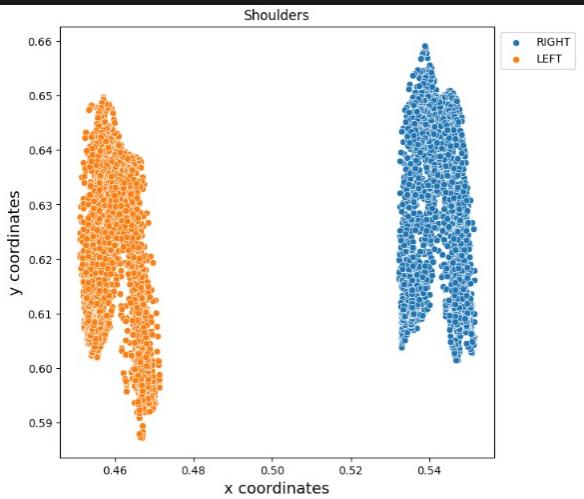
# PUSH



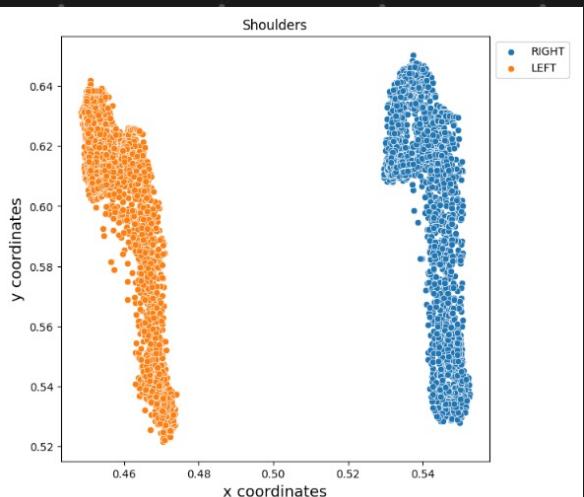
# SEXY CORNERS



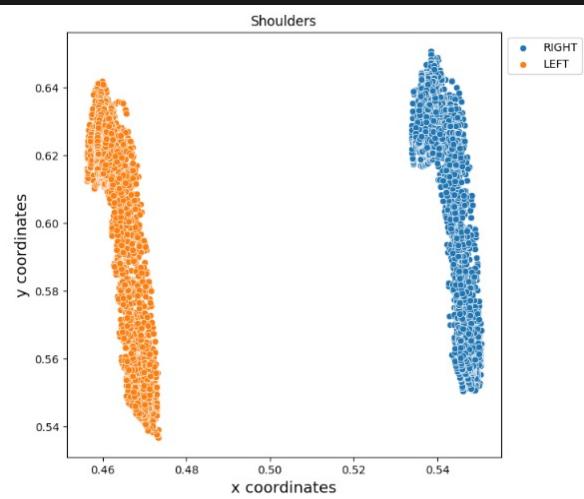
**REGULAR**



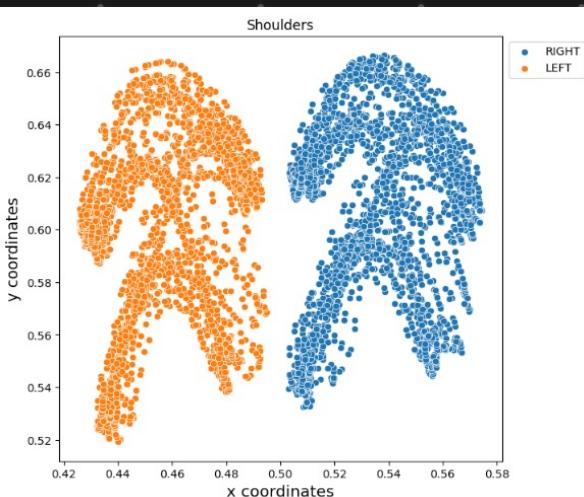
**PUSH**



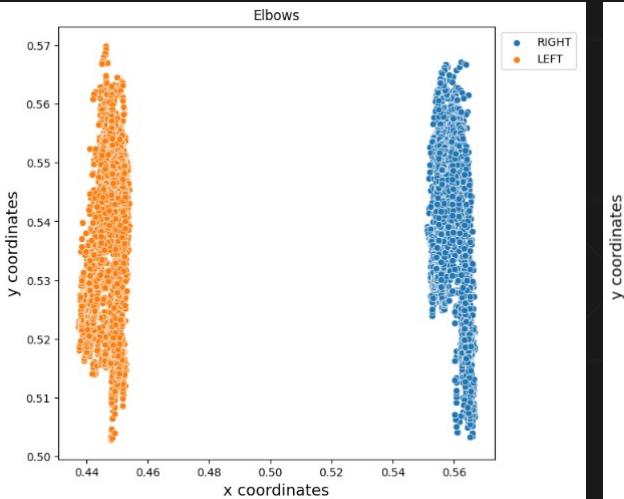
**PULSE**



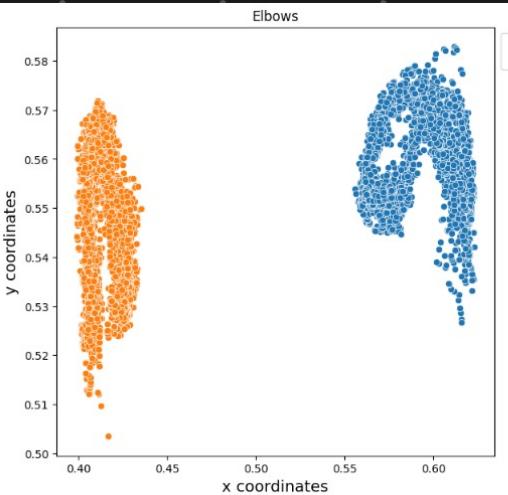
