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# Swing'in Or Swing Out: Prototyping A Lindy Hop Classifier

By Eugenia Chuah

For DSI-SG-39, 10 Nov 2023





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# What Is The Lindy Hop?

Black American Dance originating  
from **Harlem, New York City**



Danced as a **performance** and  
**competition**



Commonly danced **socially** too



Photo by Andrew Lin Yikai



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# Over 40+ International Lindy Hop Events Each Month



TAKE A VACATION FROM YOUR EVERYDAY LIFE ▶ WELCOME TO HERRÄNG DANCE CAMP

THE WORLD'S MOST COMPREHENSIVE AND EXCITING DANCE EVENT FOCUSING ON AMERICAN VERNACULAR DANCES FROM THE GOLDEN AGE OF JAZZ • DANCE DISCIPLINES: LINDY HOP, BALSAO, BOOGIE WOOGIE, SLOW DRAG, SOLO JAZZ AND TAP

# HERRÄNG DANCE CAMP

THE SHOW must Go On!

by Lennart Westerlund, Patrik Pettersson, Livette Rønnekleiv, Sing Yuen Lim, Joosteet Wiggen, Hyunum Choi, Frida Heggström Dahl, Anders Silberg, Juan Villafane, Alexandre McCormack, Nicolas Denoux, Jill De Muellenare, Live Band: REVERENT JUKE (Belgium), Swingtime Ball 2023 Beijing, Time: 11/03(FRI) - 11/05(SUN), 歌华大厦 Beijing, CHINA

a Roarin' Night Out

# DIGA DIGA DOO

22-24 SEPT. 2023

Show • Workshops • Parties  
SHANGHAI MANSION BANGKOK, THAILAND  
GORDON WEBSTER BAND AND THE RHYTHM HOPPERS

International Dancers  
NILS ANDRÉN & BIANCA LOCATELLI  
ARI BELTRAN & SIMON BRESSANELLI  
RICO LIM & CHLOE HONG • Burlesque MILA SPIGORON  
Authentic Latin & African Dance MAKO RUAN • Dancer and choreographer JUAN VILLAFANE  
Top & Vernacular Jazz Dance JOSETTE WIGGAN

TICKETS & INFO DigaDigaDooKK

蜜蜜推拿派

# BUBBLE POP '23

LINDY EXCHANGE 台北國際搖擺生活節

OSAKA SWING PRESENTS

# 17TH OSAKA LINDY EXCHANGE 2023

13TH(FRD)-15TH(SUND OCT.)

[HTTPS://OSAKASWING.COM/](https://osakaswing.com/)



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# Growth in Online Lessons With International Instructors

PETER&NAOMI

Members Practice Programs Blog Bio + Tour Contact Log In

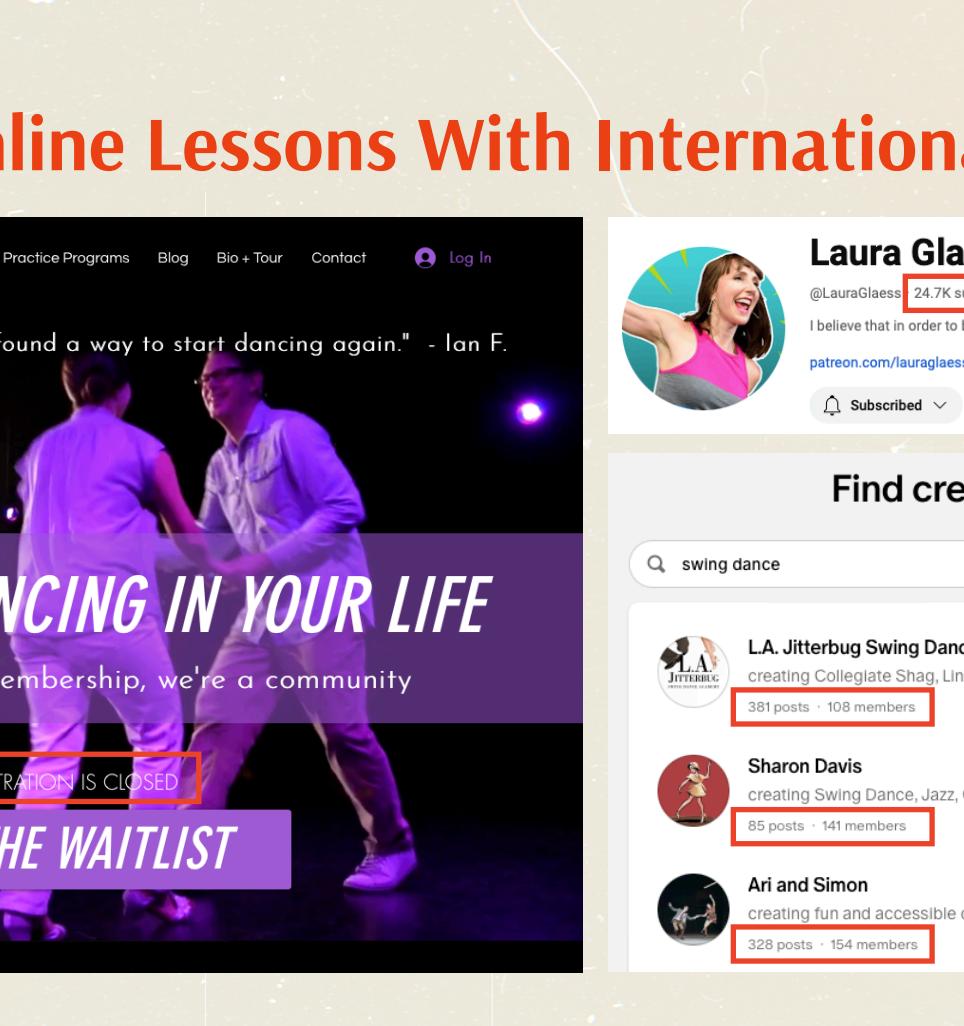
"When I joined the membership I found a way to start dancing again." - Ian F.

