

# Classifying Horizontal Arm Movement by Speed and Direction



Adrian Kim

School of Computer Science & Engineering, Seoul National University  
linkoffate@gmail.com



## Background

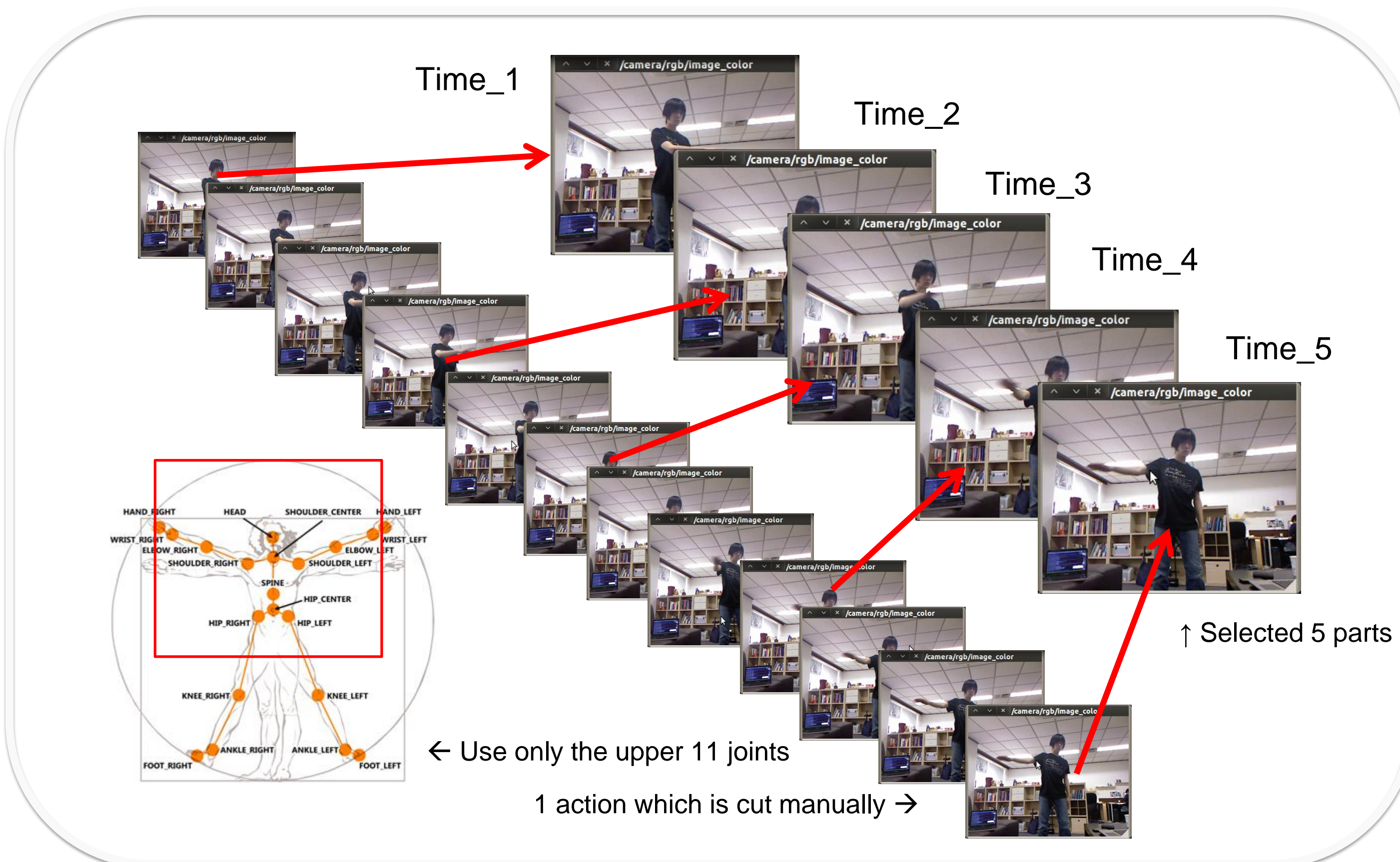
- Movement is a serial of static poses (skeleton data)
- Kinect can extract skeleton data from its camera
- Neural networks can represent more complex functions with more hidden layers
- Neural networks are used to learn from real numbers

