

iKarate: Improving Karate Kata

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In Collaboration With:



20/5/2020

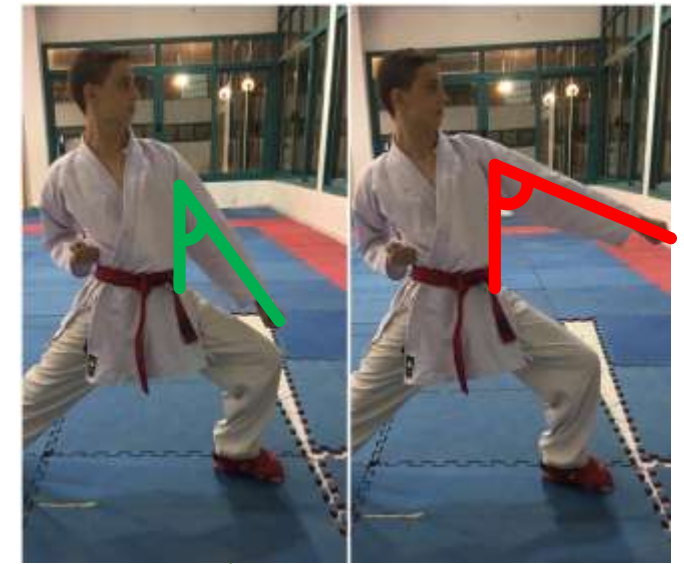
INTRODUCTION 1/2

- ❑ Karate Kata is composed of moves.
- ❑ Moves must be done in a certain way.
- ❑ **Common mistakes:**
 - Joints Angle.
 - West Rotation.
 - Hand Position.
 - Leg Position.

Age Uke

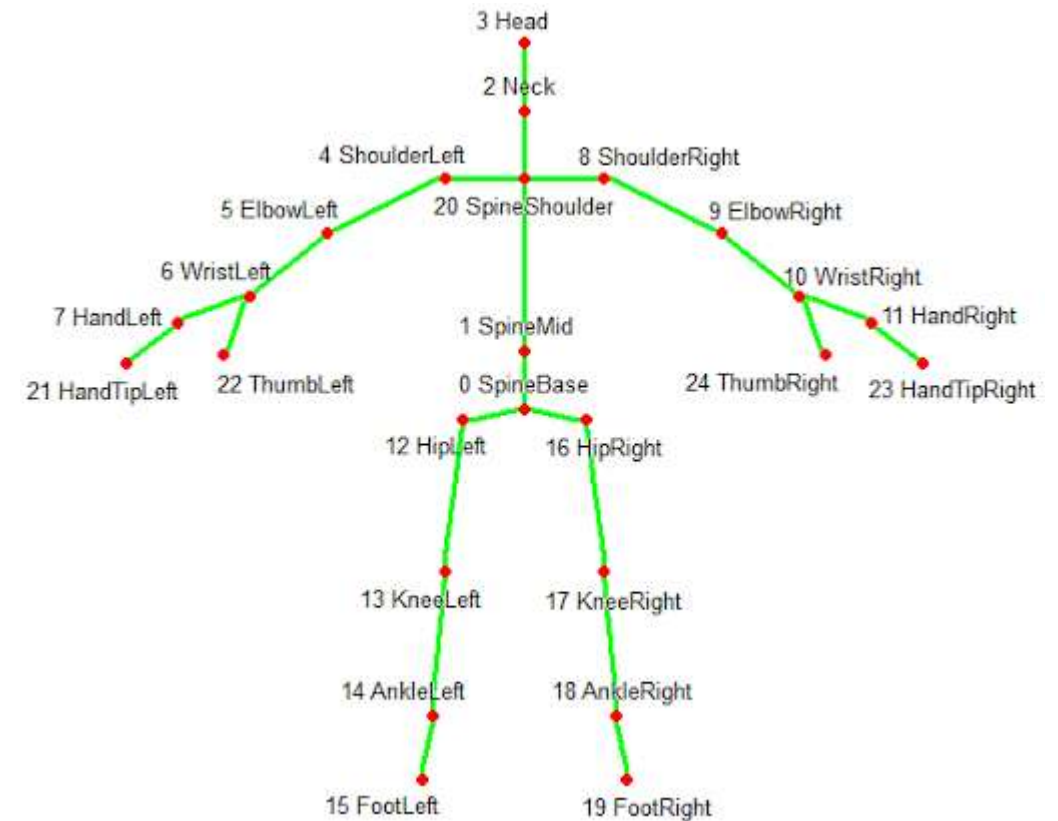


Gedan Barai



INTRODUCTION 2/2

- ❑ Kinect support the tracking of up to 6 people.
- ❑ Kinect supports the tracking of up to 25 joints.
- ❑ Each joint is identified by its name.
- ❑ Each joint has its coordinates (X, Y, Z).
- ❑ The skeleton has 2 tracking states (Tracked - Not Tracked).
- ❑ Kinect is able to capture 30FPS (Frames per second).