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I believe that in order to become a good dancer, you have to dance! That's why, on my chan...

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swing dance



**L.A. Jitterbug Swing Dance Academy**

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**Sharon Davis**

creating Swing Dance, Jazz, Charleston & Burlesque  
85 posts · 141 members



**Ari and Simon**

creating fun and accessible content for Lindy Hoppers  
328 posts · 154 members



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# Problem Statement

How can we support Lindy Hop self-practice after online lessons?

## Prototyping a Lindy Hop AI trainer



Getting Comfortable Using Your Arms



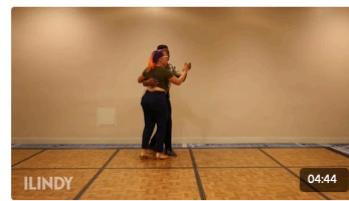
Swing Out Foundations



Swingin' in 8 Beats



Connecting With A Partner



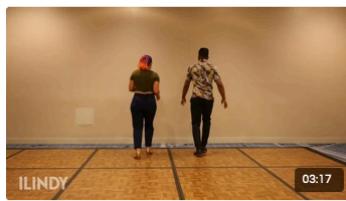
Swingin' in 8 Beats Challenge With Music



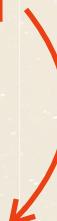
8 Beat Challenge - Explanation



8 Beat Solo Footwork With Music - Right Foot



8 Beat Solo Footwork with Music - Left Foot



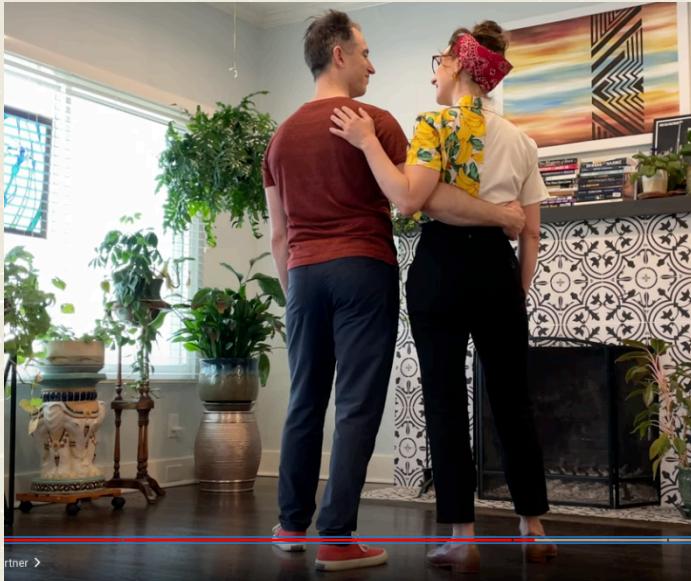


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# Lindy Hop: Connecting With a Partner