## Research Questions

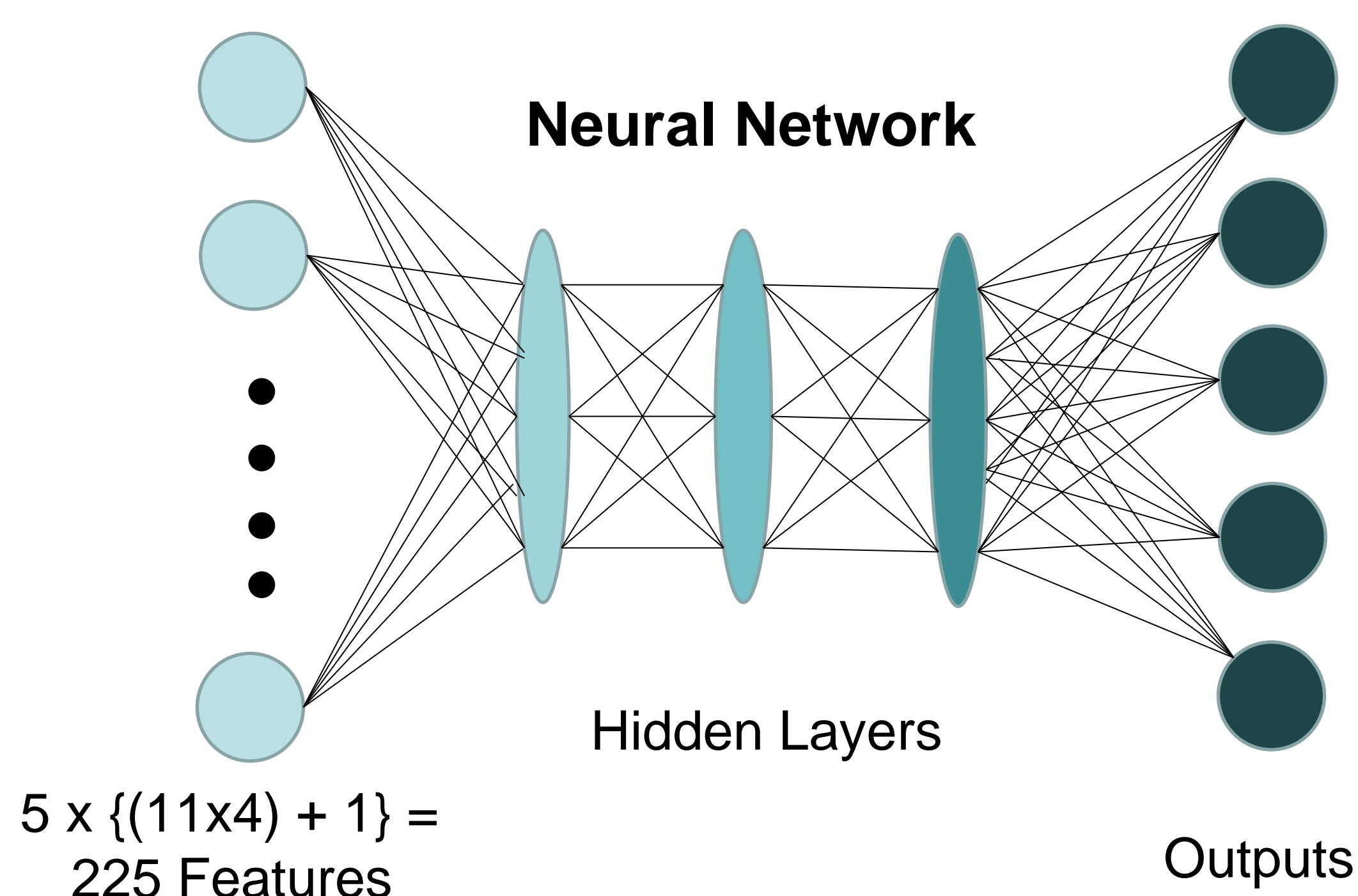
- Can movements be classified in the same way as static poses?
- Can movements be classified by speed and direction?
- How accurate is the classification? Does it classify speed and direction properly?

## Method

- Define movement with 5 frames by dividing into 5 static parts.
- Datasets are made by selecting the parts by hand.
- One part = time + skeleton\_data (parsed by Java code)



Hidden Layer # : 3, 6  
Learning Rate : 0.3  
Momentum : 0.1  
Fold # : 12



## Classification

- Class 1 : Swinging to the right in normal speed
- Class 2 : Swinging to the right in faster speed
- Class 3 : Swinging to the left in normal speed
- Class 4 : Swinging to the left in faster speed
- Class 5 : Not swinging horizontally (Exceptions)
- Data Set 1 : Swinging to the right – 26 movements
- Data Set 2 : Swinging to the left – 33 movements