**SEXY  
CORNERS**



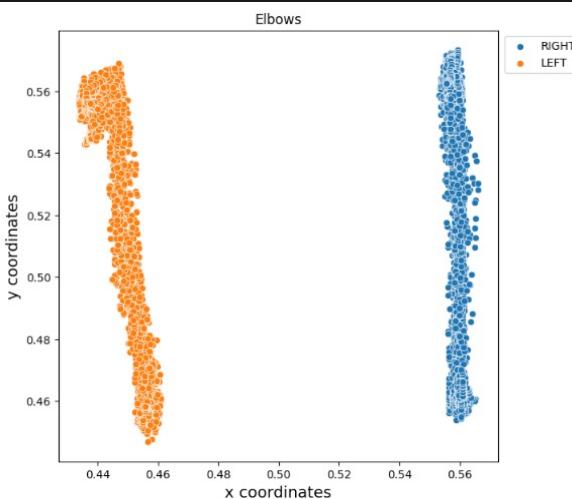
**REGULAR**



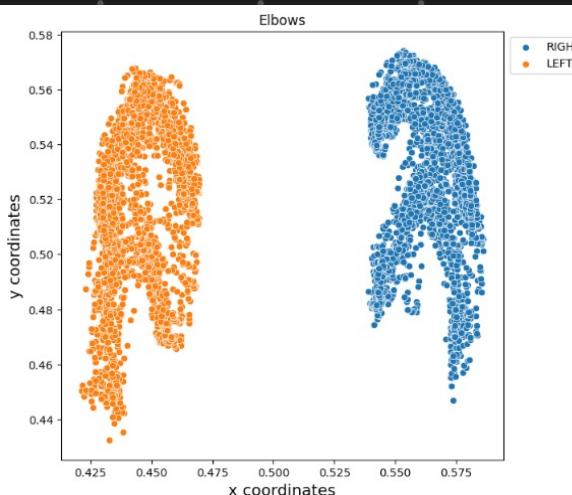
**PUSH**

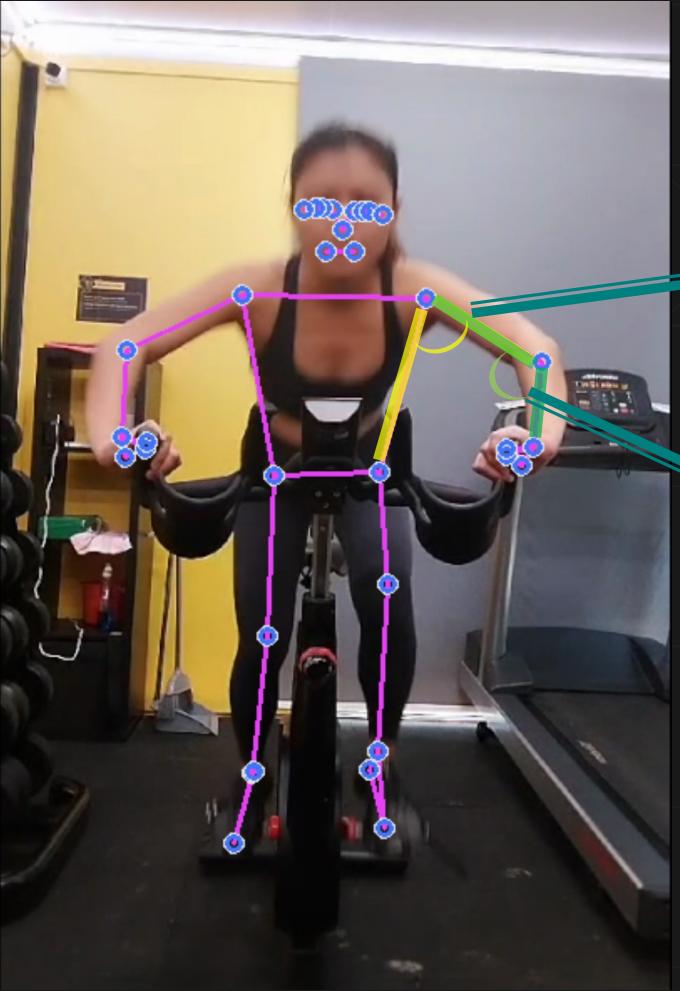


**PULSE**



**SEXY CORNERS**



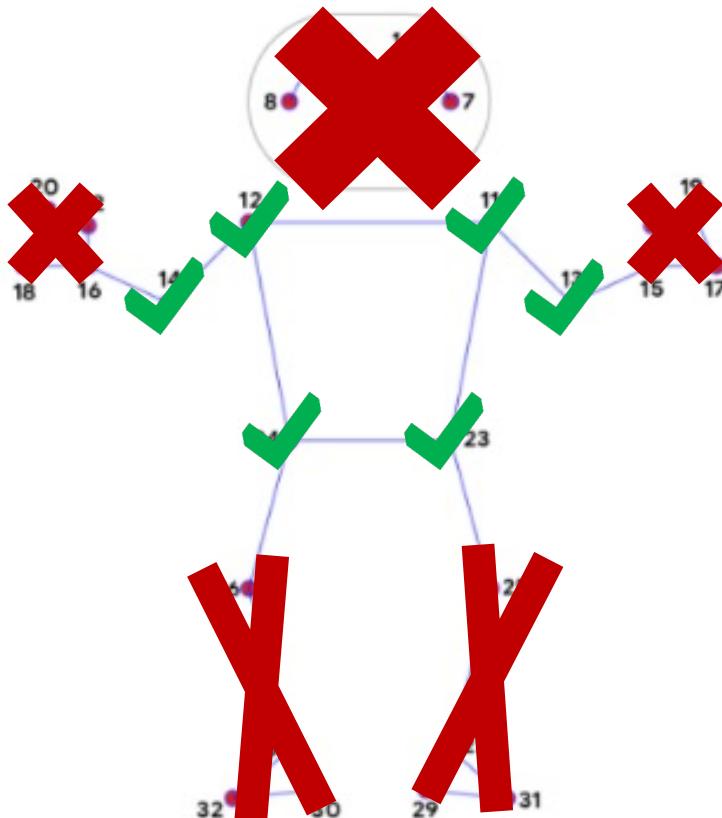


angle\_RIGHT\_SHOULDER

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)