## Closed Position

Position at the start of any **song**



## Open Position

Position at the start of a **dance move**

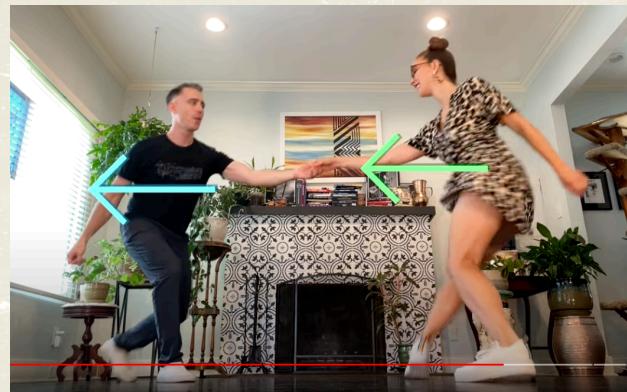




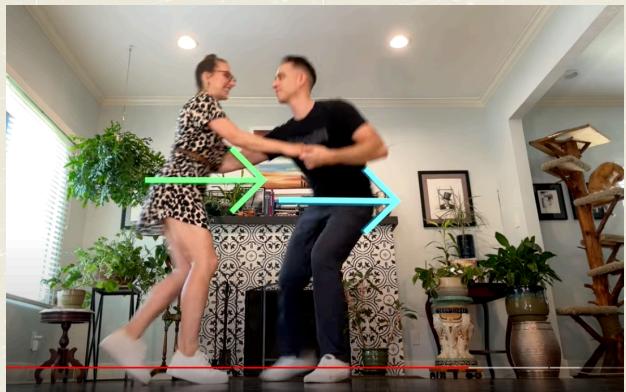
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# Lindy Hop: The Swing Out

## 1. Same Direction



## 2. Re-Direction

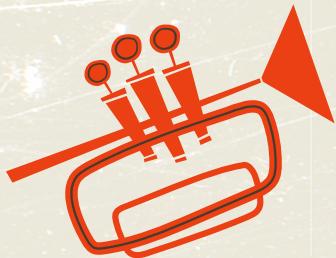


## 3. Opposite Directions



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# DATA COLLECTION





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# Video Recordings

- Videos filmed in Oct 2023 to songs with **slow-to-medium tempos**
- Clips were individually edited out from the recording sequence
- 28 clips of Swing Out from **open**, captured as **2902** rows
- 23 clips of Swing Out from **closed**, captured as **2460** rows

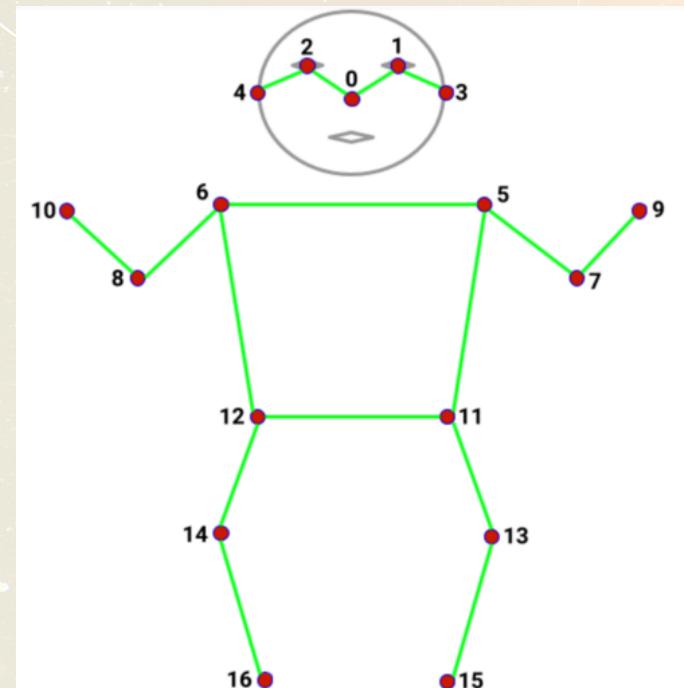




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# Coordinates of Body Parts Extracted Using YOLO v8

- You Only Look Once (YOLO) algorithm that detects objects in real time using convolutional neural networks
- Use of YOLOv8m-pose model pre-trained on the COCO dataset for object tracking and pose estimation
- Object tracking of dancers as individuals
- Detection of 17 keypoints (x, y coordinates of body parts) including nose, eyes, ears, shoulders, elbows, wrists, hips, knees, and ankles