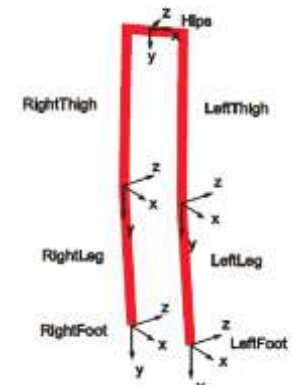
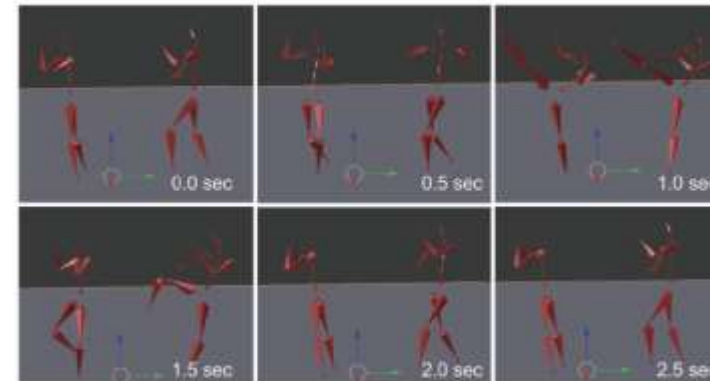


RELATED WORK

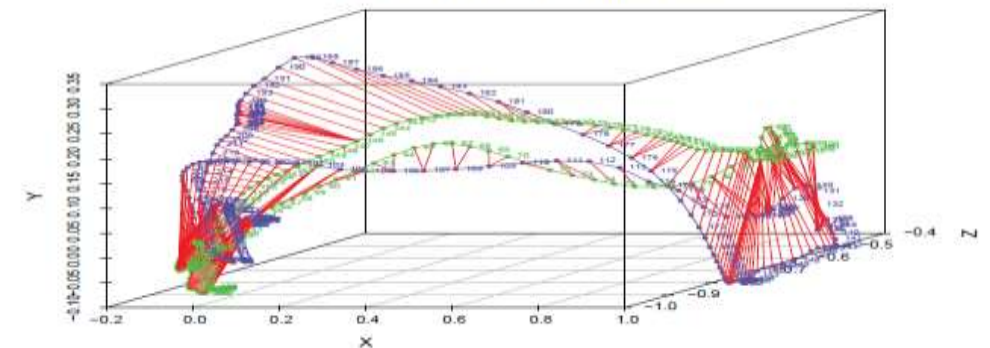
HUMAN MOTION ANALYSIS



- ❑ Actions could be performed in **different speeds** and **different body proportions**.
- ❑ Using Shadow toolkit.
- ❑ Angle **normalization** algorithm And **DTW** alignment algorithm.
- ❑ The proposed evaluation and visualization technique seems to be a valuable tool for advanced human motion analysis.