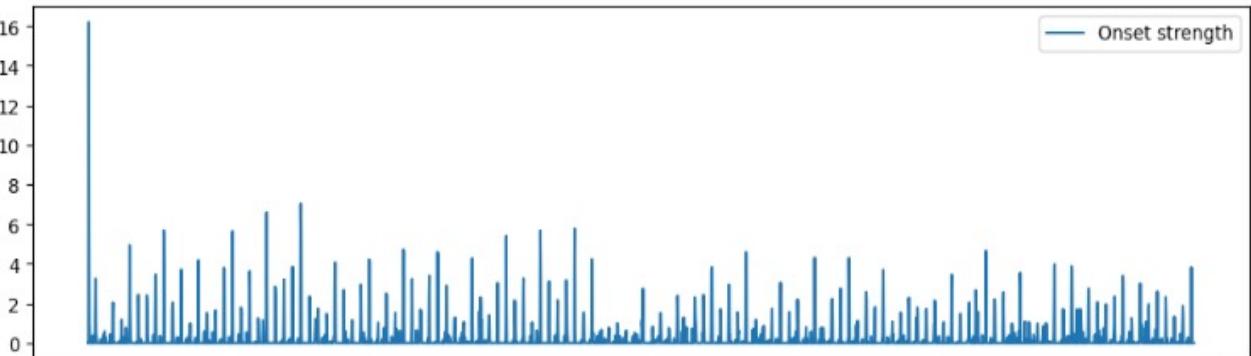
Created angles



## **SECTION B: TEMPO**

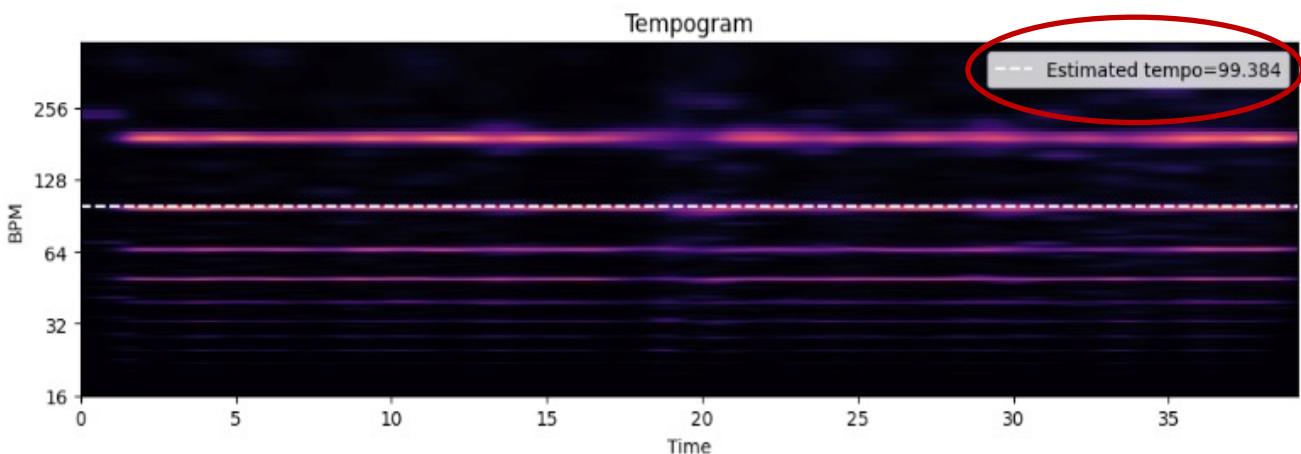
SECTION B

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

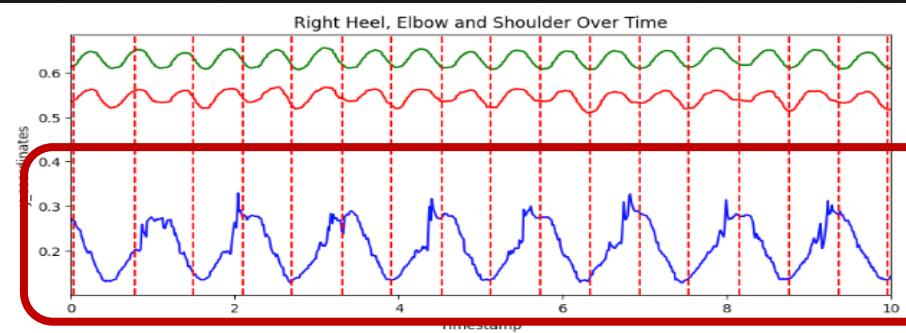


SEXY  
