Human Activity Recognition

Team 32

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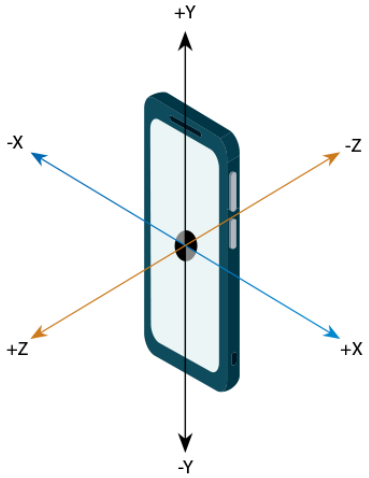
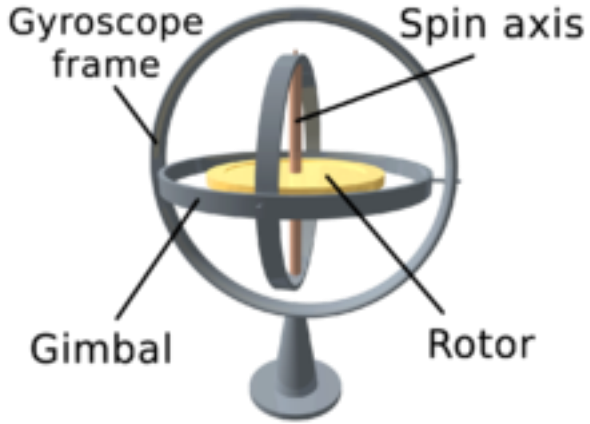
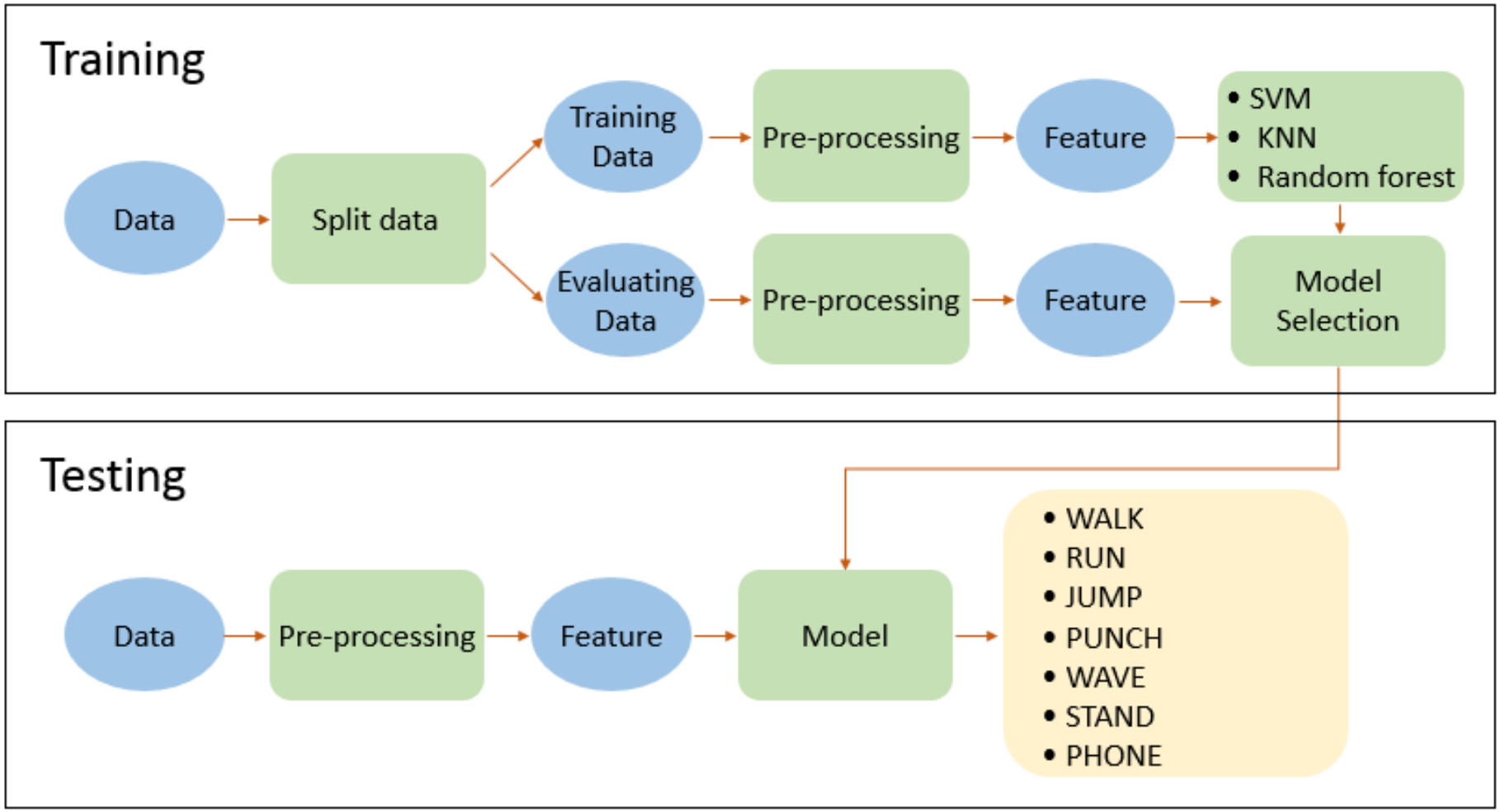
Topic