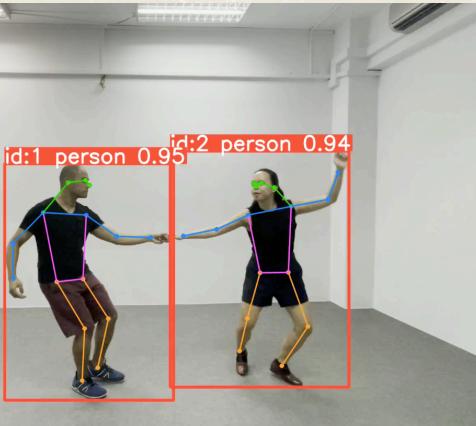




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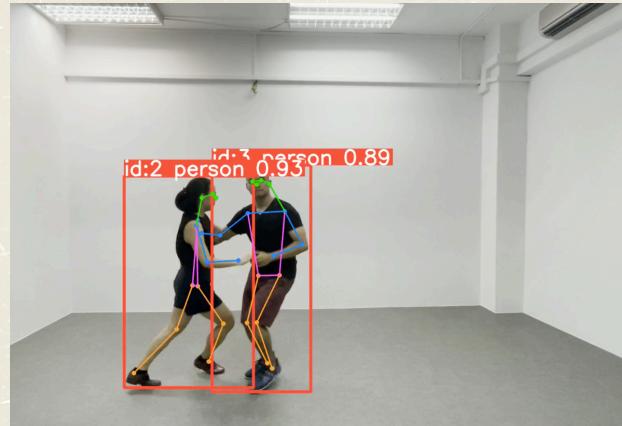
# YOLO v8: The Swing Out

## 1. Same Direction



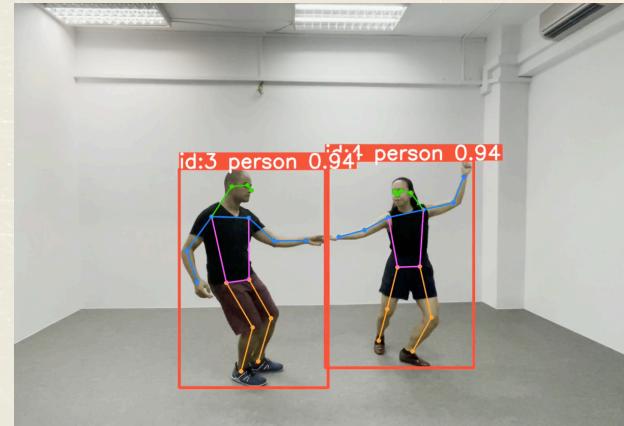
Unique Persons 1 and 2 detected by YOLO.  
Person on Left as Lead, Person on Right as Follow.

## 2. Re-Direction



Possible blocking of Follow during when the  
dancers change position

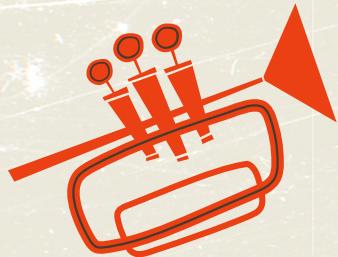
## 3. Opposite Directions



Person 3 and Person 4 Detected. Data was  
cleaned to map keypoints to the correct  
person before analysis and modelling