CORNERS

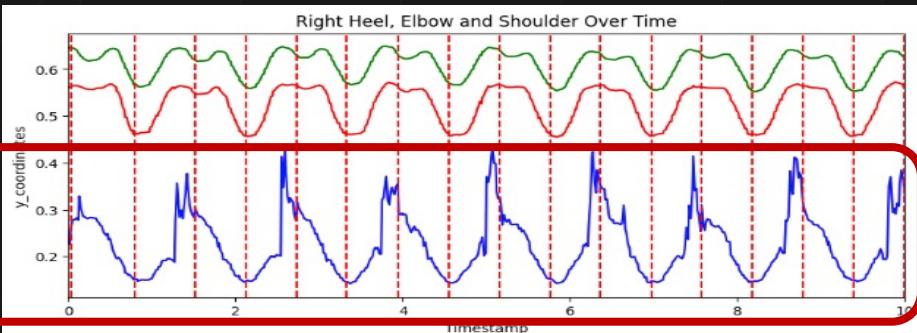
01

# PLOT

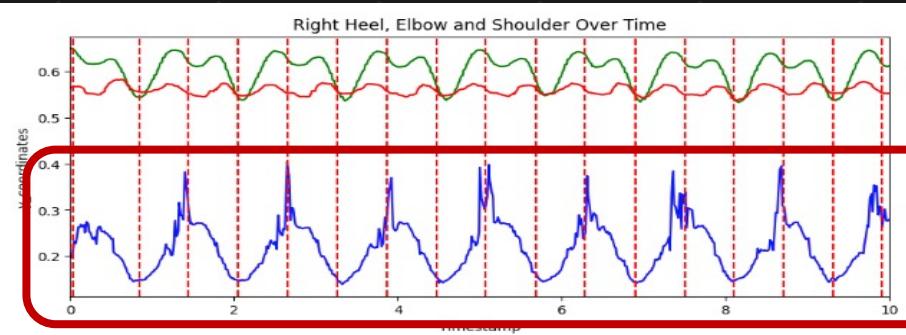
REGULAR



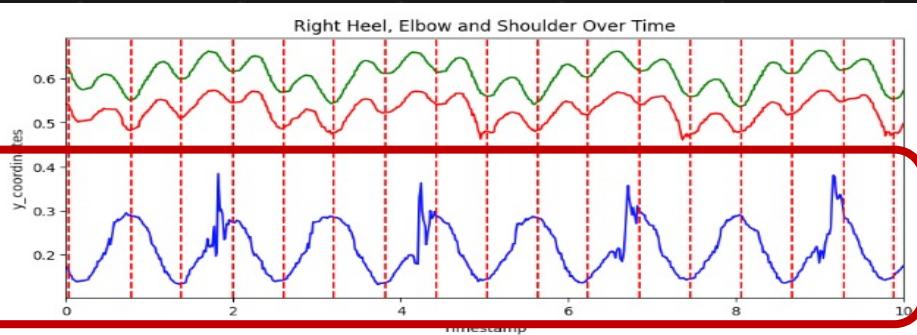
PULSE



PUSH

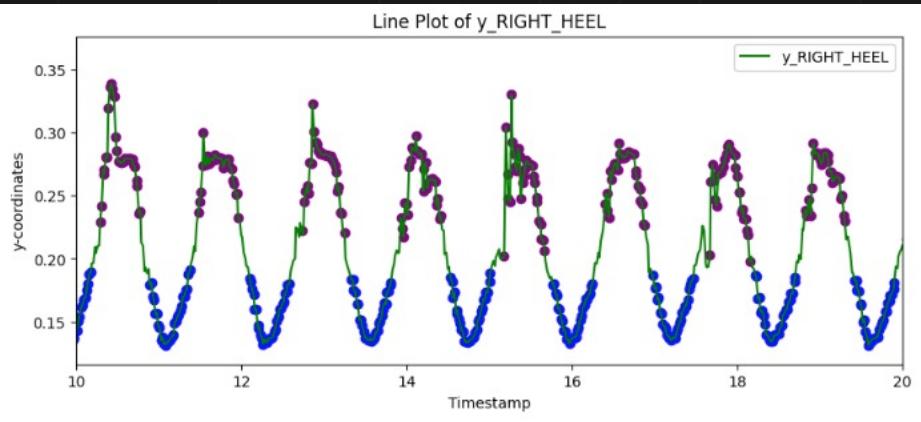


SEXY CORNERS

