



Hand Gesture Recognition

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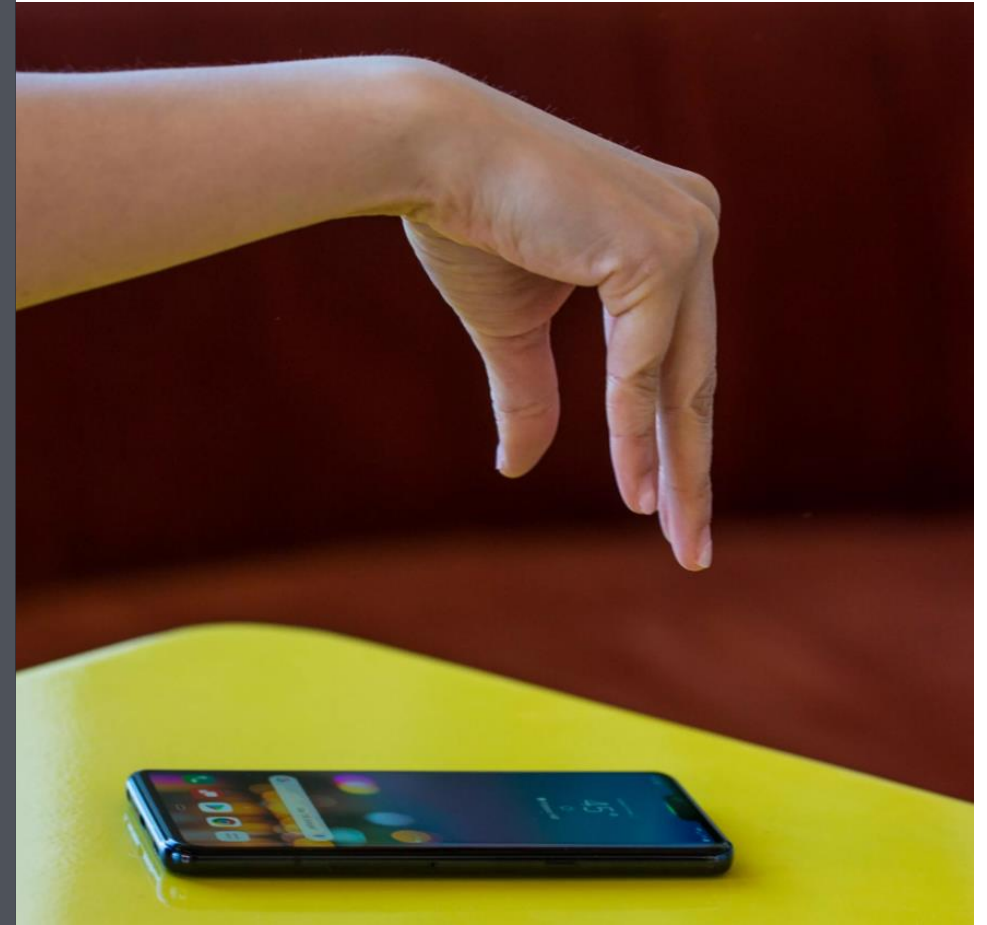
Brown University

10/22/2019

[GitHub Link](#)

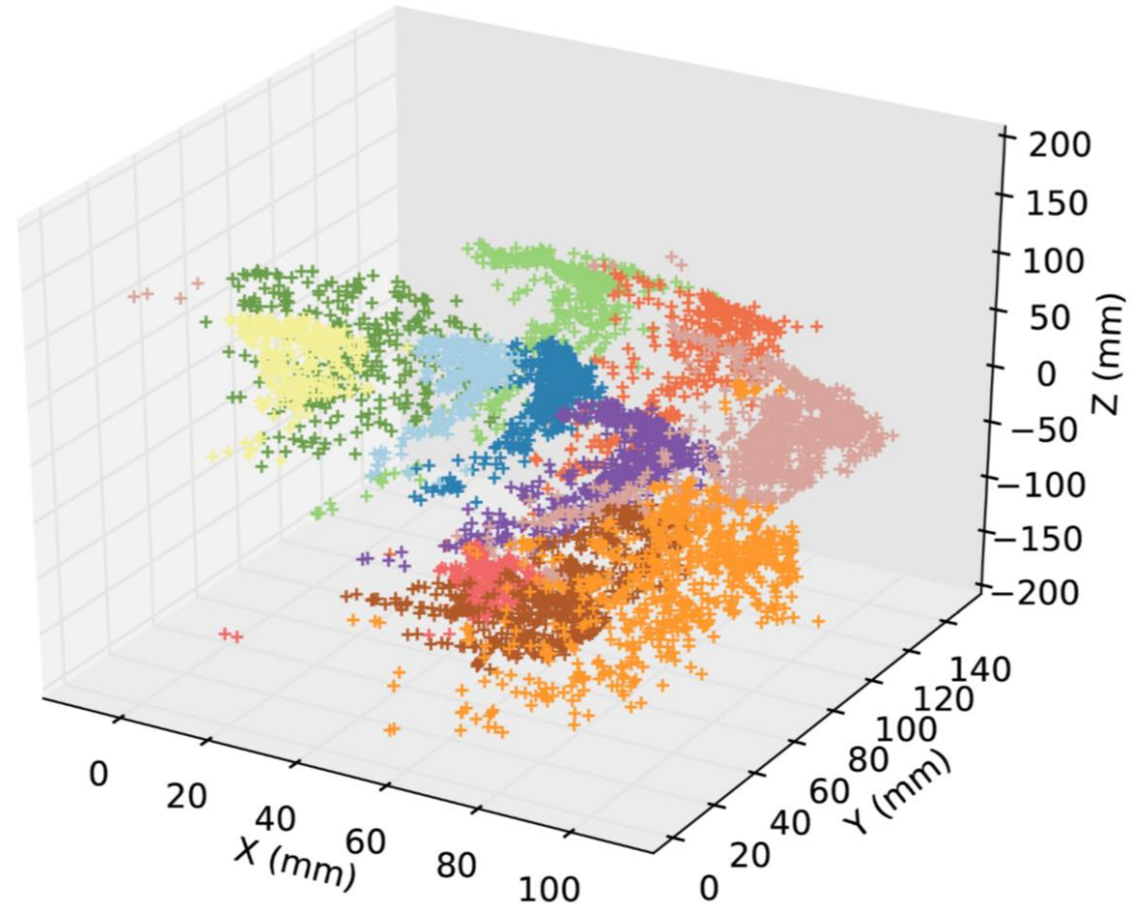
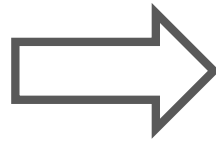
Intro

- The purpose of this project is to build a model to predict hand gestures and who made these gestures.
- Classification methods will be used in this project.
- Hand gesture recognition can be a very powerful tool in interaction with electronic devices.
- Data is obtained from UCI Machine Learning Repository.