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# EXPLORATORY DATA ANALYSIS

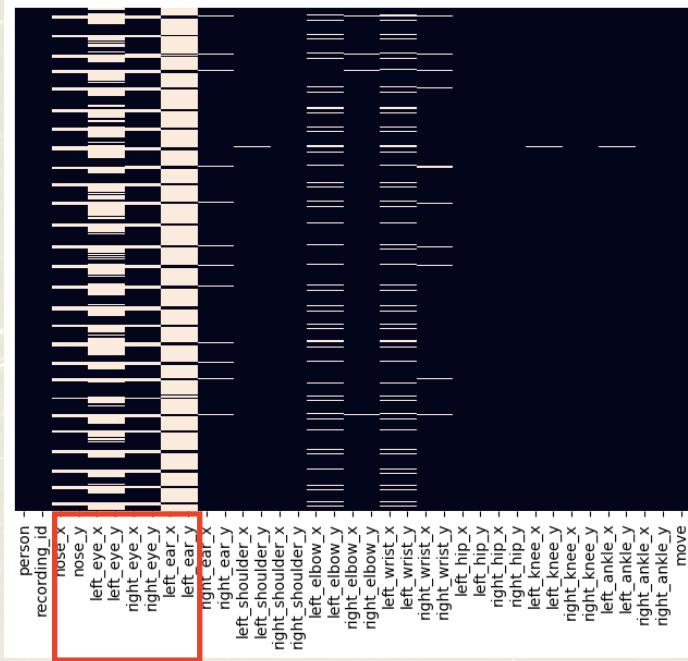




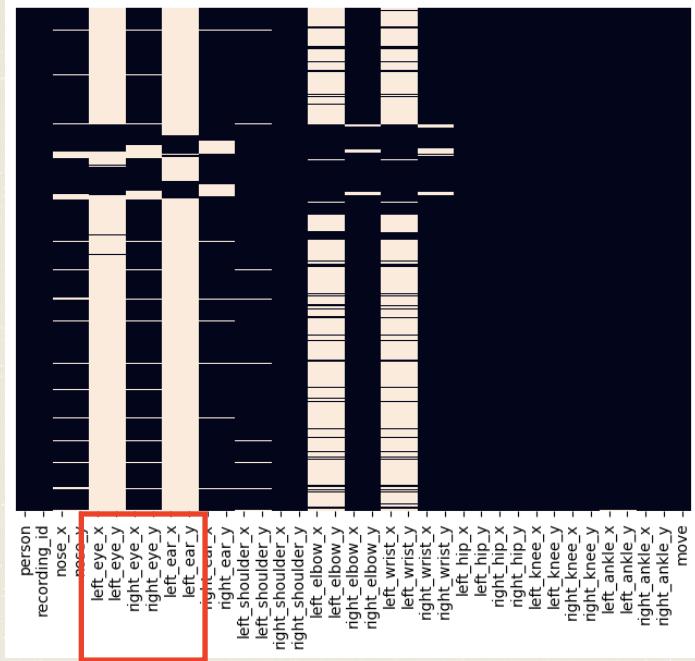
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## Follow: Poor Detection of Left Facial Features in both Swing Outs

Swing Out from Open:  
Heat Map of Missing Values



Swing Out from Closed:  
Heat Map of Missing Values

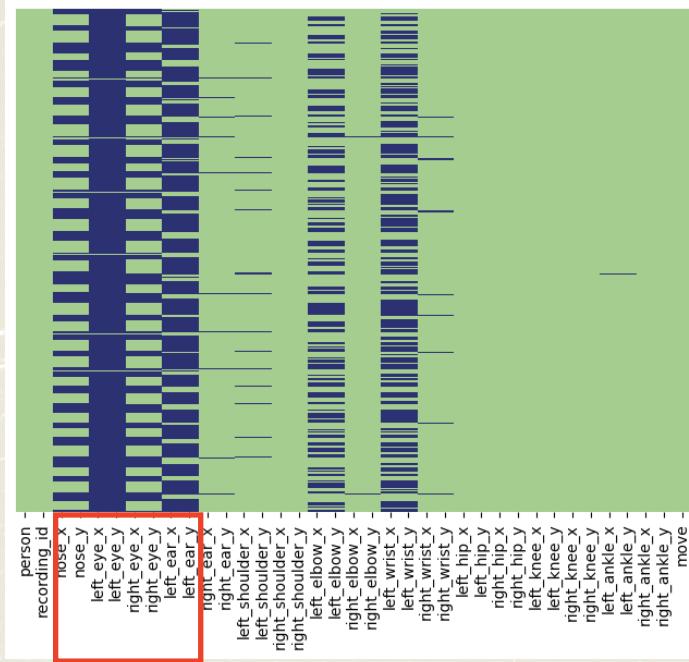




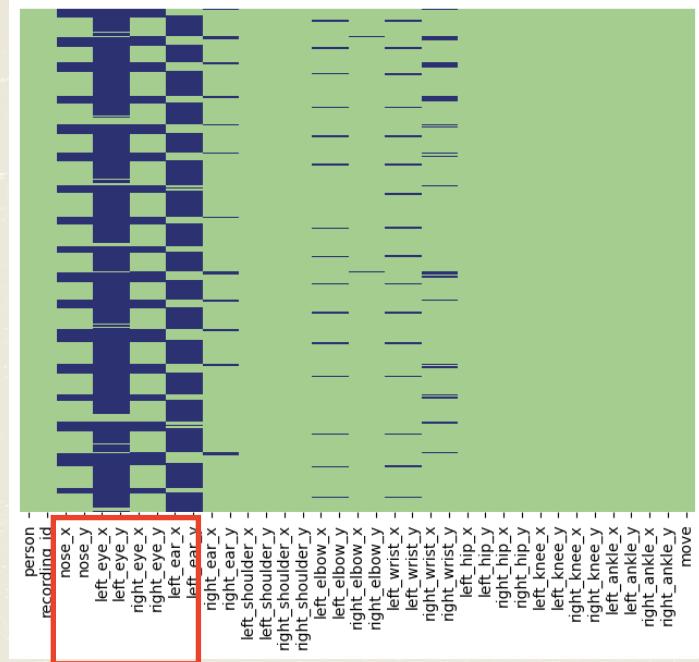
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# Lead: Poor Detection of Left Facial Features in both Swing Outs