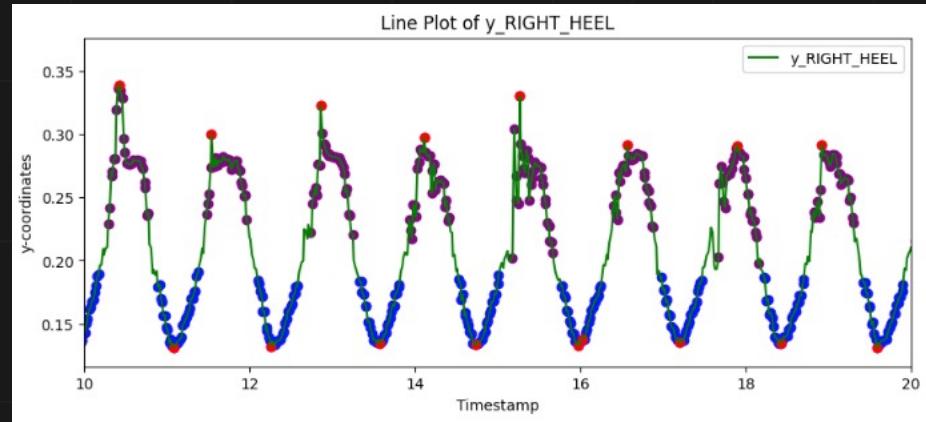


# FIND MINIMA & MAXIMA

02

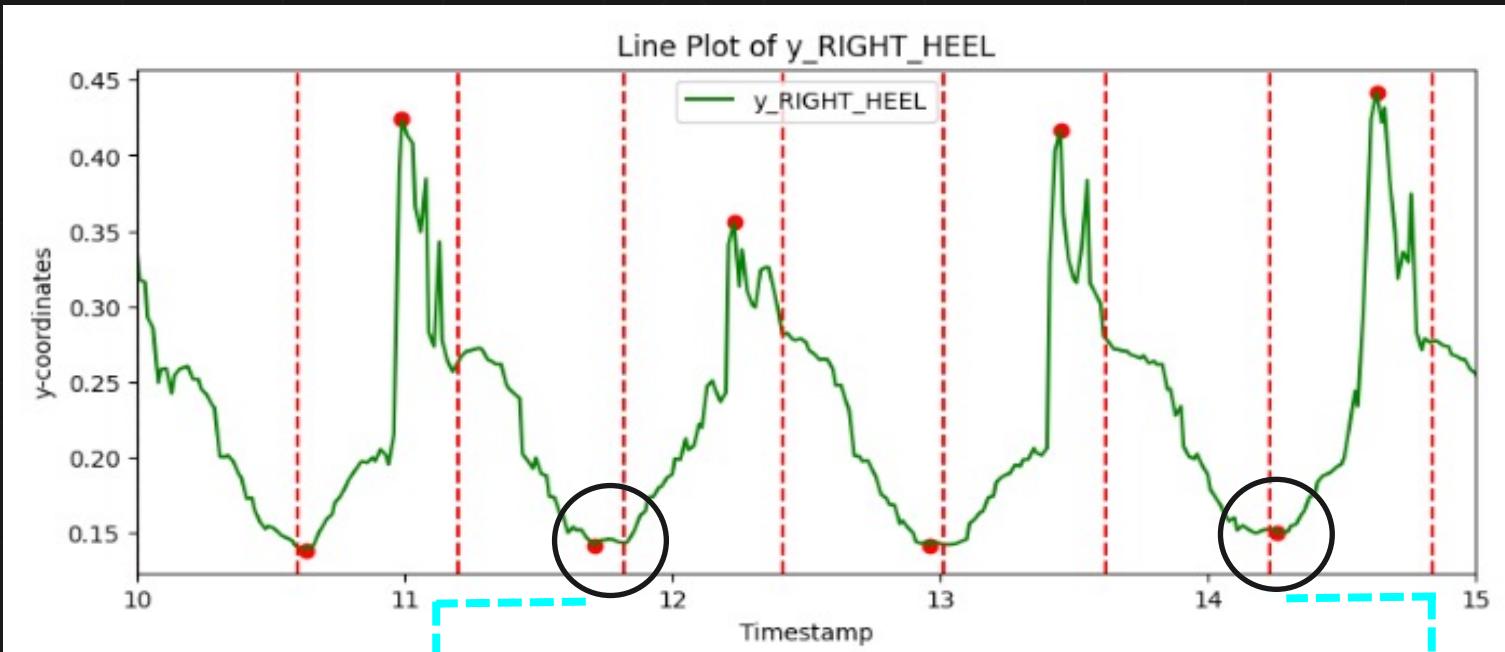


03



# 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 windows.

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