DTW signal mapping of Hips rotation

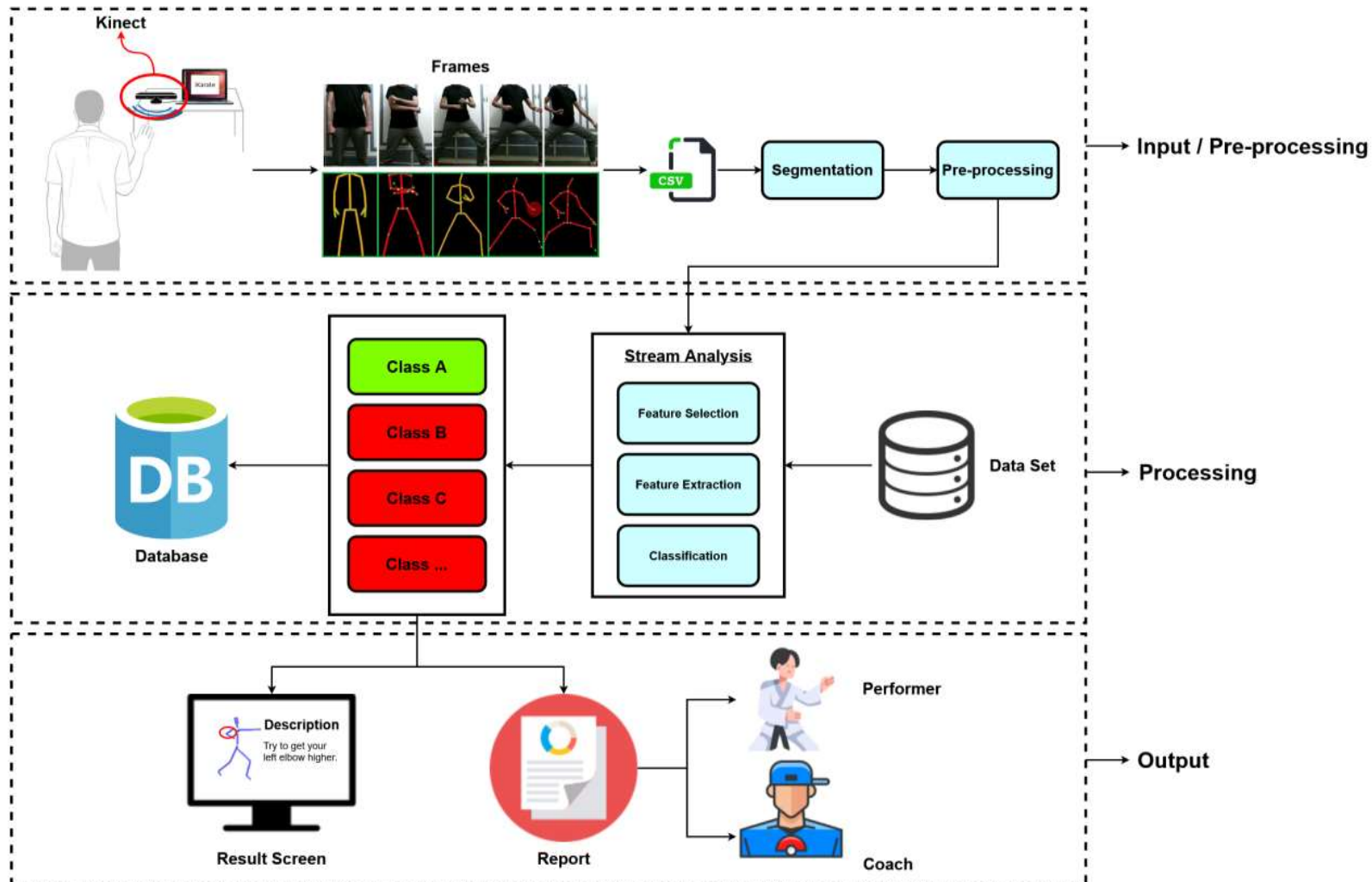


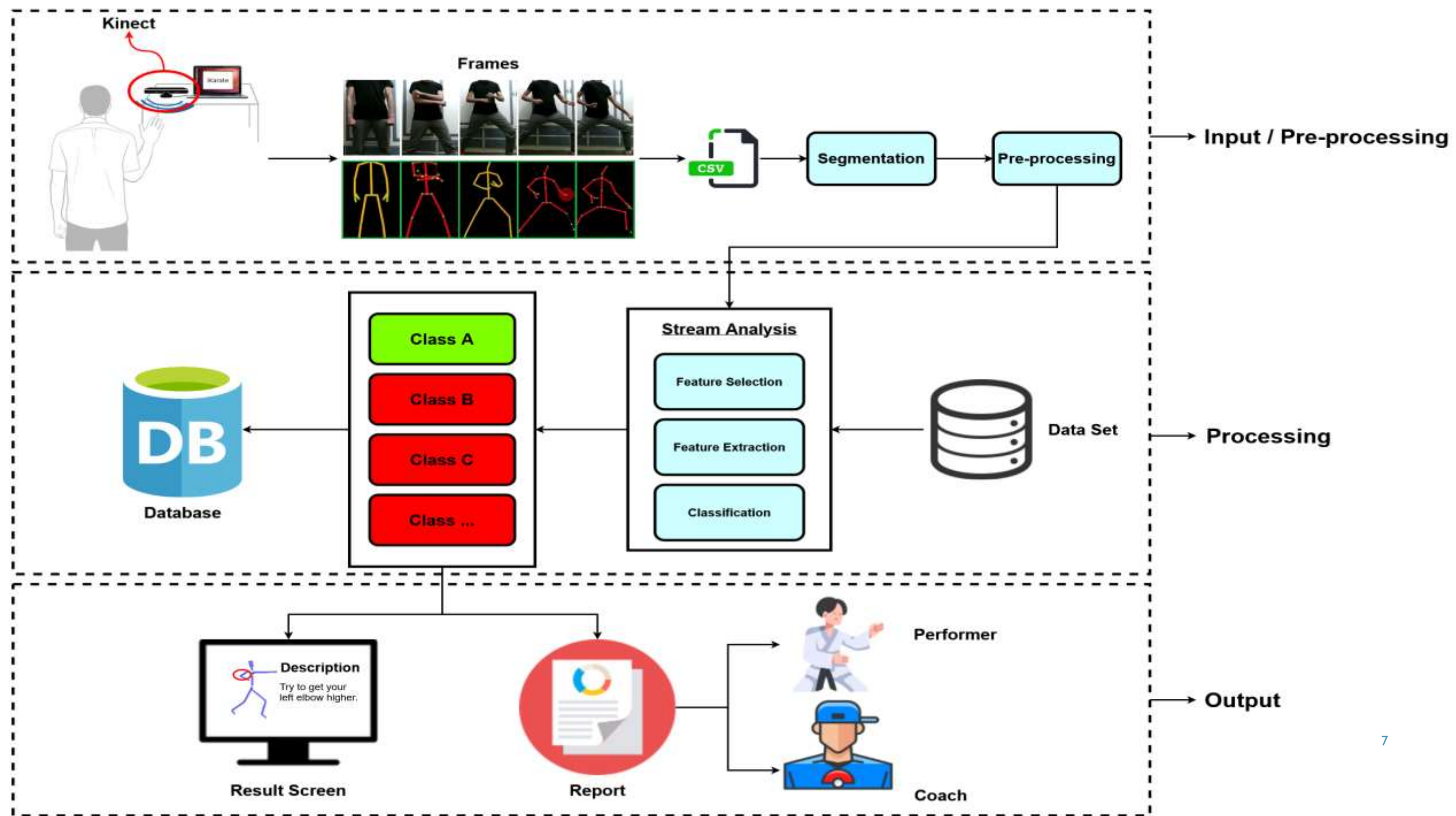
PROBLEM STATEMENTS



Enhancing the **Classification Accuracy And Time** of karate kata, providing **Feedback** and taking into consideration the **Different Speed And Body Proportions**.