- Use the sensor (accelerometer and gyroscope) of mobile phone to predict the human activity





How to do this project



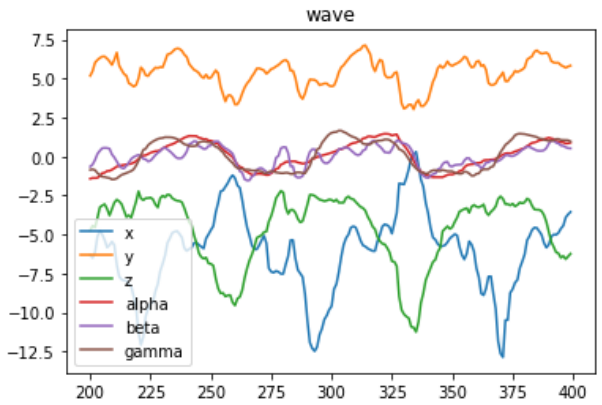
Collect Data

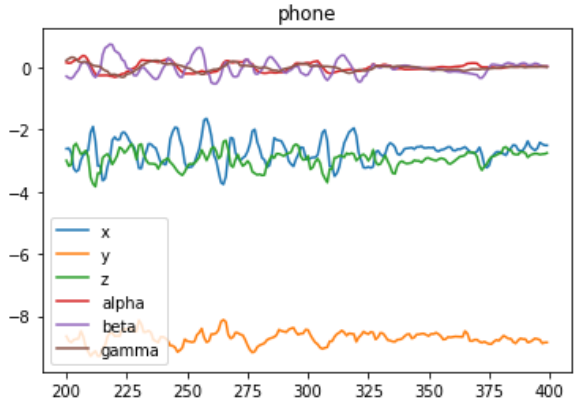
- Accelerometer -> Acceleration
- Gyroscope -> Angular Velocity