Preprocess

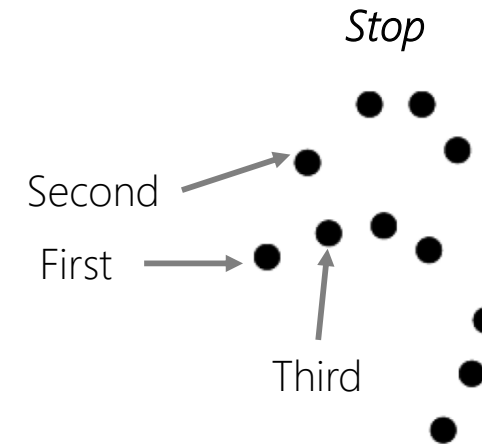
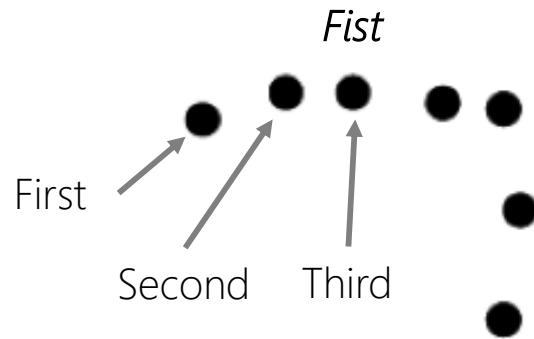
- As the size of a human hand is reasonably bounded, MinMaxScaler is used for preprocess.
- After preprocessing 36x78095. All features are continuous.



Reason for Missing Values

The markers are unlabeled.

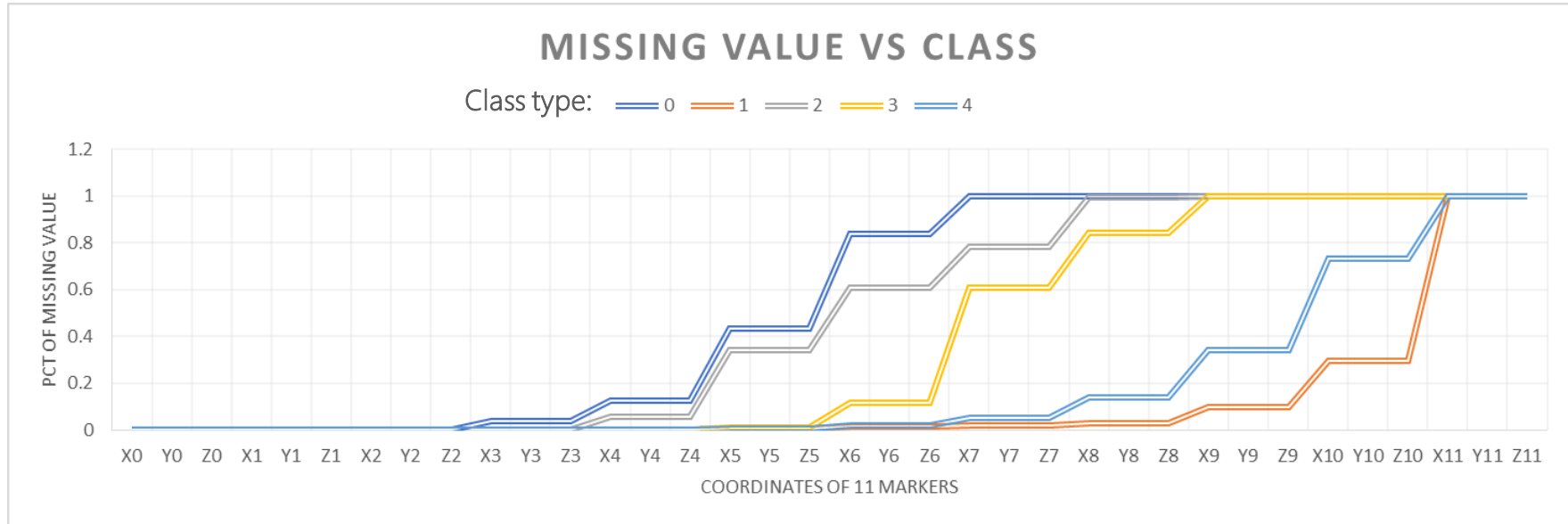
So the number of markers of a given record are not the same in different records.