SYSTEM OVERVIEW





DECORATOR DESIGN PATTERN

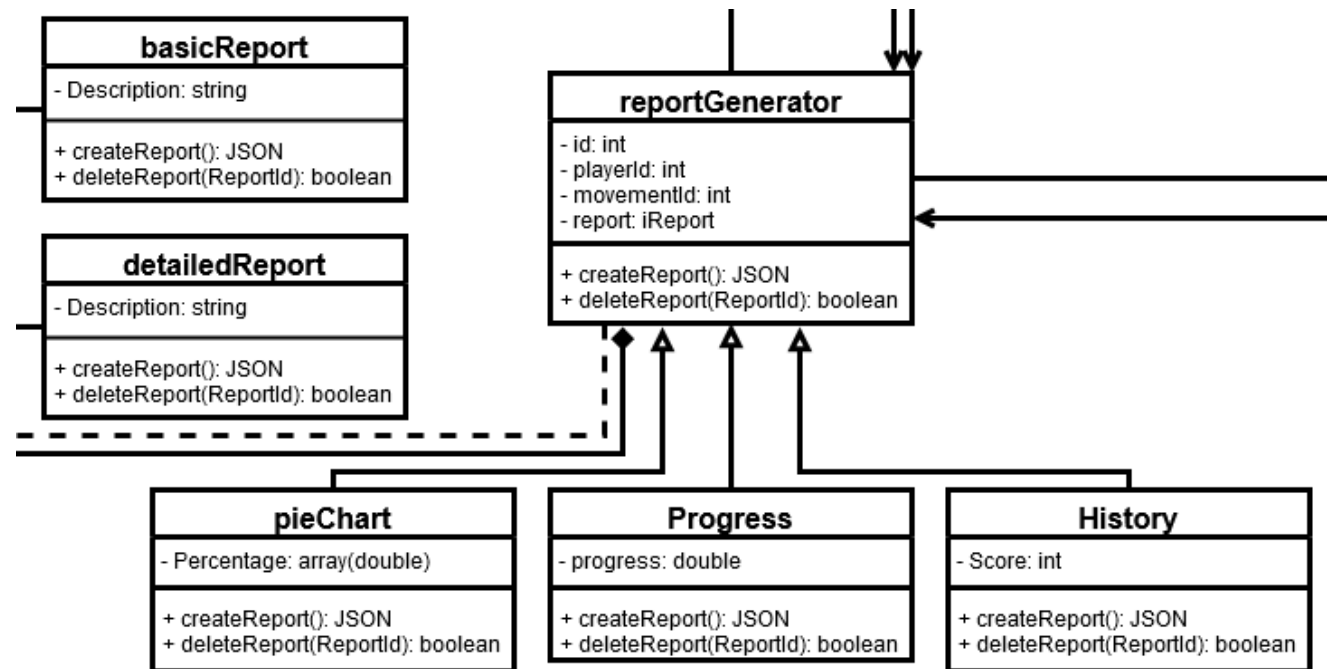


□ Intention:

- Attach additional behavior or state to an entire class.

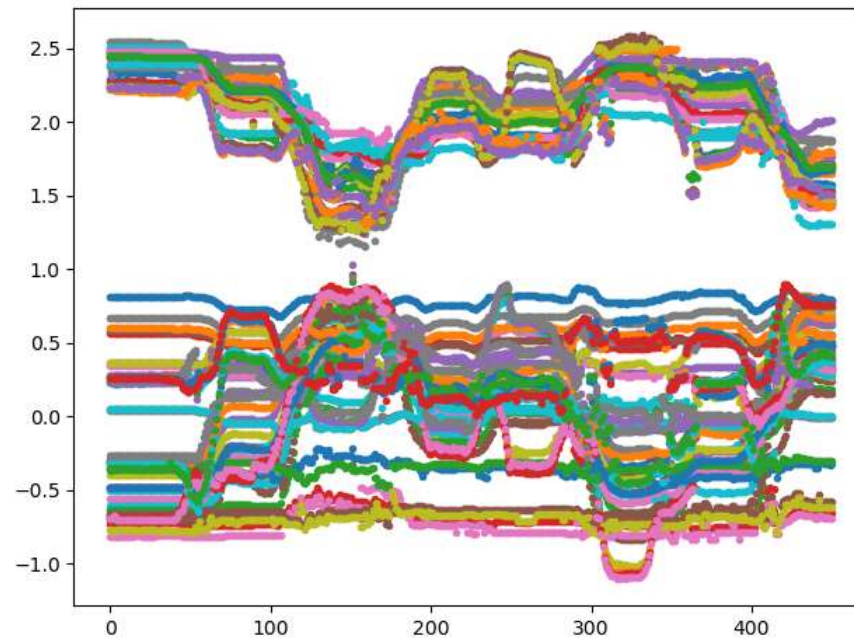
□ Usage:

- Creating dynamic report system for better customizations.

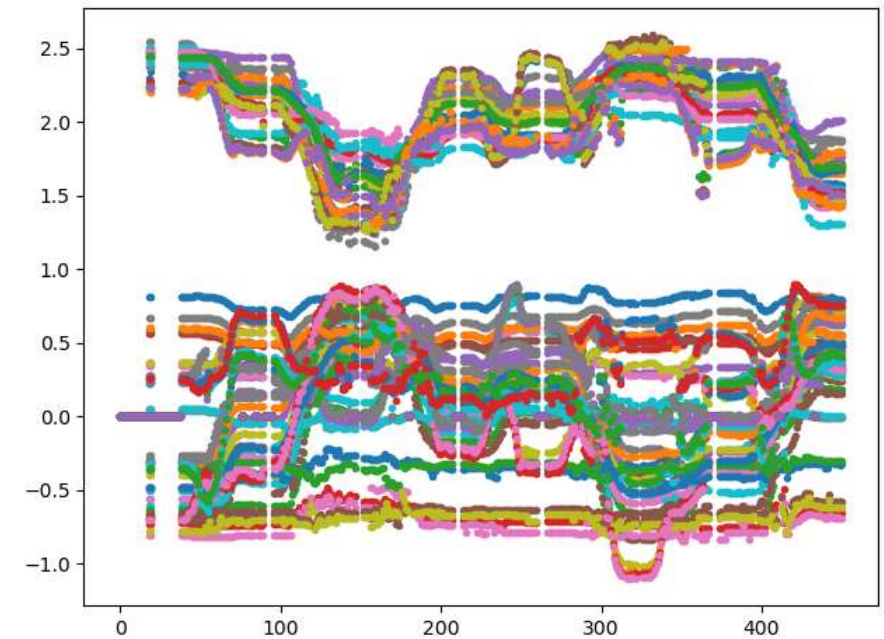


PRE-PROCESSING I/3

- Get Xbox Kinect(s) Readings.
- Data Interpolation.
- Feature Selection.
- Data Segmentation.