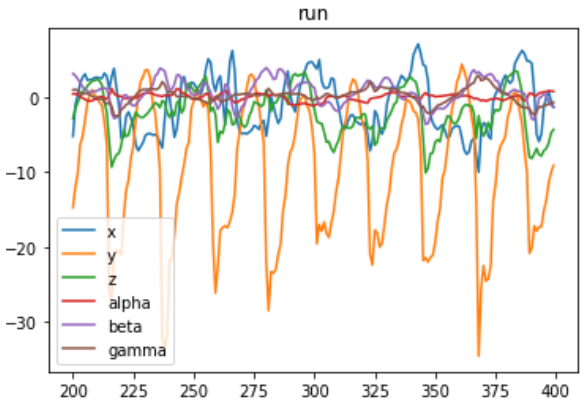
```
window.addEventListener('devicemotion',get_data,false);

function get_data(event){
    var alpha=event.rotationRate.alpha*Math.PI/180;
    var beta=event.rotationRate.beta*Math.PI/180;
    var gamma=event.rotationRate.gamma*Math.PI/180;
    var x=event.accelerationIncludingGravity.x;
    var y=event.accelerationIncludingGravity.y;
    var z=event.accelerationIncludingGravity.z;
}
```

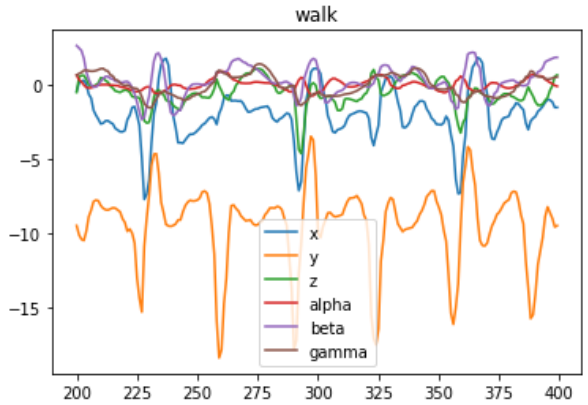
Data

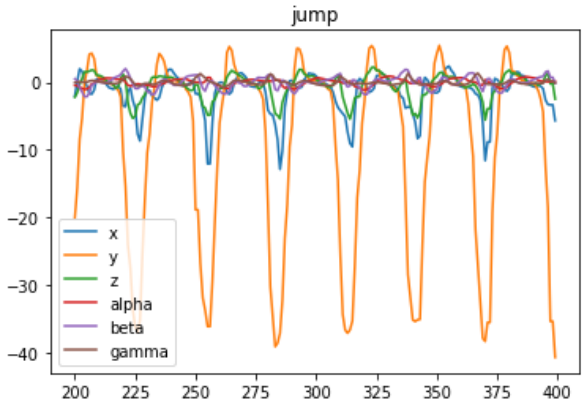
- For each activity

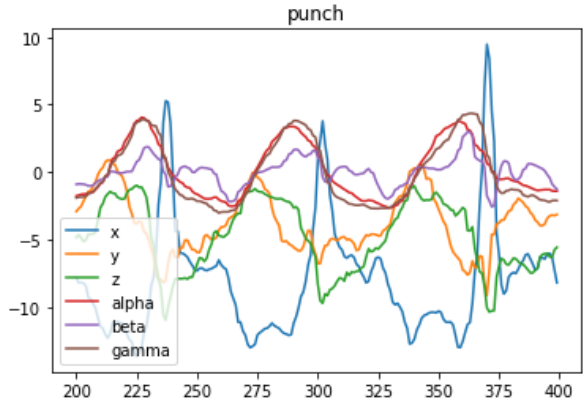


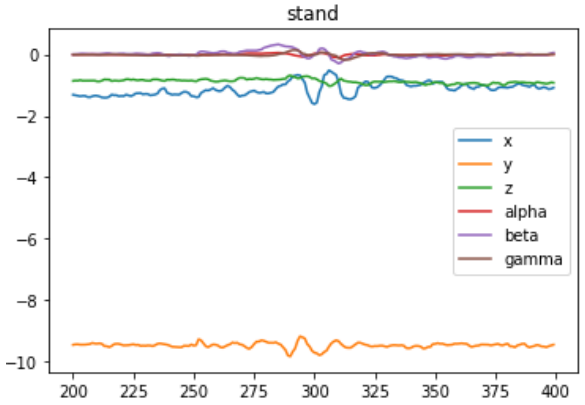






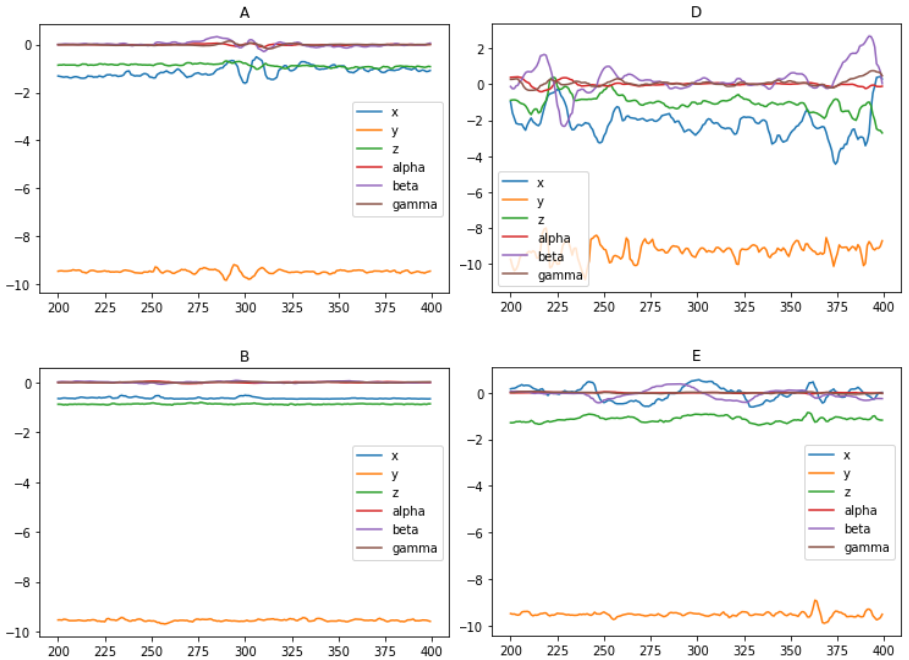




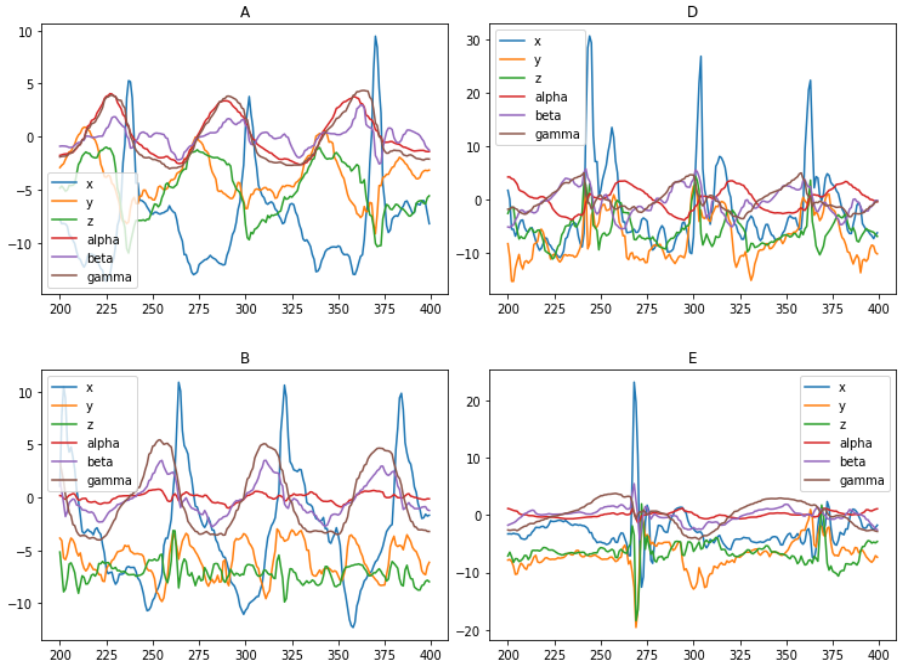


Data

- For each member in ‘stand’
  - Everyone has a little difference