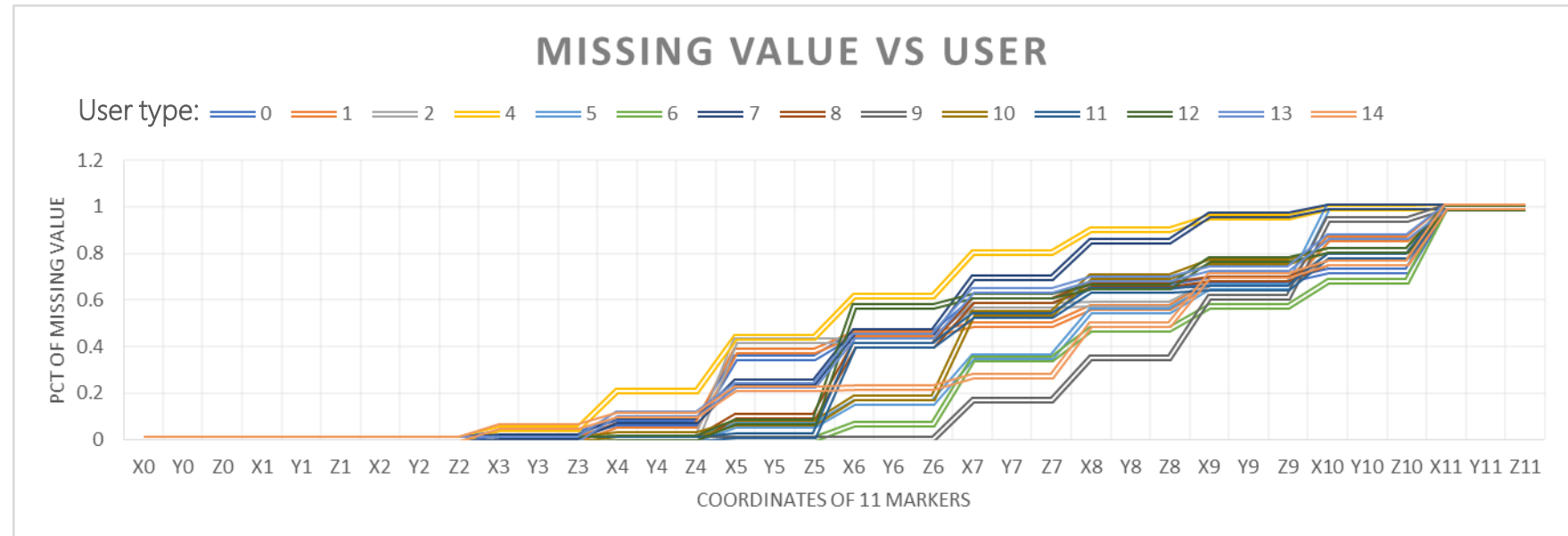
- For this reason, coordinates are more likely to be missing for lower ranked markers.
- In many gestures, not all the markers can be detected by the camera.
- Missing not at random