Before



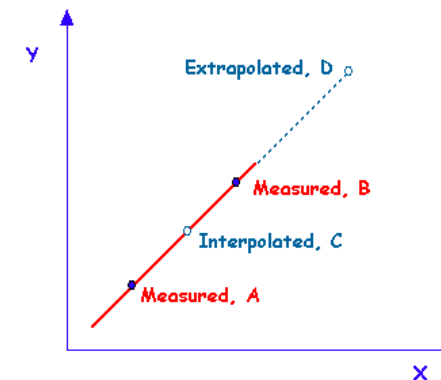
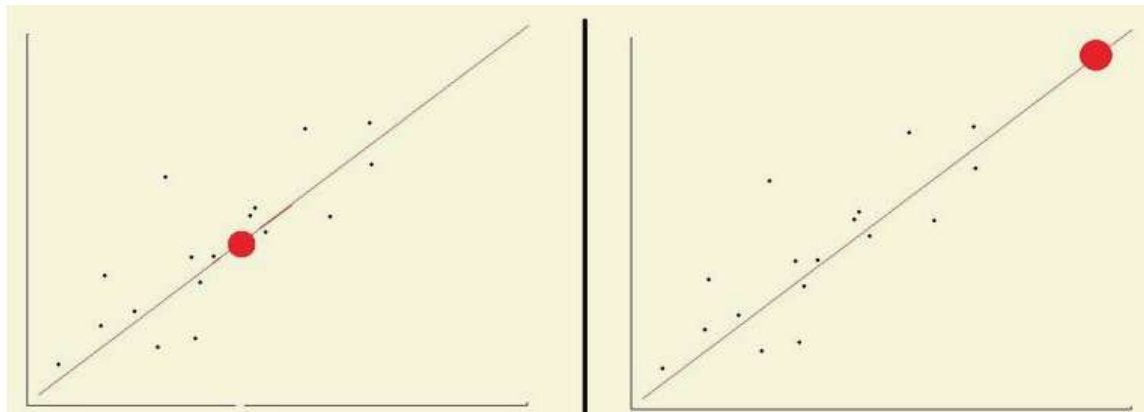
After

PRE-PROCESSING 2/3

INTERPOLATION & EXTRAPOLATION



- ❑ Interpolation is a method of constructing new data points within the range of a discrete set of known data points.
- ❑ Extrapolation is an estimation of a value based on extending a known sequence of values or facts beyond the area that is certainly known.
- ❑ Both are used for predicting the value of a dependent variable.



PRE-PROCESSING 3/3

FEATURE SELECTION & SEGMENTATION



❑ Feature Selection:

- Find the dominant joint in the skeleton.
- This joint will be extracted to be used in segmentation.

❑ Segmentation:

- Calculate the average of each 3 frames and subtract them from the previous 3 (Windowing).
- Calculate the stream threshold using ISO Data algorithm.
- Segment each movement based on the subtraction of the windows and the threshold.

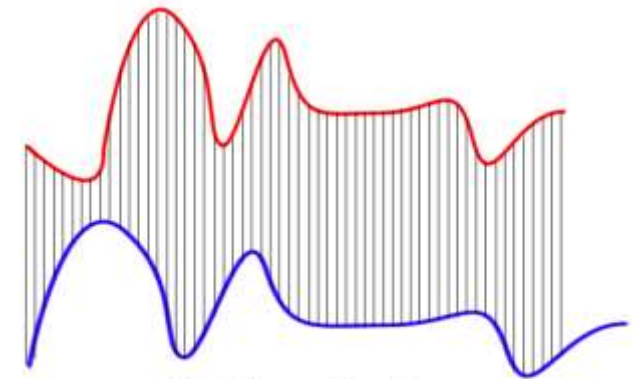
PROCESSING

□ Main used algorithm (F-DTW):

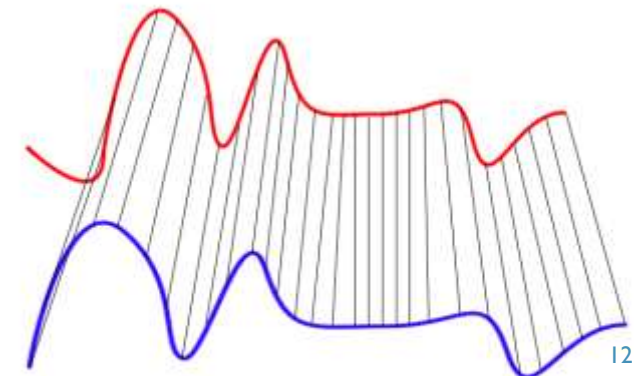
- Is an algorithm for measuring similarities between two signals using Euclidean equation.
- Each signal may have different speed from the other signal.
- Each signal doesn't need to be matched with its mirror.

□ We also tried:

- K-NN (K Nearest Neighbors).
- SVM (Support Vector Machine).
- DT (Decision Tree).
- C-NN (Conventional Neural Network).
- \$P Recognizer.



Euclidean Matching



Dynamic Time Warping Matching

DATA-SET

- ❑ The data-set has been collected from a Karate player from Al Ahly Sporting Club.
- ❑ **The data-set contains the following moves:**
 - 1) Hidari gedan-barai.
 - 2) Migi chudan oi-zuki.
 - 3) Migi gedan-barai.
 - 4) Migi tetsui-uchi.
 - 5) Hidari chudan oi-zuki.
 - 6) Hidari gedan-barai.
 - 7) Migi jodan age-uke.
- ❑ The player made each move and its common mistake 15 times.