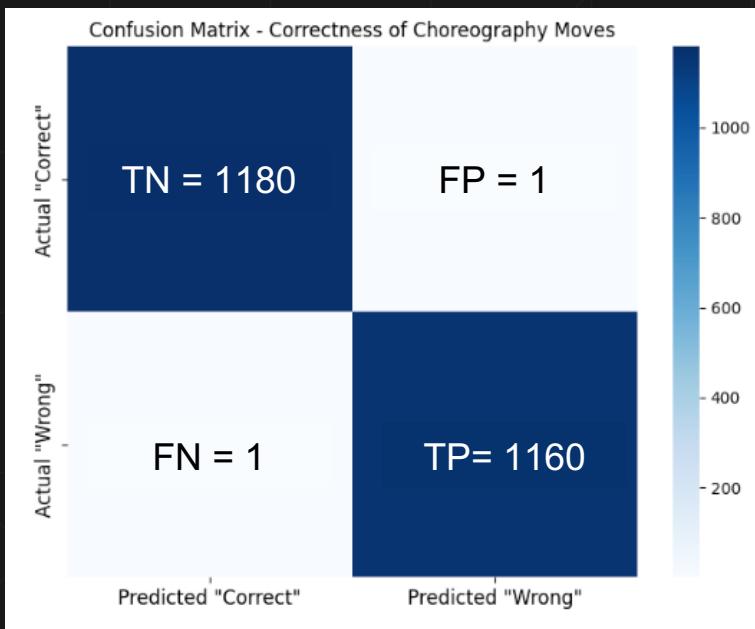
Performance:  
Closer to 1, the better

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

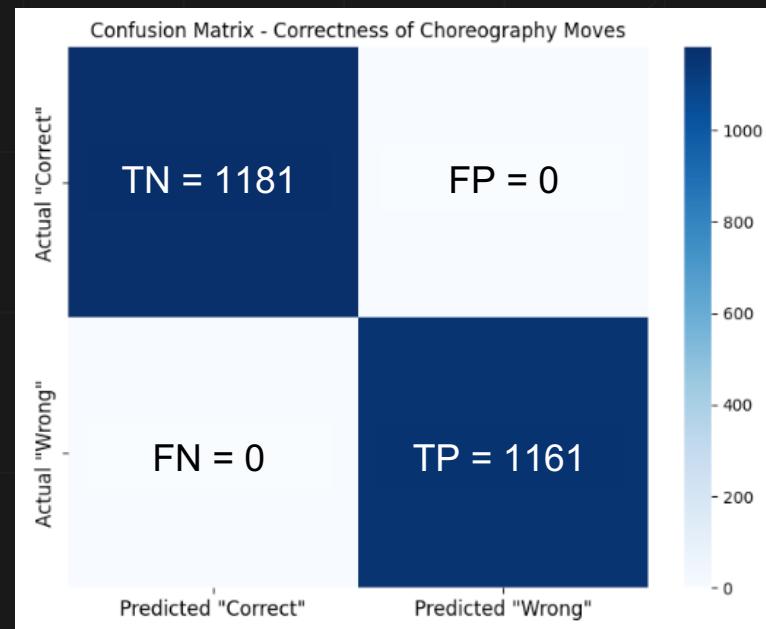
**Note:** Scores were rounded up to 2 d.p. and arranged in ascending order