- For each member in ‘punch’
  - Everyone has different frequency

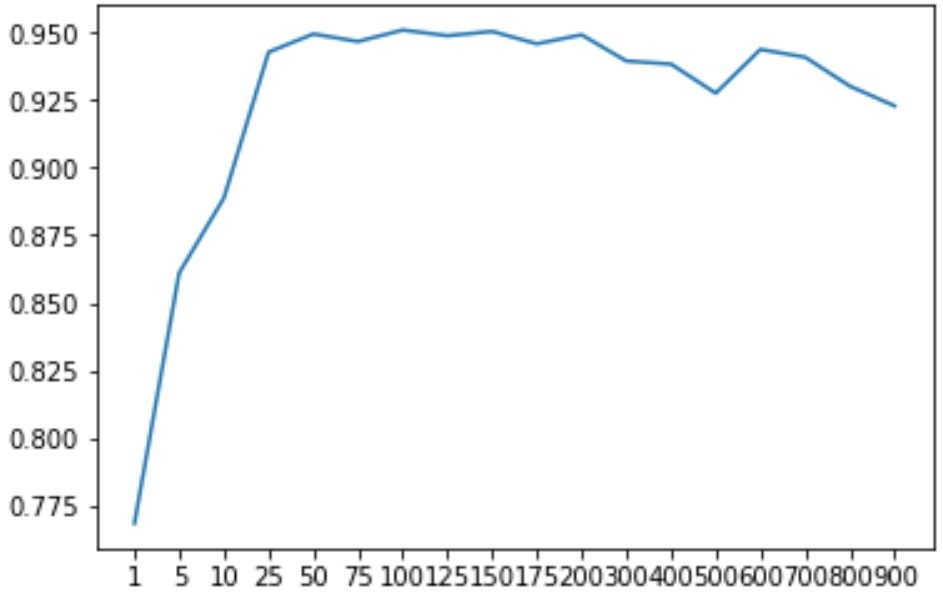


Feature

- Accelerometer and Gyroscope (44*2 = 88 features)
  - Average [3]
  - Standard Deviation [3]
  - Average Absolute Difference [3]
  - Average Resultant [1] $(\sqrt{x_i^2 + y_i^2 + z_i^2})$
  - Binned Distribution [30]
  - Mean of Mean [1]
  - Mean of STD [1]
  - STD of Mean [1]
  - STD of STD [1]