EXPERIMENTS

- ❑ Then the system was tested.
- ❑ The player tested the system 16 times.
- ❑ Each test contains the first seven moves of Karate Kata 1 (Hein Shodan).
- ❑ Each test was a combination between the correct moves and the wrong moves.



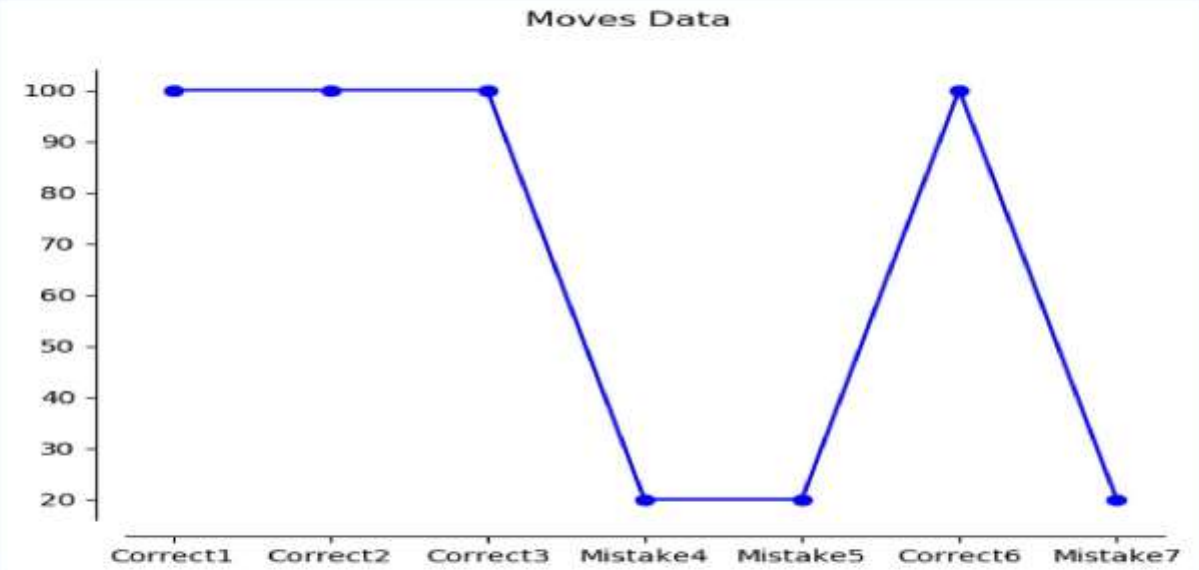
RESULTS



Session 2

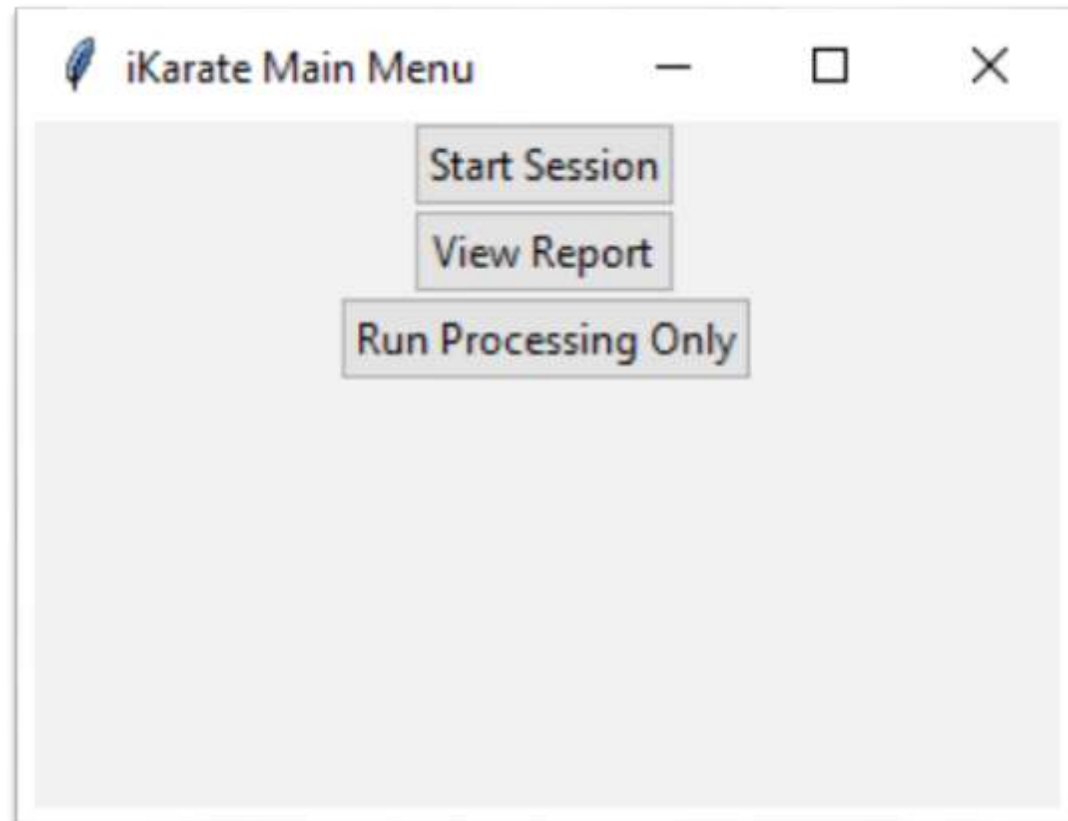
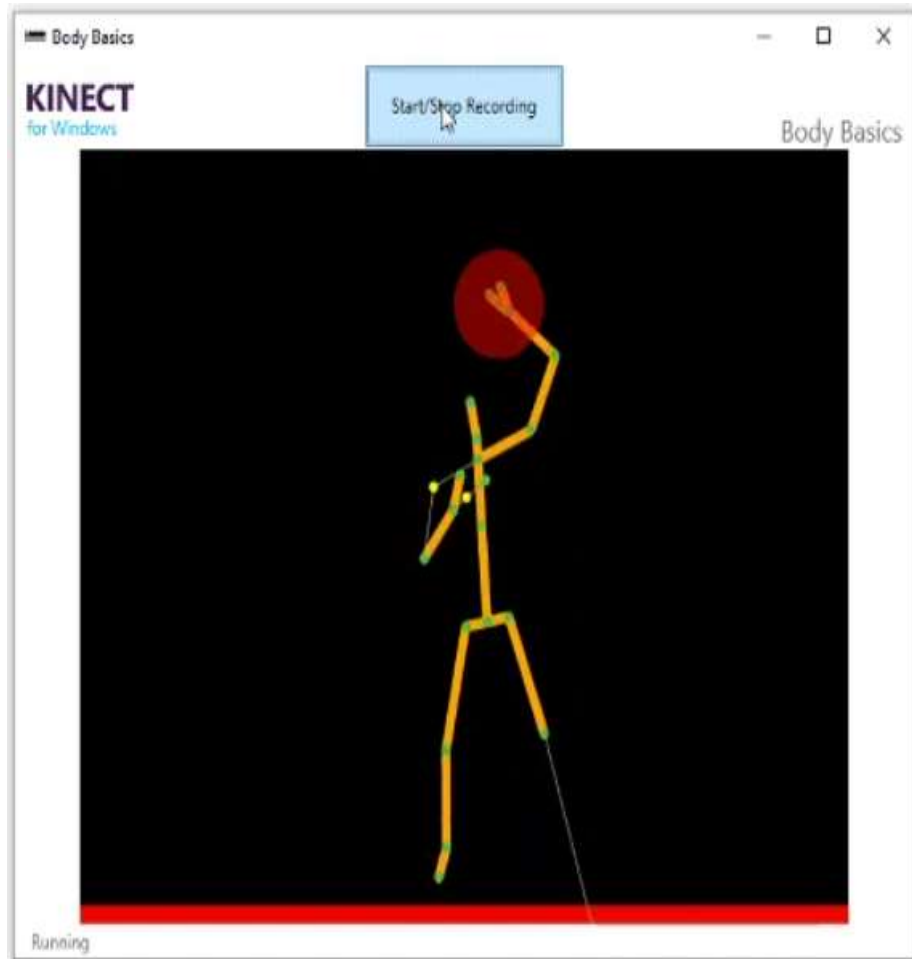
Date: 2020-05-19
 Total moves: 7
 Location: Home
 Duration: 0.23333333333333334
 Total mistakes: 2
 Accuracy: 71 %