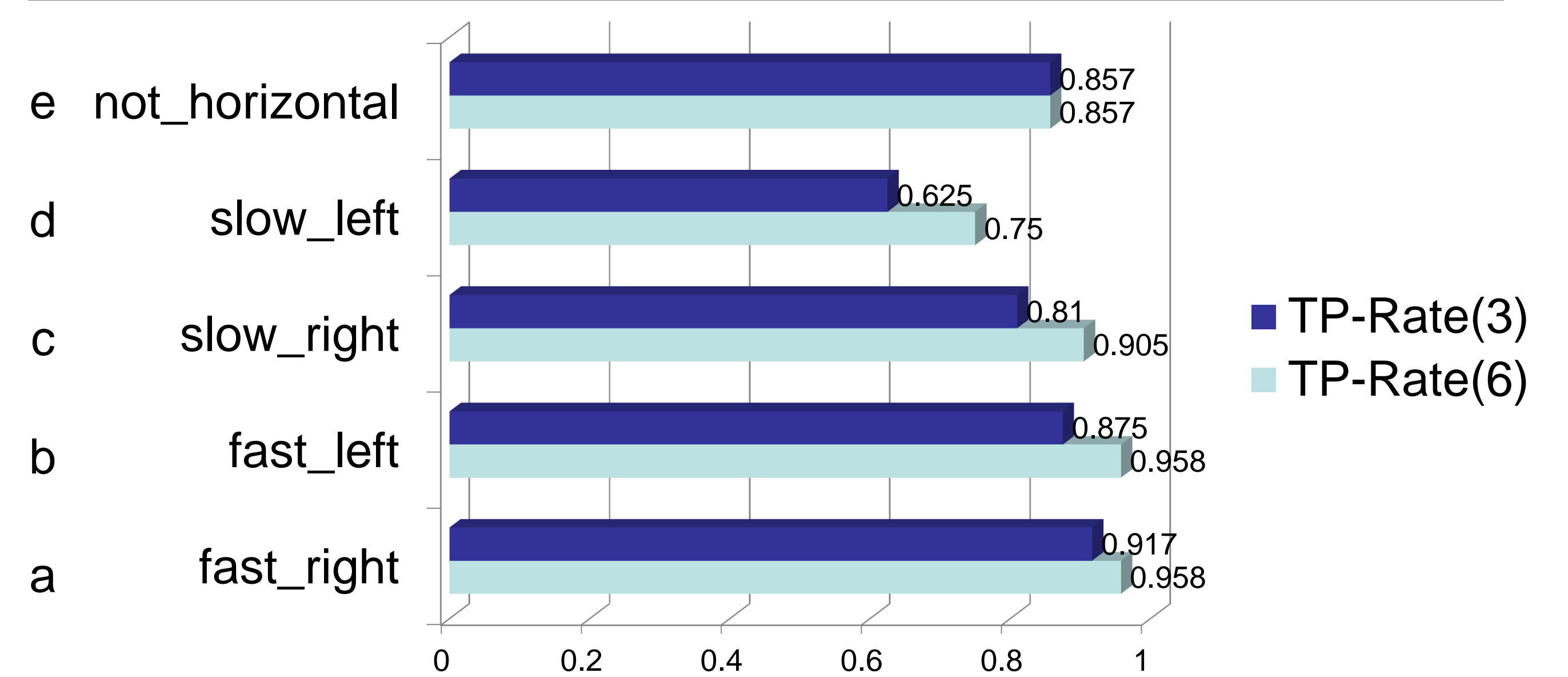


- Exceptions & Extensions

- One movement : 5~12 frames → 1~3 data
- Total data : 91

## Results & Discussion

### + Results



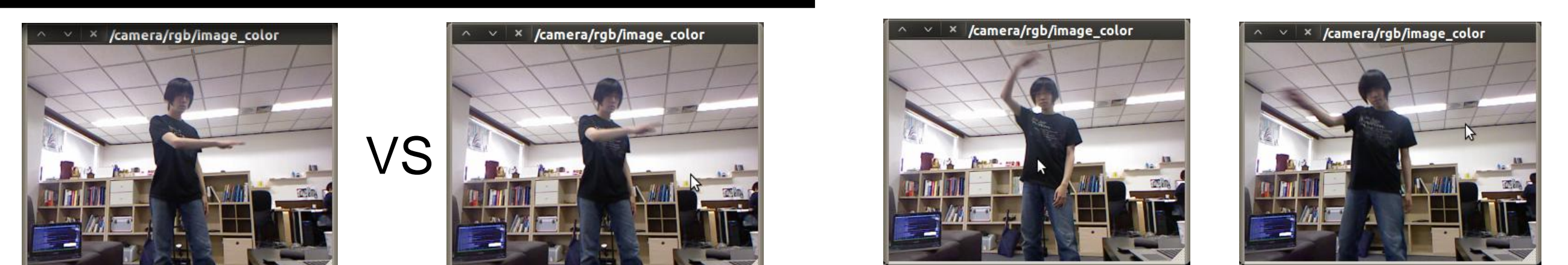
a	b	c	d	e	/
22	0	2	0	0	a
0	21	0	2	1	b
2	0	17	1	1	c
0	3	0	5	0	d
0	1	0	1	12	e

Δ Confusion Matrix(3)

- (a, c) (b, d) are usually confused.
- Anything may be confused to e
- Speed is the main problem in classifying → Training data may be the fault or more training data must be needed.
- Classifying by direction is perfect. There is no confusion to other direction.

### + Discussion

- Scarce data : Training data set was too much a small group for 225 features



The definition of START / END of each motion (in terms of manual cutting) → determines number of frames, sequence defining the motion.

- More Exceptions needed

## Reference

1. AI Project Files