SVM

- Slice data
- Data size = 100 , best

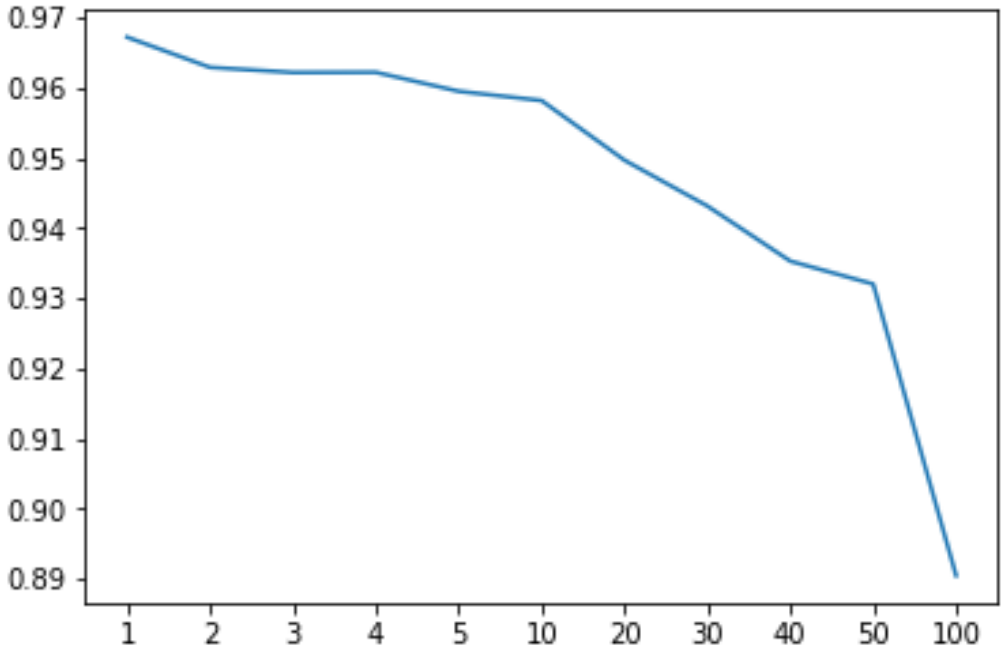


size	accuracy (100 times)
1	0.768309523809523 7
5	0.8610317460317468
10	0.888792517006802
25	0.9427991452991451
50	0.9495177304964545
75	0.9467303609341823
100	0.9509859154929575
125	0.9488732394366194
150	0.9504621848739495
175	0.9458823529411764
200	0.9492222222222219
300	0.9395081967213108
400	0.9383870967741936
500	0.9276000000000001
600	0.9438095238095225
700	0.9409259259259249
800	0.9302040816326523
900	0.922888888888876

KNN

- When Data size = 100

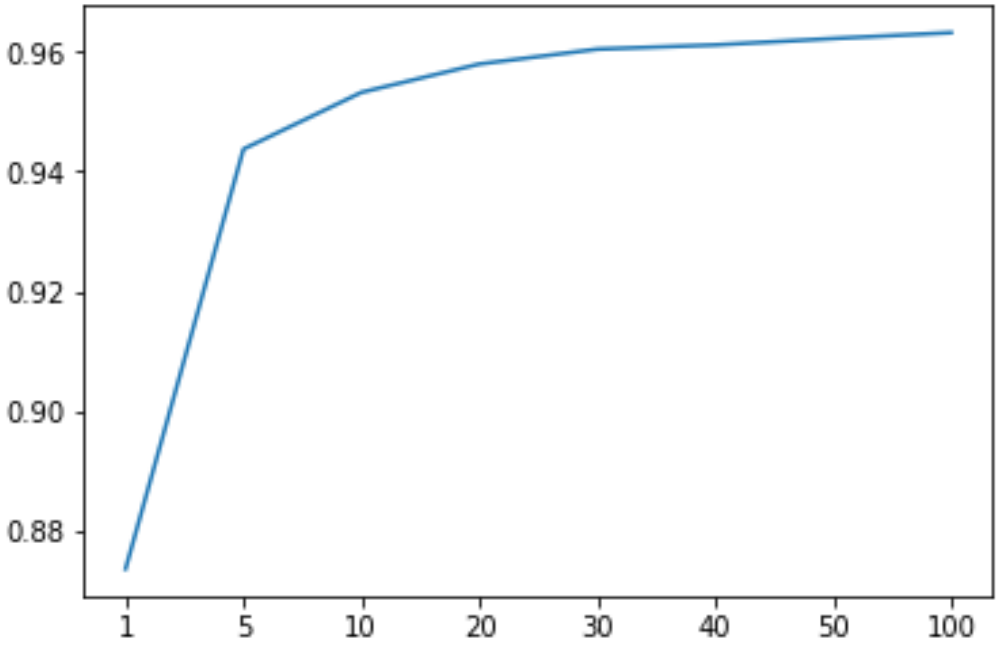
neighbor	accuracy (100 times)
1	0.967211267605633
2	0.962901408450703
3	0.962169014084506
4	0.962197183098590
5	0.959492957746477
10	0.958169014084506
20	0.949661971830985
30	0.94312676056338
40	0.935267605633803
50	0.932000000000000
100	0.890422535211266



