

Automatic Recognition of Fitness Motions

Jeff Lin





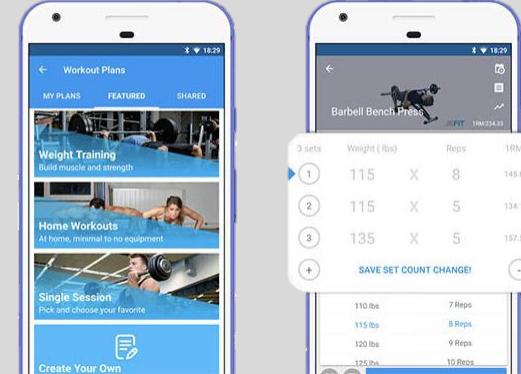
Current Fitness Trackers

- Apple Watch Workout app:
tracking for Running Indoor or Outdoor, Elliptical, Cycling, and other activities manually

- Other Fitness or Workout Apps: Planners or Manual trackers



- Propose an AUTOMATIC RECOGNITION OF FITNESS ACTIVITIES and tracker



Pictures searched from Google Images

Fitness and Health Apps with Wearables

Market Analysis

~ 31 million Apple Watch units were sold worldwide in the year 2019 according to CNET

~ Estimated to reach 134 million units of smart wearable devices (Fitbit, Galaxy Active, Wear OS by Google) in 2020 according to MarketWatch.

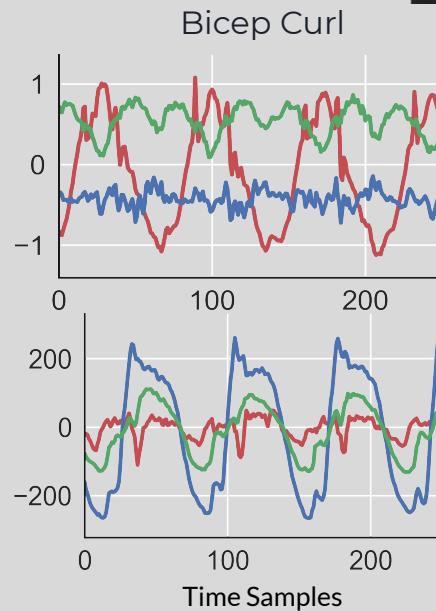
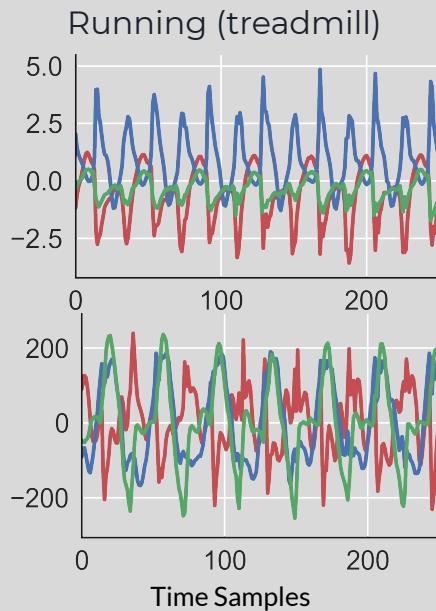
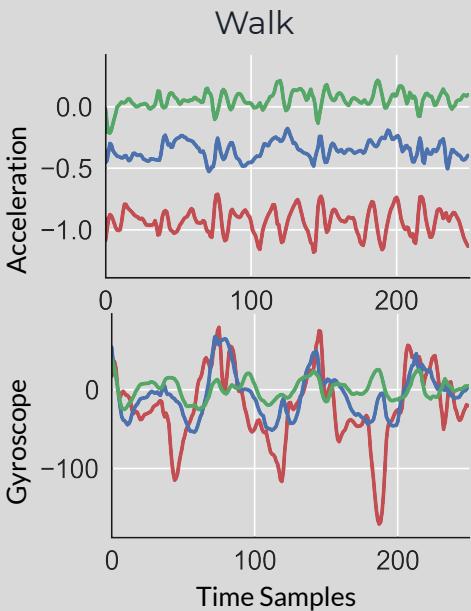
~ Fitness and health mobile apps are also on the rise with growth rate of 23% (MarketResearchFuture)