EDA on Missing Values

Class of gestures:
Missing not at random

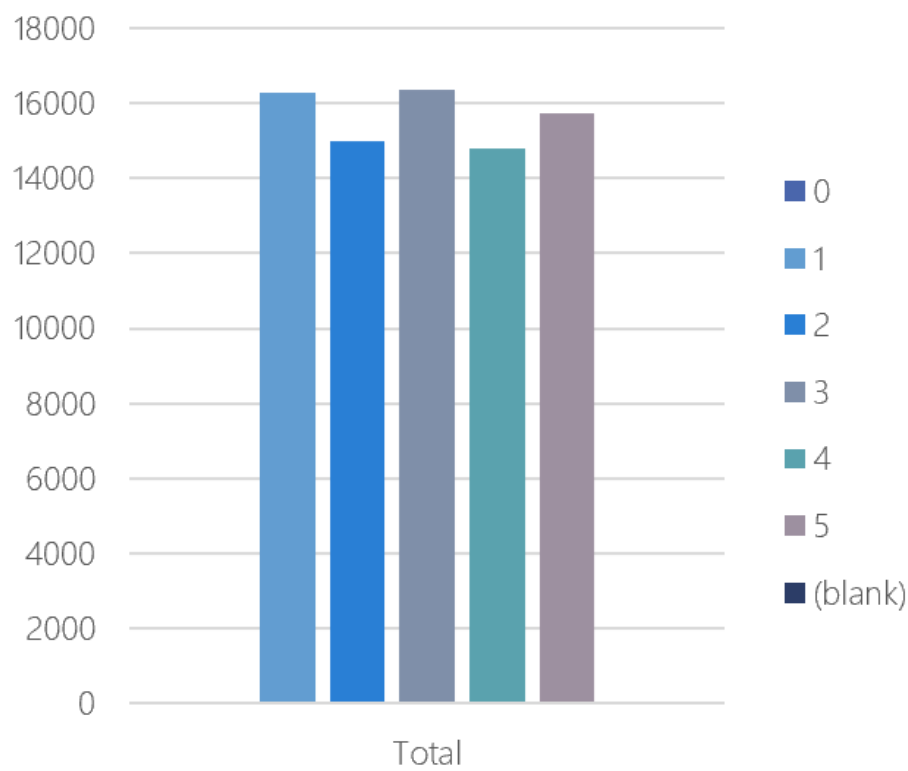


Users:
Missing not at random

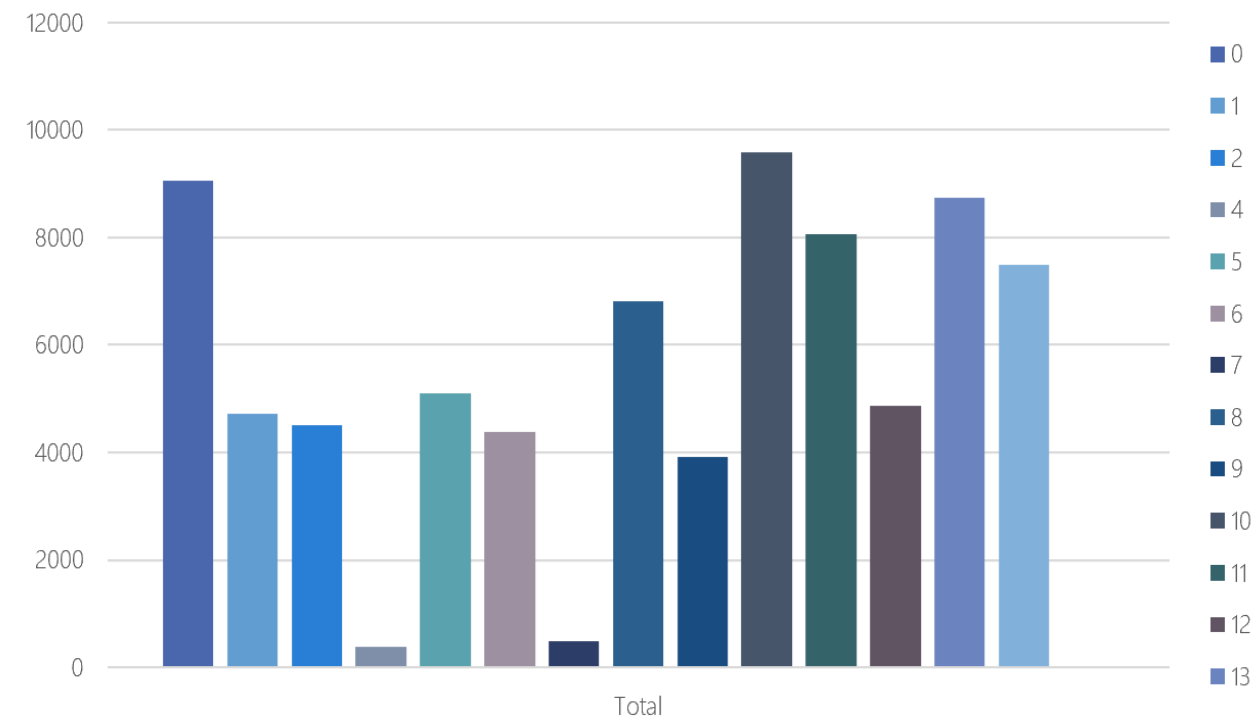


Balance

Class of gestures



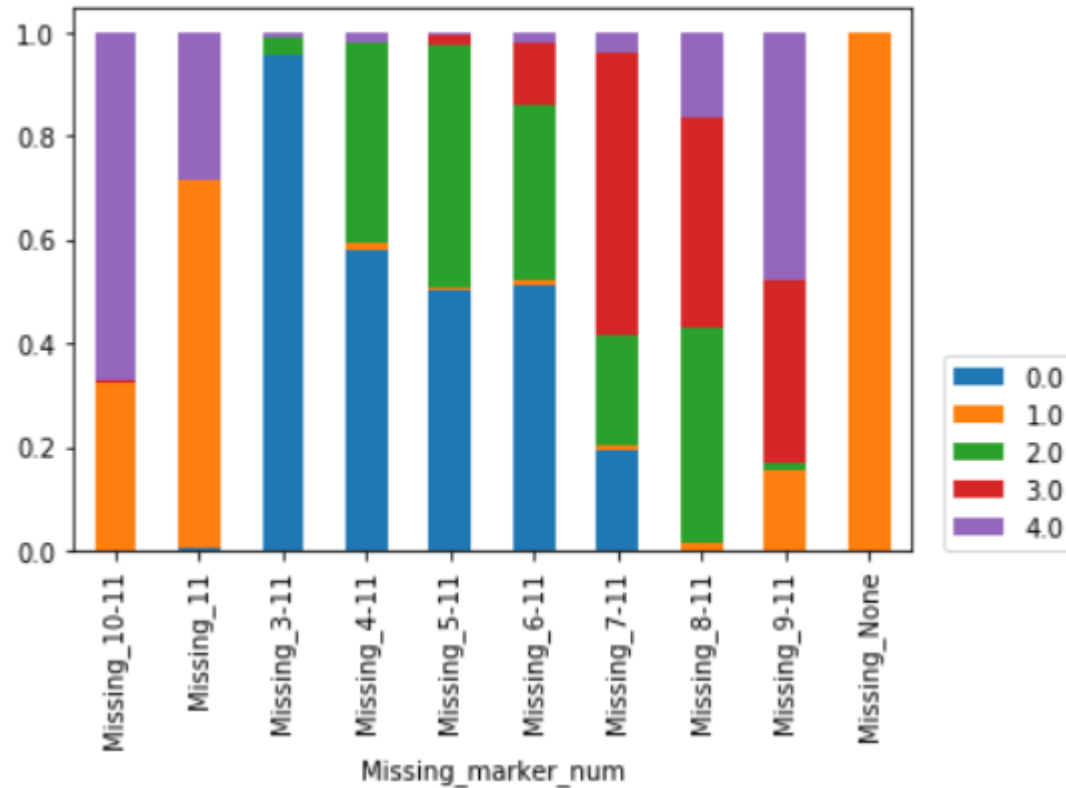
User



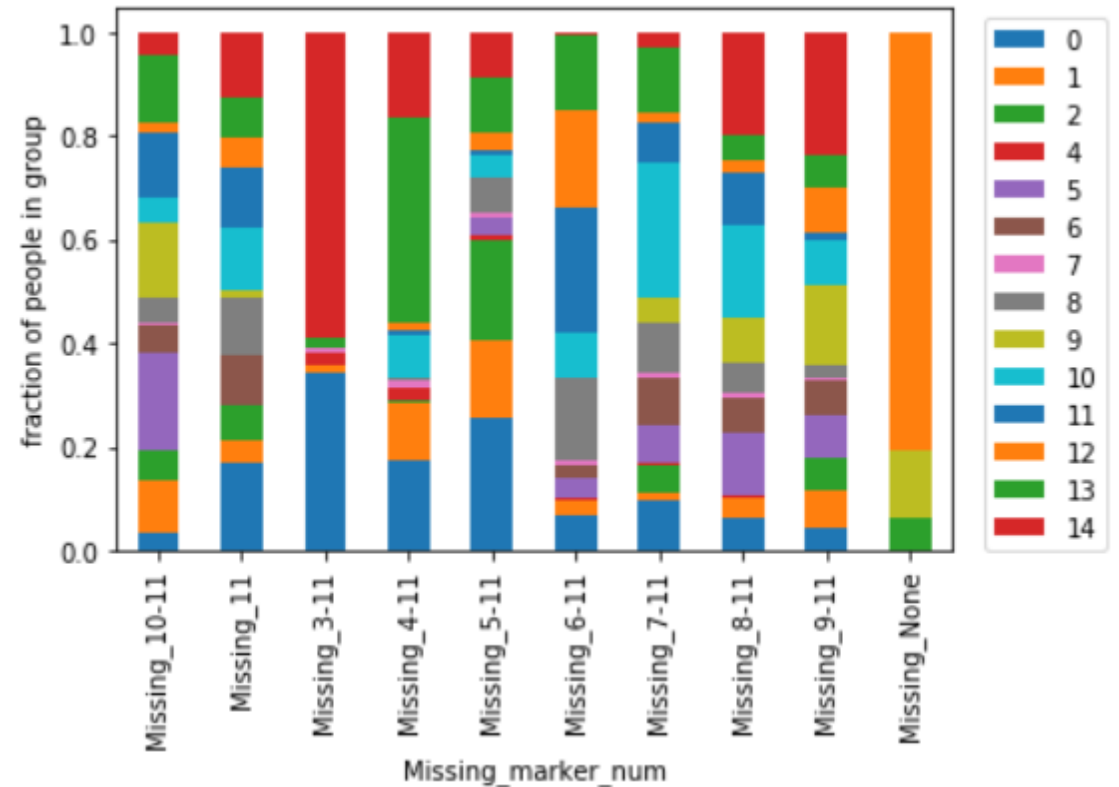
EDA on Missing Values

To utilize this information, a new column is created to show which markers are.