Random forest

- When Data size = 100

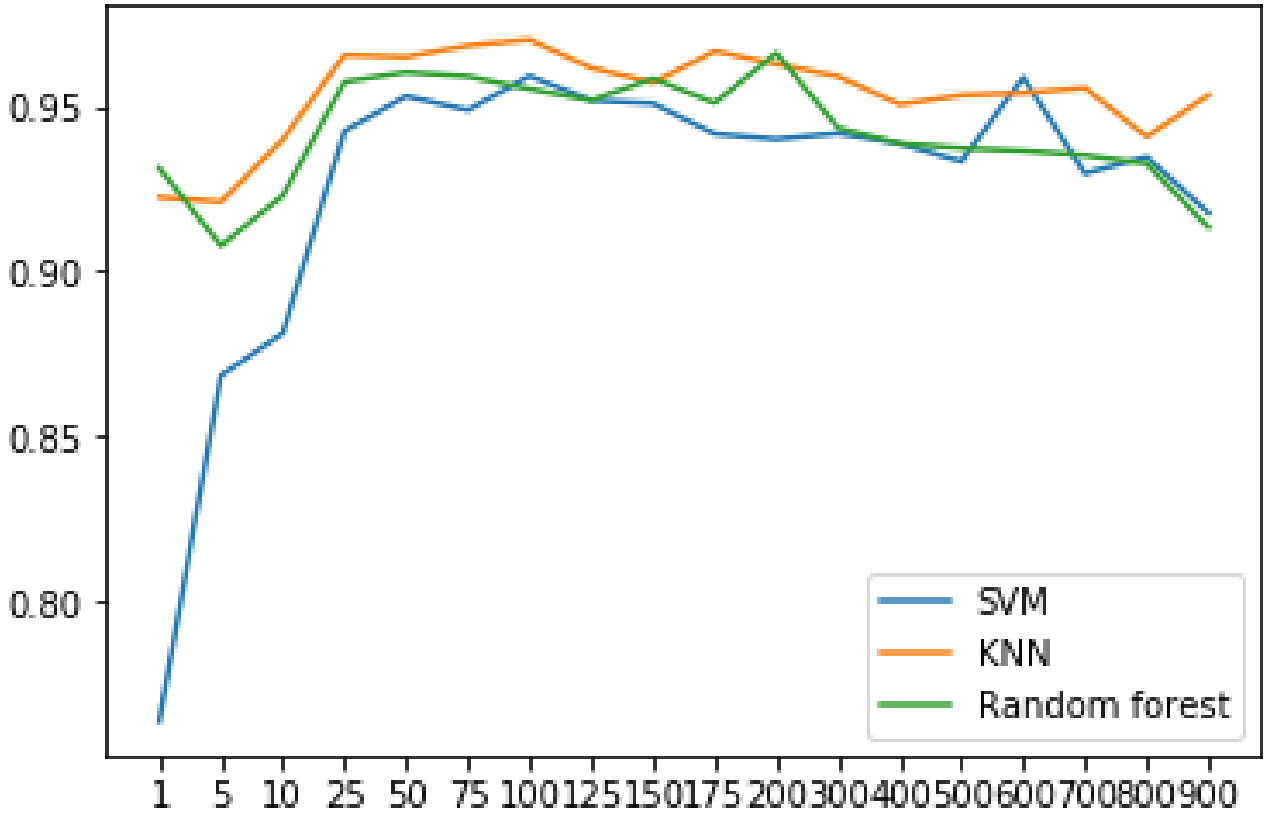
tree	accuracy (100 times)
1	0.8736619718309855
5	0.943746478873 24
10	0.9532112676056345
20	0.9579436619718302
30	0.9604225352112663
40	0.9611267605633792
50	0.9621971830985904
100	0.9631830985915478



Compare

- For different data size
  - SVM
  - KNN (n_neighbors = 1)
  - Random forest (tree_num =100)