Motion of Fitness Activities

- ❑ RecoFit (Microsoft Research)
- ❑ from 96 subjects
- ❑ 68 activities
 - Body Exercises (Squat, Jumping Jacks)
 - Cardio Exercises (Running on treadmill, elliptical machine)
 - Weight Exercises (Bicep Curl, Tricep Exten.)
 - Resting or Device not worn
- ❑ Total of 1572 recordings of activities
 - From 20 secs to over 2 mins

Motion: Accelerometer & Gyroscope



Motions AI

Automatic Recognition of Fitness Motions

- Avg. accuracy of **90%** for 68 activities types (F-score also 90%) evaluated on 25271 samples of 5 seconds of motion
- Some activities have lower F-score (11 activities)
 - Location of the sensor
 - Low number samples for certain activities
- Currently, can help health conscientious people keep track of activity automatically.



Thank you!

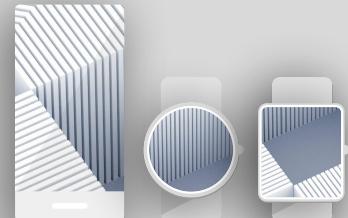
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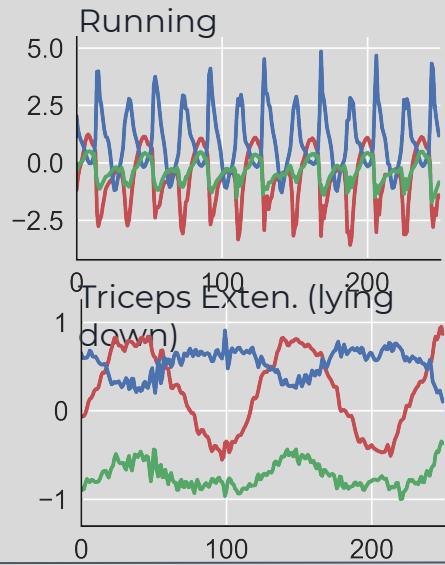
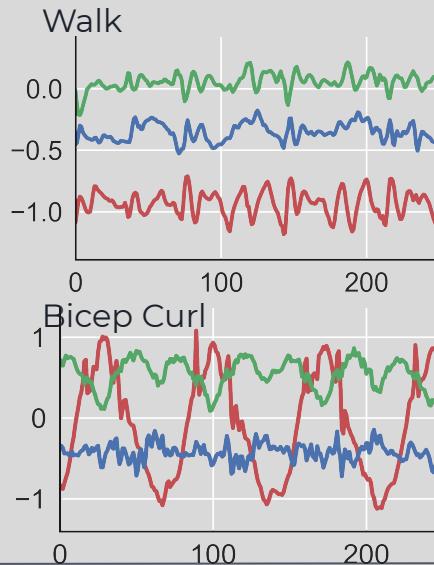
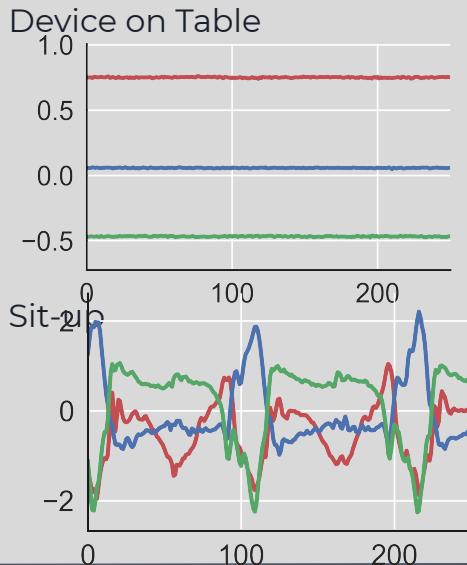
github.com/jleifnf