- ❑ F-DTW: 83.67%
- ❑ K-NN: 70%
- ❑ SVM: 60.2%
- ❑ DT: 53.06%
- ❑ C-NN: 57.1%
- ❑ \$P Recognizer: 54%



| # | Name | Duration | Mistake | State | Accuracy |
|---|----------|----------|--------------------------|---------|----------|
| 1 | Correct1 | 0.8 | None | Correct | 100 % |
| 2 | Correct2 | 0.8 | None | Correct | 100 % |
| 3 | Correct3 | 0.8 | None | Correct | 100 % |
| 4 | Mistake4 | 0.8 | The mistake will be here | Wrong | 20 % |
| 5 | Mistake5 | 0.8 | The mistake will be here | Wrong | 20 % |
| 6 | Correct6 | 0.8 | None | Correct | 100 % |
| 7 | Mistake7 | 0.8 | The mistake will be here | Wrong | 20 % |

GUI (GRAPHICAL USER INTERFACE)



PAPER I PUBLISHED



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PAPER 2 ACCEPTED



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to Bassel ▾

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Dear Bassel Emad,

We are glad to inform you that your paper:

Paper ID: 48
Paper Title: iKarate: Karate Kata Guidance System And Anomaly Detection
Authors: Bassel Emad

has been accepted as a Full Paper at the 17th International Conference on Mobile Systems and Pervasive Computing.

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of exploration and excavation among the cities of Lycia, especially by Sir Charles Ross, who in 1846 brought back the remarkable statues now in the Lycian Room at the British Museum. The linguistic affinities of the Lycian language are as yet not certainly determined. See Lehmann, *Beiträge zur Erklärung der lykischen Sprache* (1875-78). The few Lycian inscriptions collected in the *Corpus Inscript. Lat.* See Treubner, *Geschichte der Lykier*. See APOLLO.

Lycōris. See LYCIA.
Lycosūra (viii)

RESEARCH PAPER



to have... was allowed the privilege of dining in the Pryneum. This decree, which was proposed by Stocles, has come down to us at the end of the list of the Ten Orators. Lycurgus is said to have published fifteen orations, of which only one has been preserved. This oration, which was delivered in 331, is an accusation of Leocrates (*Karà Λεοκράτη*), as Athenian citizen, for abandoning Athens during the battle of Chaeronea, and settling in the Grecian State. The best editions of Lycurgus are those of Osann (Jena, 1821), Mätzner (1833), and Meier (1847), Rehdantz (1876), and (1880). See also Dürrbach, *L'Orateur* (1890). Another excellent text is that of his *Oratores Attici*. The oration is also found in the collections of Reis

(1) Son of Poseidon and married to Dirce. He assumed the name of his brother Nereus; and, after his death, he was worshipped as Nereus. He was the father of the Nereids. He was also found in the collections of Reis