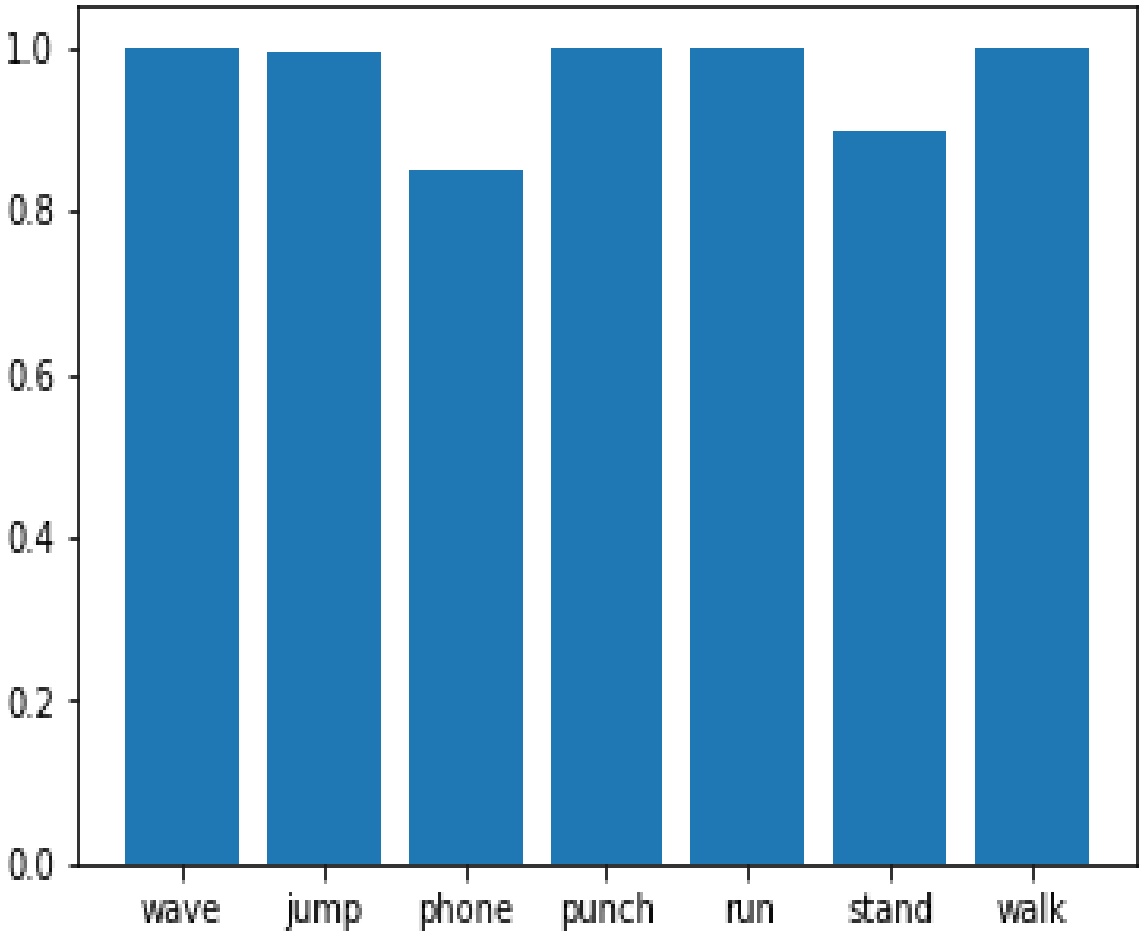
- KNN > Random forest > SVM



Result

- For each activity
  - Jump : only 1 for ‘stand’
  - Phone : many for ‘stand’
  - Stand : many for ‘phone’

```
wave      1.0
jump      0.9938650306748467
phone     0.8497109826589595
punch     1.0
run       1.0
stand     0.8953488372093024
walk      1.0
```



Conclusion

- Action that are too close will result in lower accuracy
  - Like ‘stand’ and ‘phone’
- Periodic action vary from person to person
  - ‘punch’, ‘wave’, ’jump’
- May cause erroneous predictions when exchanging action
- Can collect more data of other activity to predict more human activity

Group contribution table

- 20% - 0416009 洪冠群
  - SVM
- 20% - 0416090 王洧晟
  - Collect data, Server
- 20% - 0416091 林彥岑
  - Preprocessing, Feature generation
- 20% - 0416098 王于哲
  - KNN
- 20% - 0513406 陳凱文
  - Random forest

Demo