linkedin.com/in/lin-jeff-t

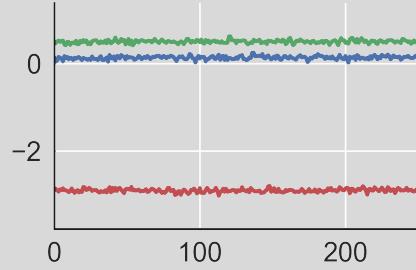


Motion: Accelerometer

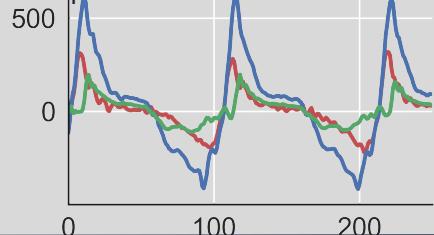


Motion: Gyroscope

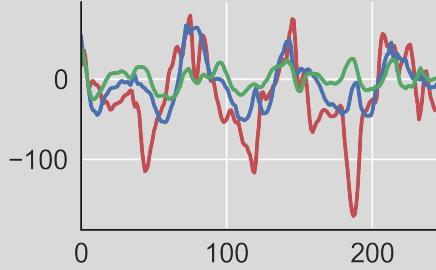
Device on Table



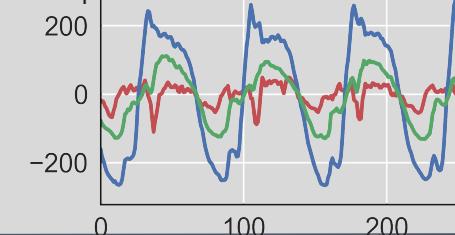
Sit-up



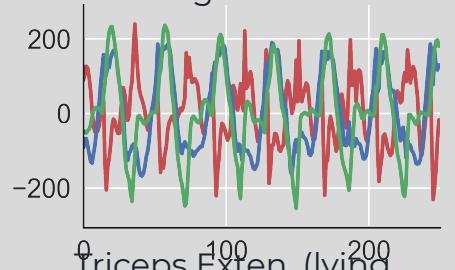
Walk



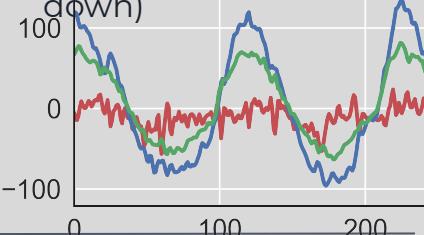
Bicep Curl



Running



Triceps Exten. (lying down)



Classification Report

Exercises	n	Precision	Recall	F1-score
Dumbbell Row (knee on bench) (both arms)	382	66%	69%	68%
Dumbbell Row (knee on bench) (left arm)	59	71%	49%	58%
Dumbbell Row (knee on bench) (right arm)	64	95%	88%	91%
Dumbbell Squat (hands at side)	343	92%	89%	90%
Jump Rope	74	91%	84%	87%
Lawnmower (label spans both arms)	25	95%	80%	87%
Lawnmower (left arm)	134	76%	96%	84%
Lawnmower (right arm)	149	94%	91%	93%
Lunge (alternating both legs, weight optional)	480	91%	70%	79%
Overhead Triceps Exten.	293	96%	99%	98%
Overhead Triceps Exten. (label spans both arms)	26	61%	88%	72%
Power Boat pose	196	83%	91%	87%
Pushup (knee or foot variation)	196	86%	93%	89%
Pushups	118	91%	83%	87%

Classification Report

Exercises	n	Precision	Recall	F1-score
Repetitive Stretching	193	56%	52%	54%
Rest	383	72%	56%	63%
Side Plank Right side	194	97%	87%	92%
Squat (arms in front of body, parallel to ground)	416	89%	94%	91%
Static stretch	1764	67%	75%	71%
Static Stretch (at your own pace)	1178	70%	66%	68%
Triceps Exten. (lying down)	184	97%	92%	95%
Triceps Exten. (lying down) (left arm)	5	100%	100%	100%
Triceps Exten. (lying down) (right arm)	4	100%	25%	40%
Triceps Kickback (knee on bench) (both arms)	400	65%	70%	67%
Triceps Kickback (knee on bench) (left arm)	58	85%	29%	44%
Triceps Kickback (knee on bench) (right arm)	64	86%	84%	85%
Two-arm Dumbbell Curl (no alternating)	350	95%	89%	92%
Walking lunge	366	75%	100%	85%