DELL PHASE TWO ACCEPTED



Envision the Future 2020 - Interim Design Phase Results Inbox x



 **EnvisiontheFuture** <EnvisiontheFuture@emc.com>
to ▾

Sun, Mar 22, 11:17 AM ☆ ↶ ⋮

Dell Customer Communication - Confidential

Dear Team Leader,

The interim report and video submitted by your team have been blindly reviewed by two senior **Dell** Technologies experts from outside the region. On behalf of the 2019/20 **Dell** Envision the Future Graduation Project competition, the Steering Committee is pleased to inform you that your project made it to the top 25 in the entire region. **Congratulations!**

During this last phase of the competition, **Dell** is offering you a unique opportunity to benefit from the expertise of **Dell** Engineers and Scientists through a new Mentorship Program that you have qualified for. The **Dell** Mentors will contact you shortly to get to know you and to agree with you on the most suitable times for your team to have a conference call every other week. During these calls, which will be dedicated exclusively to your team, you will get a chance to discuss your technical ideas and seek general guidance on the various design and implementation alternatives that you may be contemplating. Please note, however, that this free support is intended to complement, not replace, your only official source of advice and direction, which is the interaction with your Professor.

Please look out for an email that you should receive from your **Dell** Mentor within the next few days. Furthermore, please check regularly the competition web site for relevant details and future announcements.

Once again, congratulations on your successful progress towards the final phase of Envisioning the Future. Good Luck!

Best regards,
The Steering Committee

DEMO



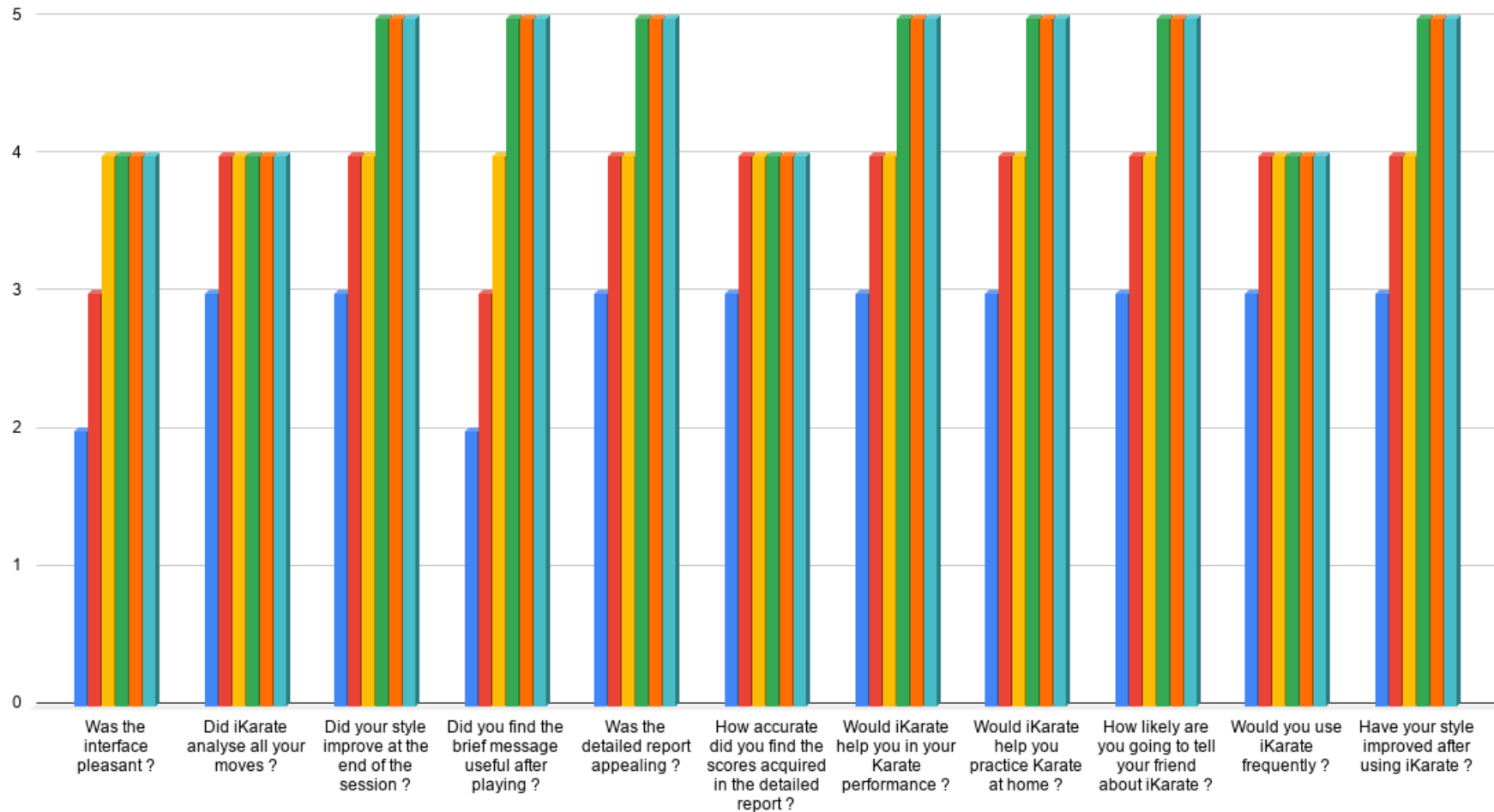
MARKET COLLABORATION



- ❑ This project is in collaboration with Al Ahly Sporting club.
- ❑ They are helping us in collecting the data-set and testing our system.
- ❑ The club is giving us reviews on the system.
- ❑ They intend to buy the system as soon as it's finished.



USABILITY STUDY



Any
questions ?

**THANK
YOU!**