Class of gestures



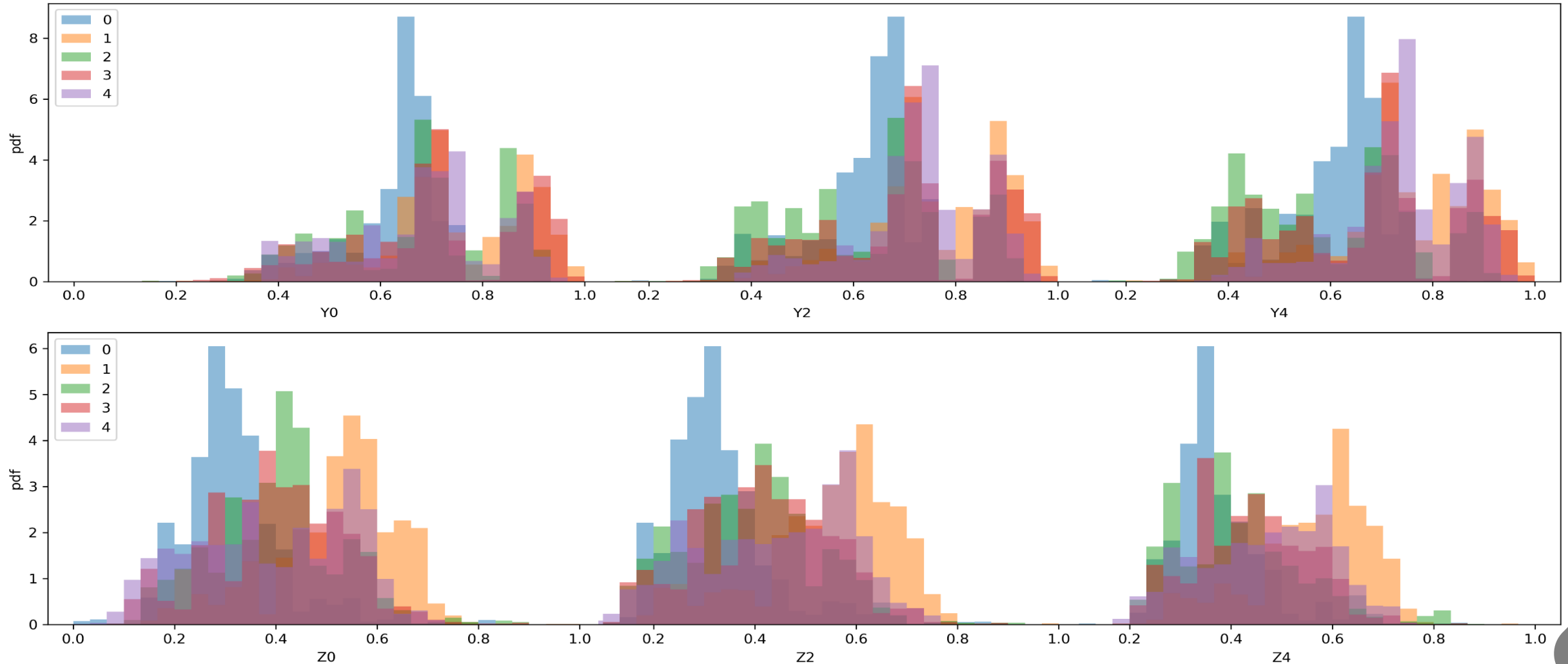
User



EDA on Coordinates, Gesture as Target

Histograms are made for coordinates.

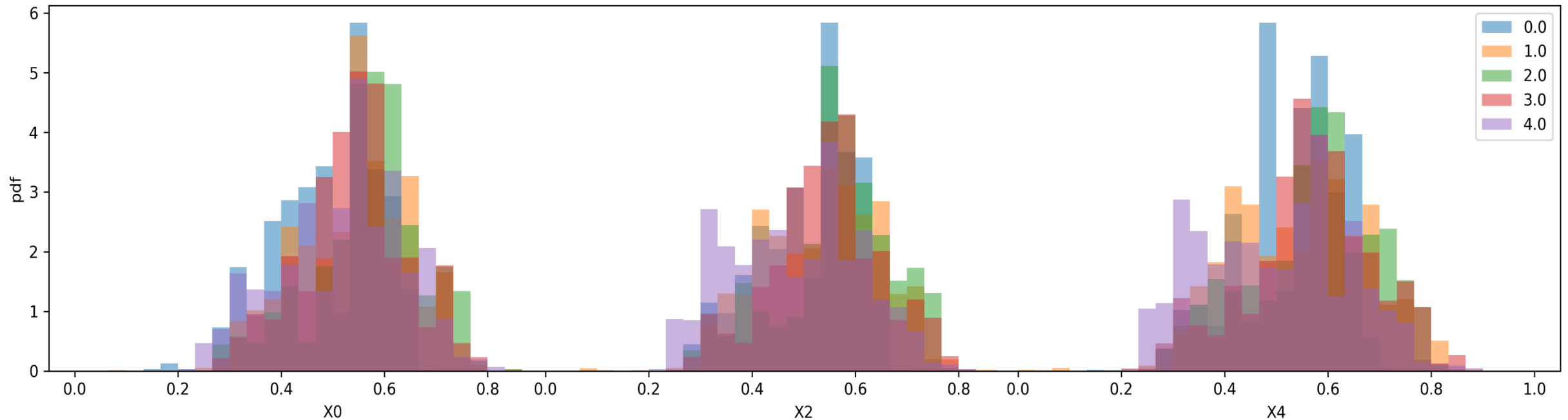
- Y and Z coordinates distribute differently on different gestures.