# CONFUSION MATRIX

XG BOOST



RANDOM FOREST



# MODEL SELECTION

Performance:  
Closer to 1, the better

	ACCURACY	PRECISION	RECALL	F1	ROC	TIME (SEC)
(Baseline) <b>RIDGE CLASSIFIER</b>	0.99	0.99	0.99	0.99	0.99	0.017
<b>LOGISTIC REGRESSION</b>	1.00	1.00	1.00	1.00	1.00	0.208
<b>XG BOOST</b>	1.00	1.00	1.00	1.00	1.00	0.332
<b>RANDOM FOREST</b>	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.



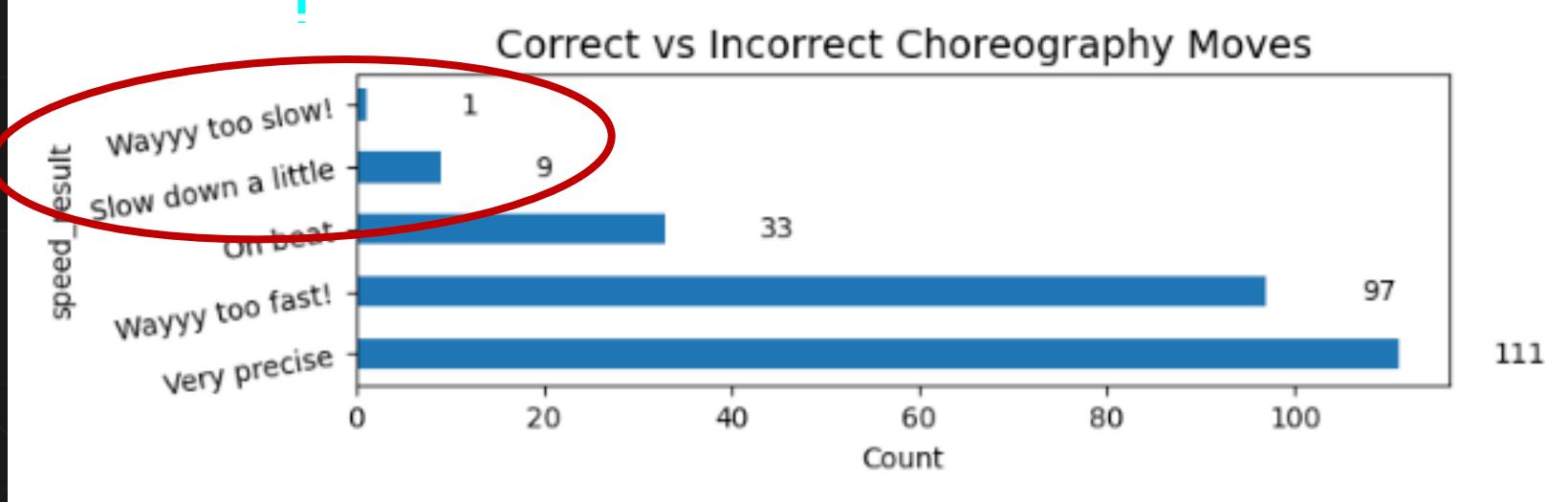
## **SECTION B: TEMPO**

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) <b>RIDGE CLASSIFIER</b>	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) <b>RIDGE CLASSIFIER</b>	0.79	0.33	0.40	0.36	0.027
<b>GRADIENT BOOST</b>	0.97	0.73	0.74	0.74	0.141
<b>RANDOM FOREST</b>	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