Swing Out from Open:  
Heat Map of Missing Values



Swing Out from Closed:  
Heat Map of Missing Values

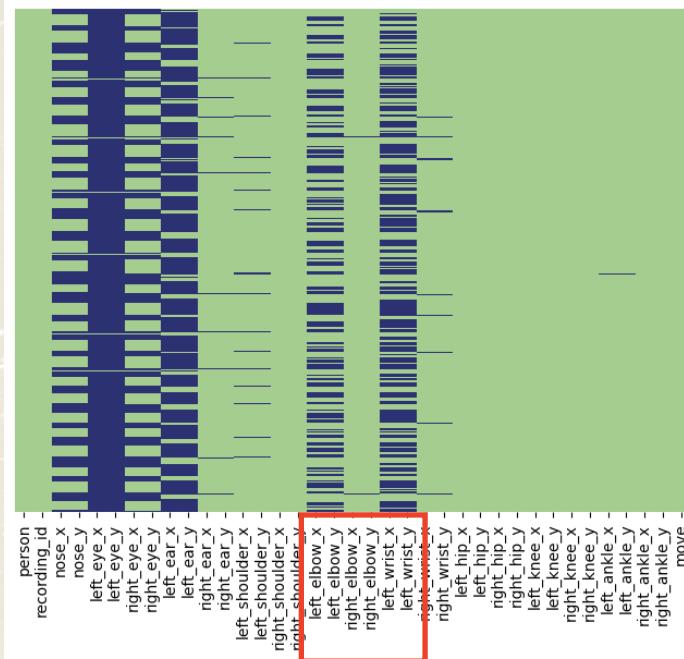




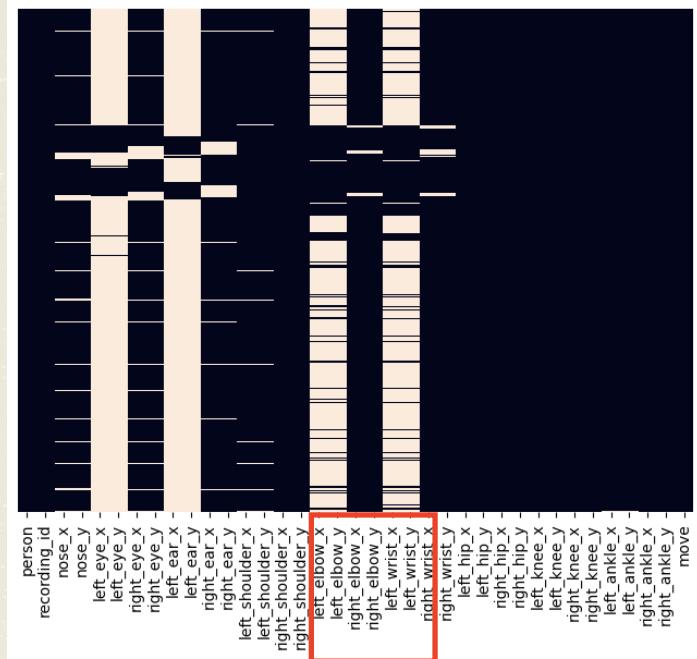
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# Intermittent Detection of Left Elbow and Left Wrist for Both for Both Swing Outs

Lead - Swing Out from Open:  
Heat Map of Missing Values



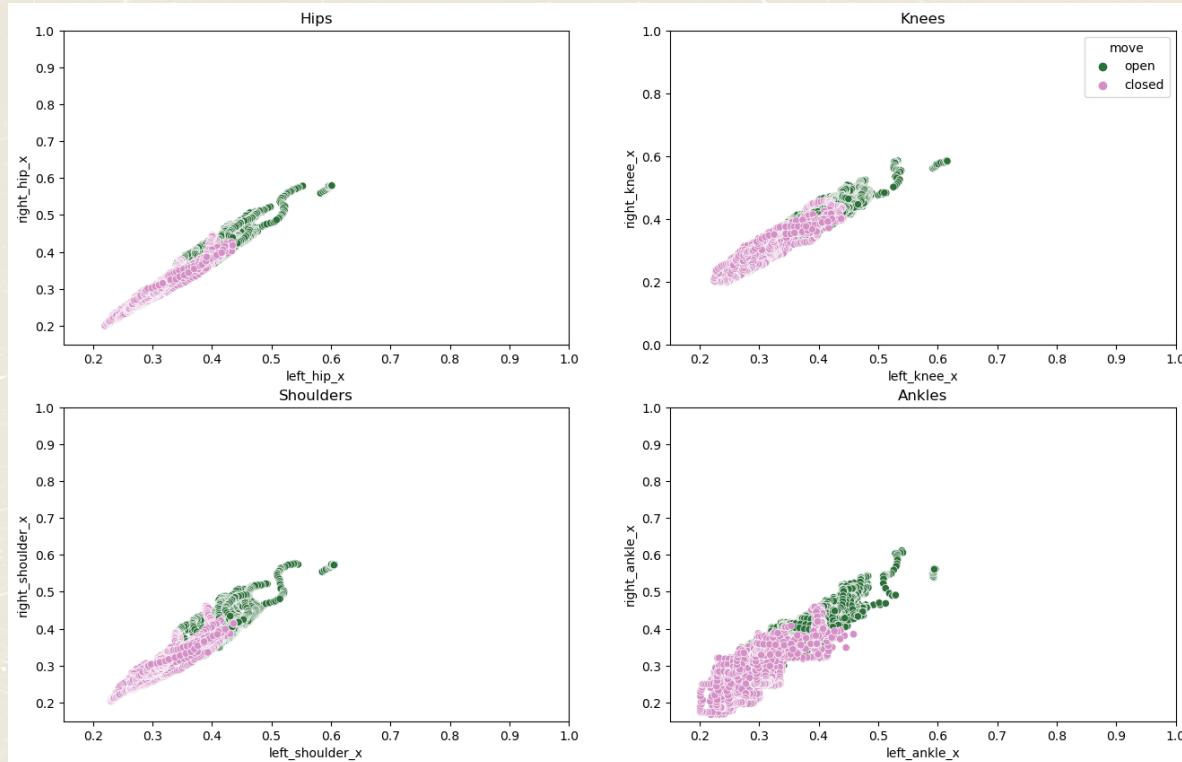
Follow - Swing Out from Closed:  
Heat Map of Missing Values