EDA on Coordinates, Gesture as Target

Histograms are made for coordinates

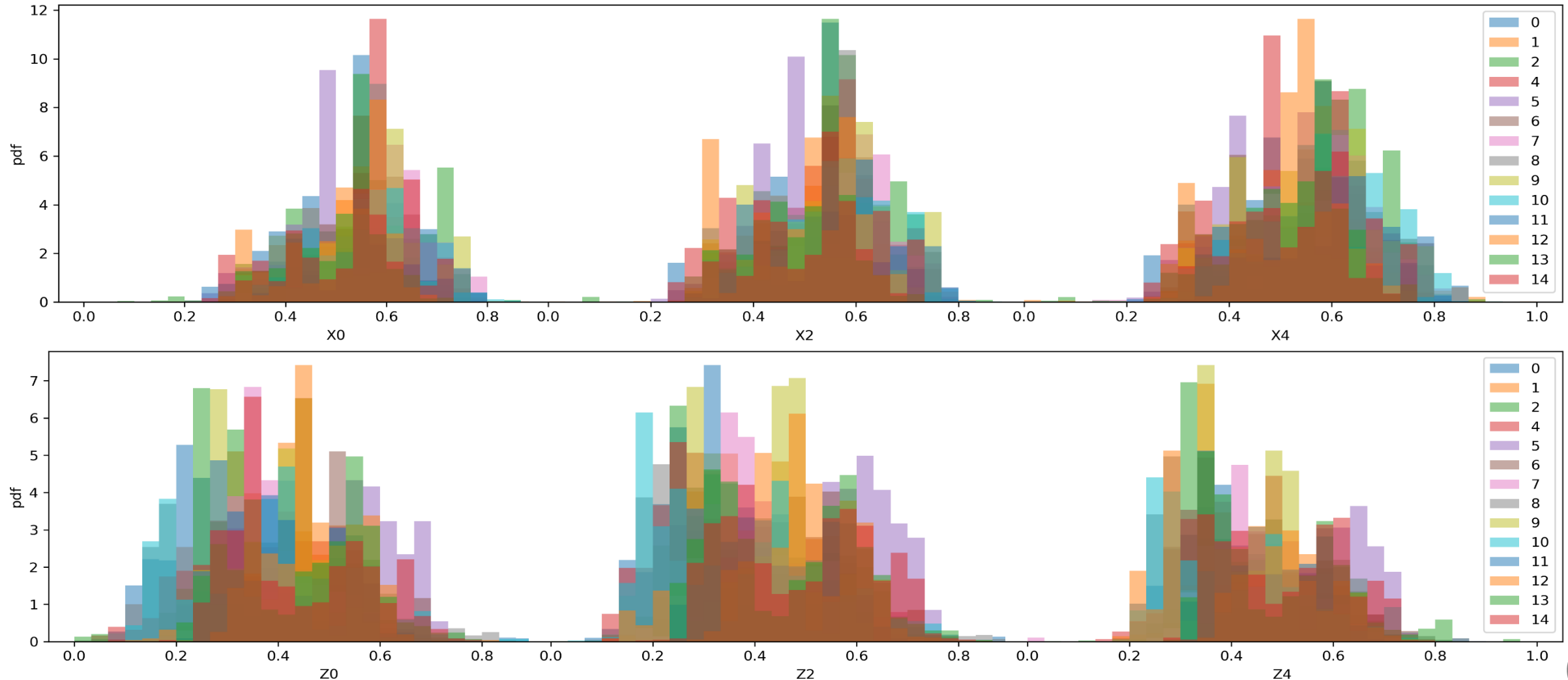
- X coordinates of the markers don't separate gestures that well, especially the first markers.



EDA on Coordinates, User as Target

Histograms are made for coordinates

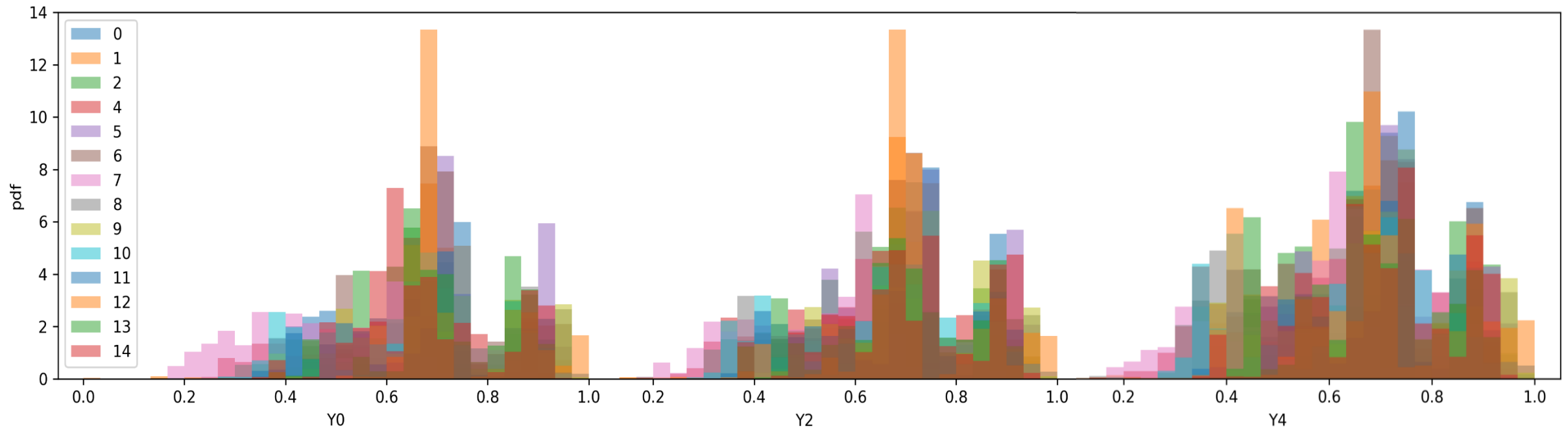
- X and Z coordinates distribute differently on different users.