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## 01 GET THE MOVES RIGHT

Predict whether the rider's choreo move is correct

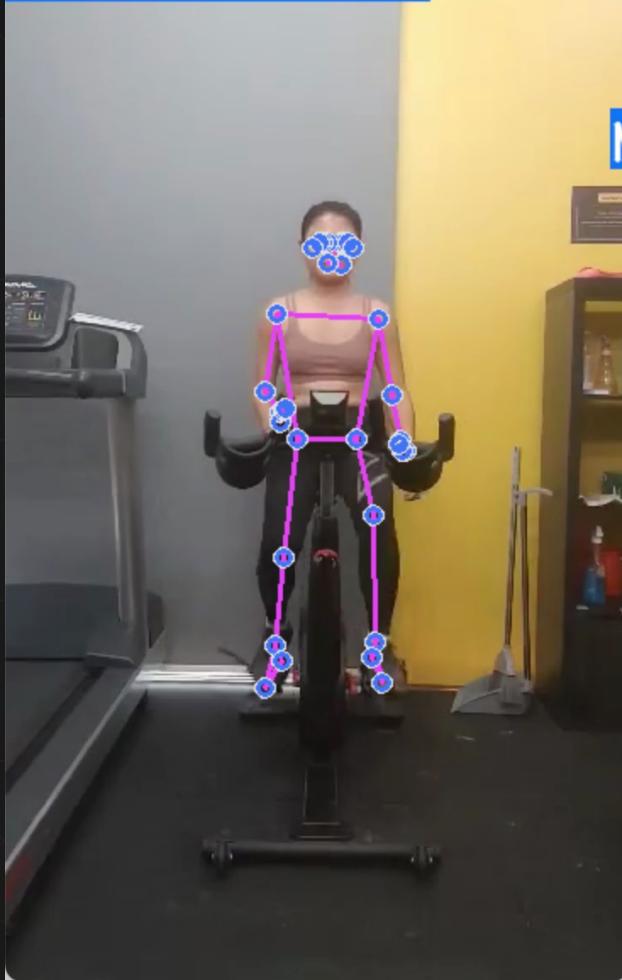
## 02 RIDE ON THE BEAT

Predict whether the rider is riding to the beat

Live video capture and feedback

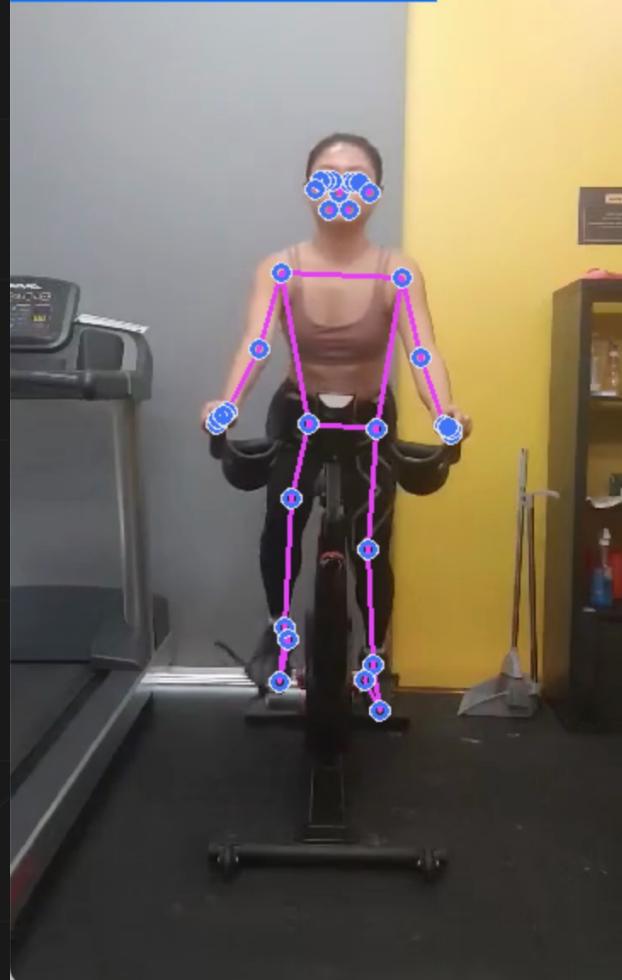
PROB FEEDBACK

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

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## 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.asiaone.com/lifestyle/fitness-study-shows-8-out-10-singaporeans-exercise-once-week-our-thoughts>
- <https://johncomino.tripod.com/noterest.htm>
- [https://www.lesmills.com/clubs-and-facilities/research-insights/audience-insights/the-number-one-reason-why-people-choose-an-indoor-cycling-class/\)](https://www.lesmills.com/clubs-and-facilities/research-insights/audience-insights/the-number-one-reason-why-people-choose-an-indoor-cycling-class/)
- <https://www.mathworks.com/help/dsp/ref/dsp.stft.html>
- <https://www.singhealth.com.sg/news/tomorrows-medicine/rise-in-cases-of-muscle-breakdown-from-spin-cycling-study>
- <https://www.straitstimes.com/sport/i-took-a-spinning-class-and-ended-up-at-a-hospitals-ae-clinic>
- <https://www.theedgesingapore.com/options/fitness/revolution-has-begun>

# THANKS!

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Do you have any questions?

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