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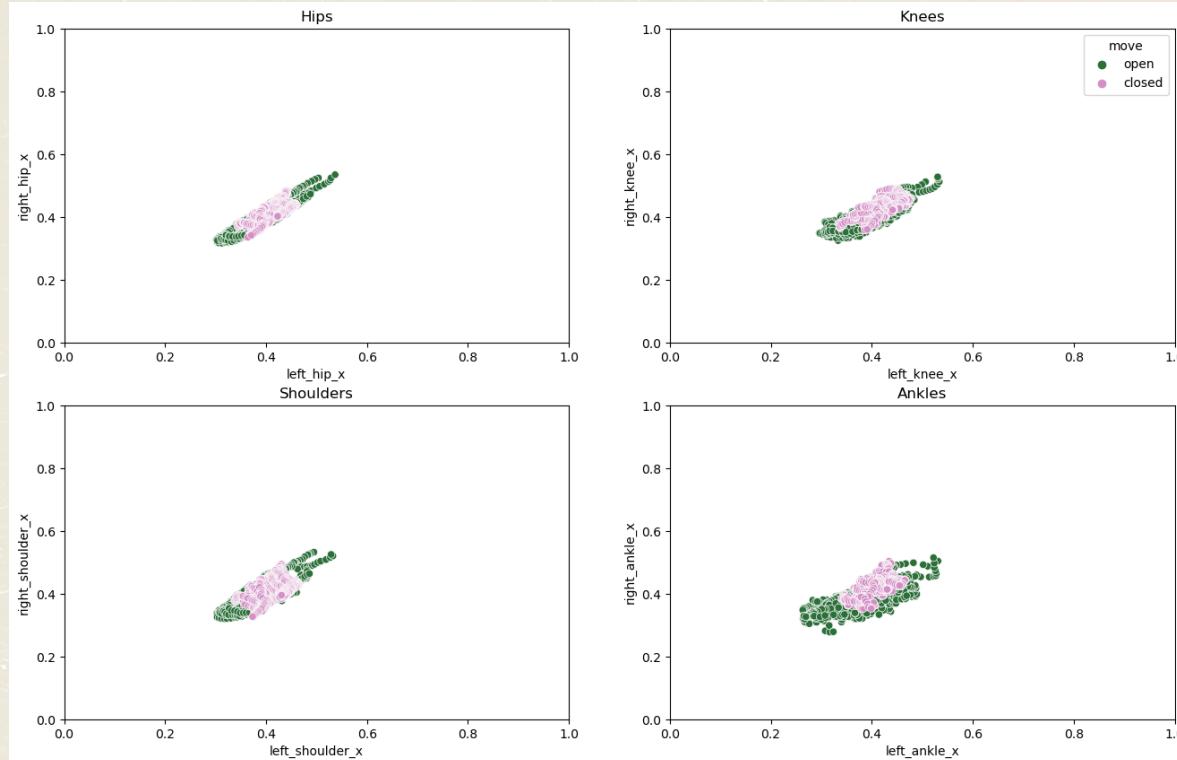
# Alignment of Follow's Hips, Knees, Shoulders, and Ankles Differentiates Swing Outs





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## Alignment of Lead's Hips, Knees, Shoulders, and Ankles is Less Distinctive