EDA on Coordinates, User as Target

Histograms are made for coordinates

- Y coordinates of the markers don't separate users that well.

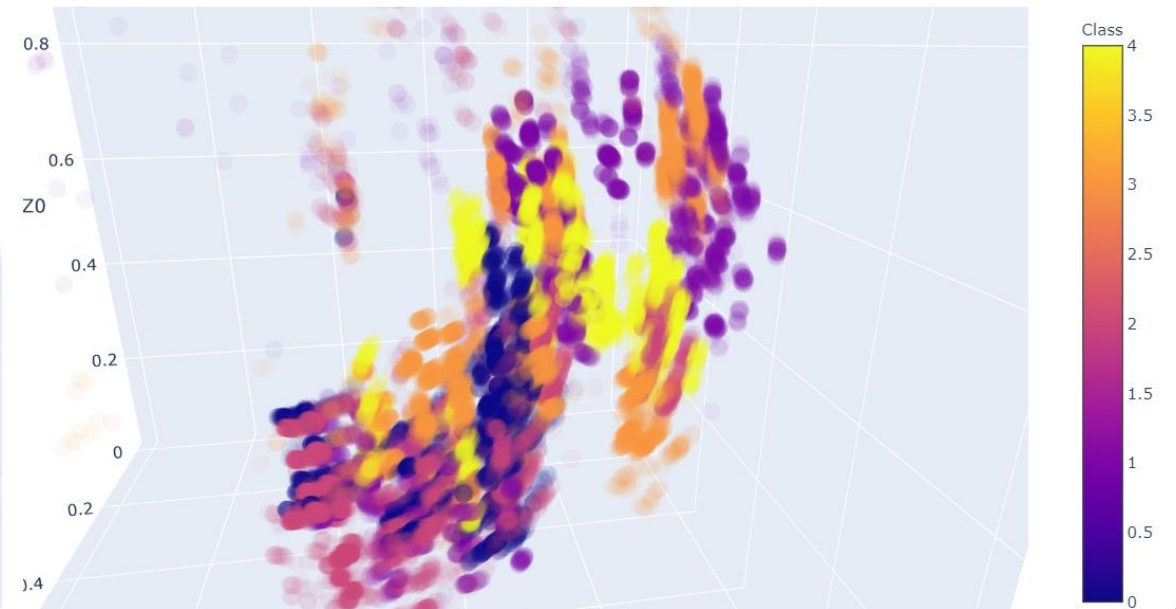
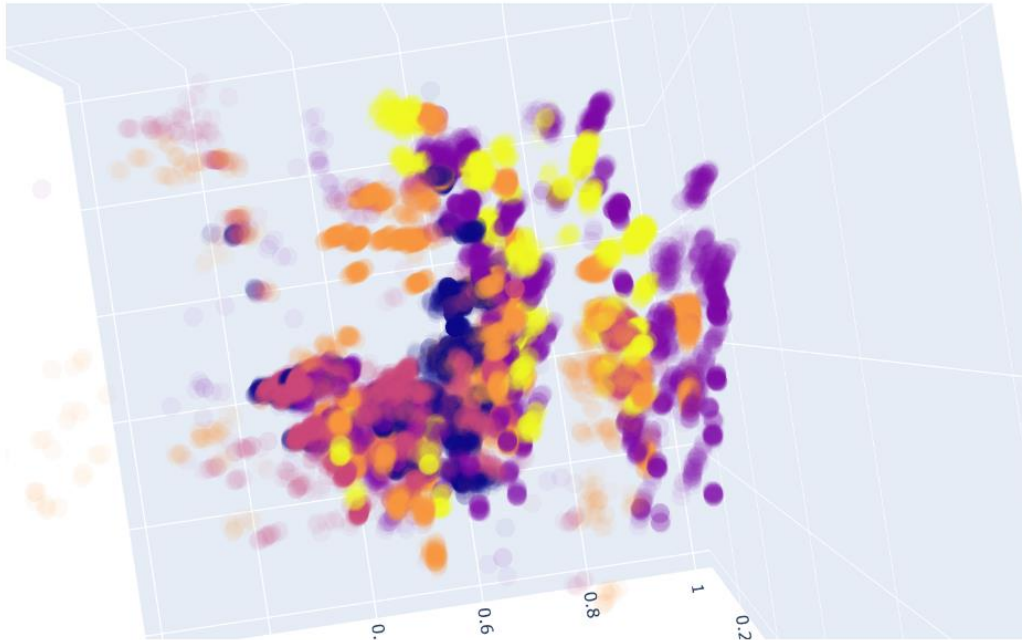


Scatter of Coordinates, Class as Target

3D scatter plot based on different class of gestures.

- **Purple** is clustered and separated from others
- **Pink** is intertwined with some of **blue**
- **Orange** is spread out
- **Yellow** is mostly in the middle