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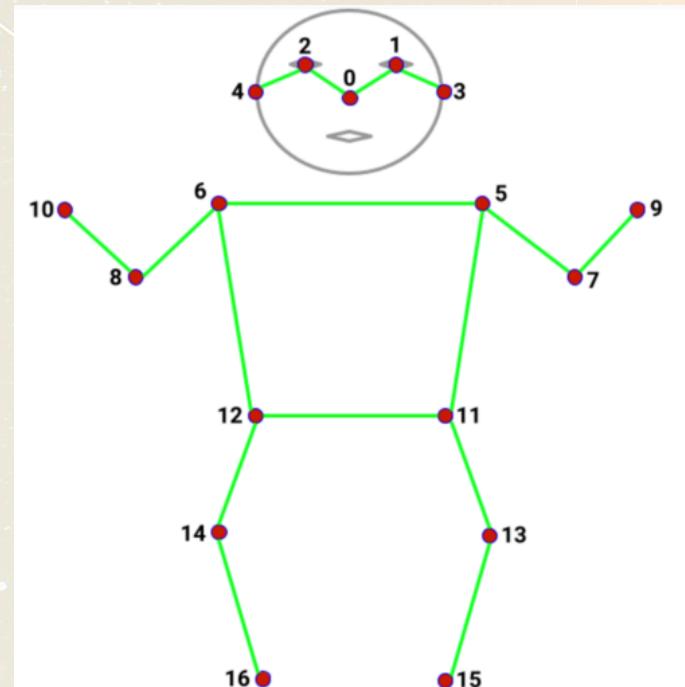
# 21 Features Selected For Modelling

## Kept

- Role - i.e. Lead / Follow
- Keypoints for both shoulders
- Keypoints for both hips, knees, and ankles

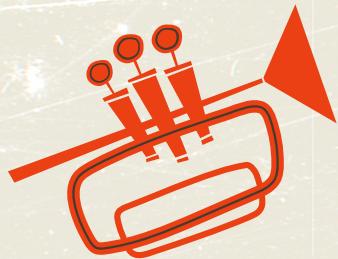
## Dropped

- Keypoints for all facial features (e.g. nose, eyes, ears)
- Keypoints for left elbow and wrist



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# MODELLING





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# Modeling with Pycaret

Model	Accuracy	AUC	F1 Score	Time Taken (s)
Extra Trees Classifier	0.9961	0.999	0.9967	0.3750
Light Gradient Boosting Machine	0.9956	0.999	0.9962	2.5130
Extreme Gradient Boosting	0.9941	0.998	0.9949	0.2970
Logistic Regression	0.7148	0.9973	0.7454	0.2510

\*Use of Synthetic Minority Oversampling Technique (SMOTE) to upsample from minority class of Swing Out from Closed



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# Learning Points and Future Work

- ✓ AI training most suitable for dance drills with **low occlusion** and **clear visibility of body parts**
- ✓ To explore detection and recognition of **entire dance sequences**



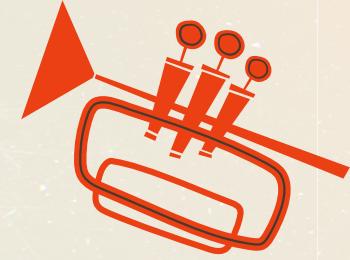
Isolation Training (e.g. Arms)



Connection and Frame Training  
(e.g. Hacksaws)



# THANKS!



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CREDITS: This presentation template was created by [Slidesgo](#), and includes icons by [Flaticon](#) and infographics & images by [Freepik](#)





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# Resources

## Photos

- Savoy Ballroom (<https://www.vintageinn.ca/tag/savoy-ballroom-harlem/>)
- Hellzapoppin (<http://www.yehoodi.com/blog/2019/5/14/watch-this-1080-hd-version-of-hellzapoppin-the-greatest-dance-scene-ever>)
- Screenshot of First Stops ([https://www.youtube.com/watch?v=pDw\\_v5NvmG8](https://www.youtube.com/watch?v=pDw_v5NvmG8))
- Charleston (<https://ilindy.com/blog/what-charleston-steps-should-every-lindy-hopper-know/>)

## Video Screenshots

- 6 Count Basic - Learn to Lindy Hop from the Ground Up by Laura Glaess (<https://www.youtube.com/watch?v=U9yKEnewTas>)
- Swingout - Learn to Lindy Hop from the Ground Up by Laura Glaess (<https://www.youtube.com/watch?v=VSE7SD3l3uA>)
- Arms - For Lindy Hop and Swing Dance by Laura Glaess (<https://www.youtube.com/watch?v=nKXhYOQkoGg>)