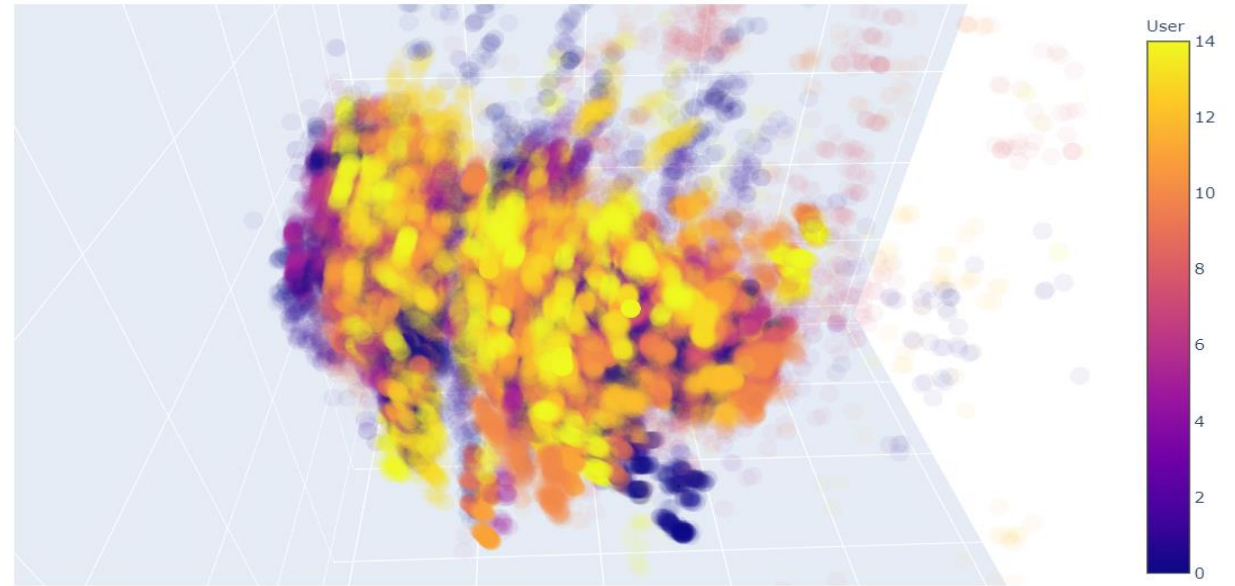
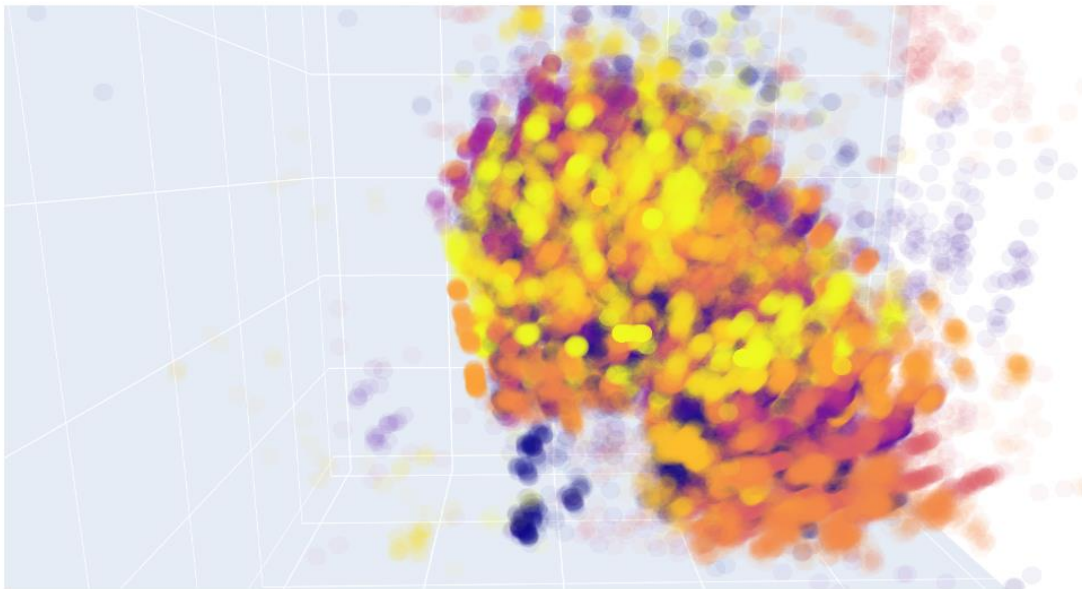
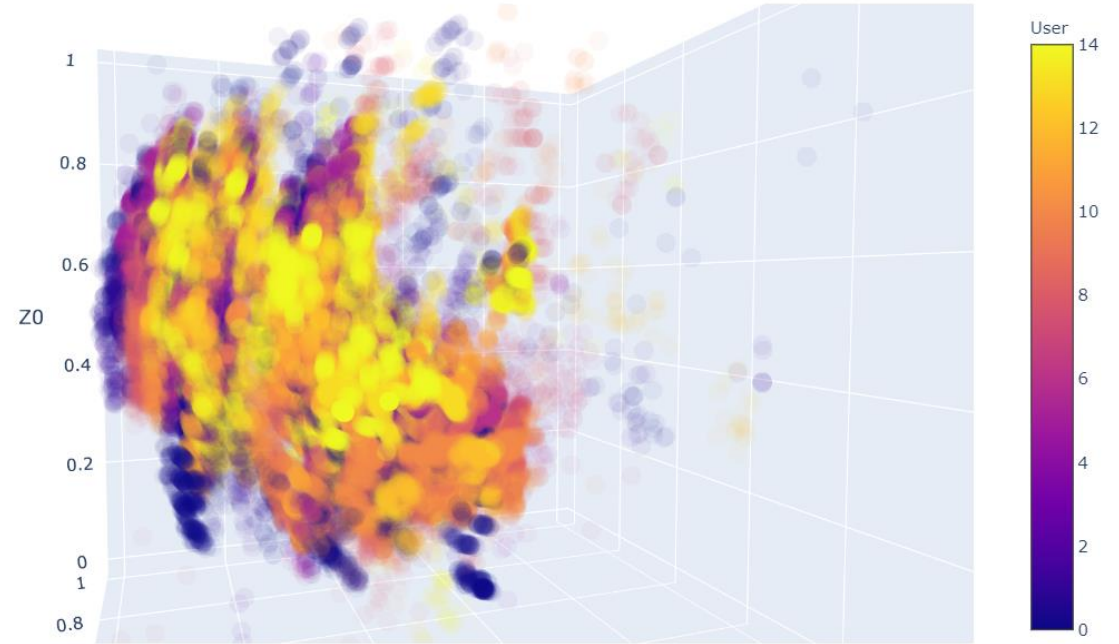
Blue: fist
Purple: stop
Pink: point with 1 finger
Orange: point with 2 fingers
Yellow: grab



Scatter of Coordinates, User as Target

3D scatter plot based on different users.

- Most points are surrounded by yellow and orange.
- Perhaps bigger hands?





Q & A