

# Sleep & Awake Classification Using Consumer Grade ENMO data

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# Importance of study

Negative health impacts related to poor sleep

Clinical monitoring tech is expensive

Consumer wearables are popular

# The Dataset

QUT dataset

14 participants

27 nights of data

Data

- Timestamp
- Clinical Activity Count
- Clinical Classification
- Consumer ENMO Count

# Approach



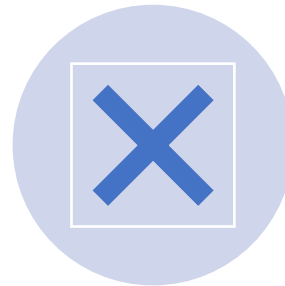
Reproduce the activity count to use the clinical grade classification algorithm.



Using Linear Regression



Initial thresholds for post classification from 20 – 40



Handled pre and post uninterrupted sleep

# Results: Ordinary least squares

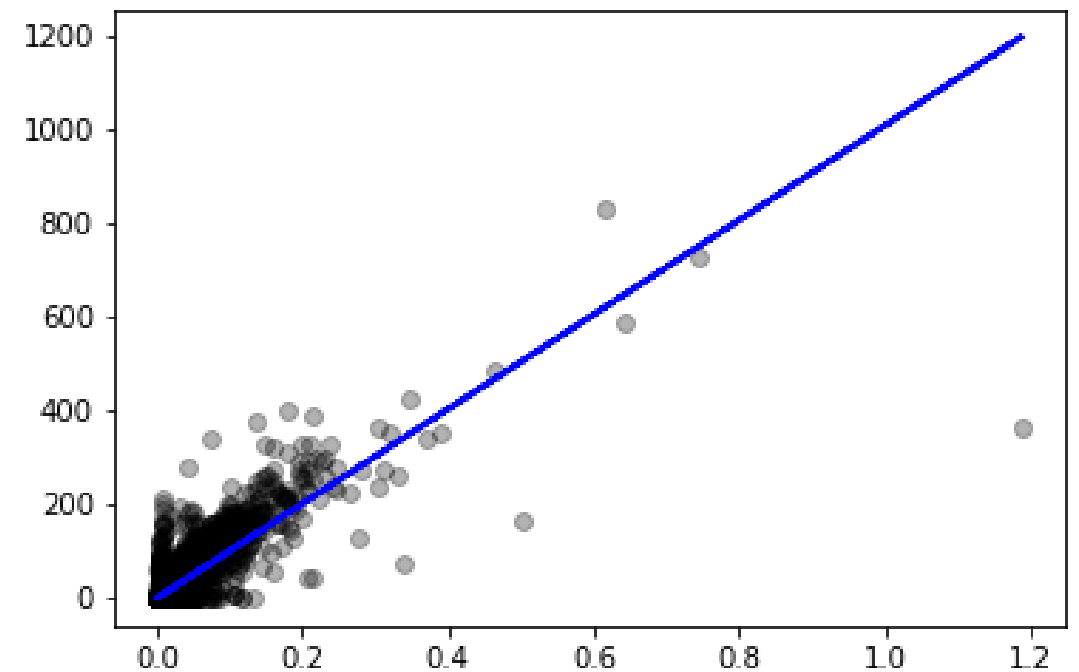
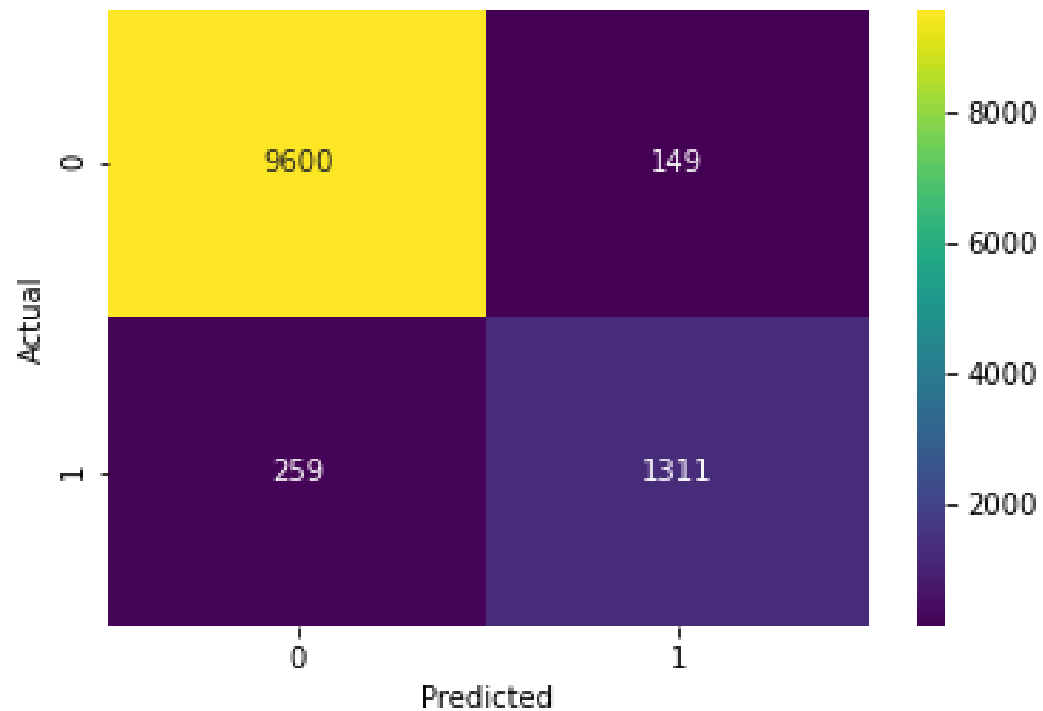
```
=====
Model:                OLS                Adj. R-squared:    0.719
Dependent Variable: Actiwatch activity counts AIC:          281449.3880
Date:                2020-10-13 17:15      BIC:          281466.4570
No. Observations:    37590                Log-Likelihood:   -1.4072e+05
Df Model:            1                    F-statistic:     9.624e+04
Df Residuals:        37588                Prob (F-statistic): 0.00
R-squared:           0.719                Scale:         104.52
=====
```

```
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                Coef.    Std.Err.    t      P>|t|    [0.025    0.975]
-----
const          -2.3034    0.0554   -41.5749  0.0000    -2.4120    -2.1948
Apple Watch ENMO 1009.2220    3.2532   310.2273  0.0000   1002.8457  1015.5983
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```

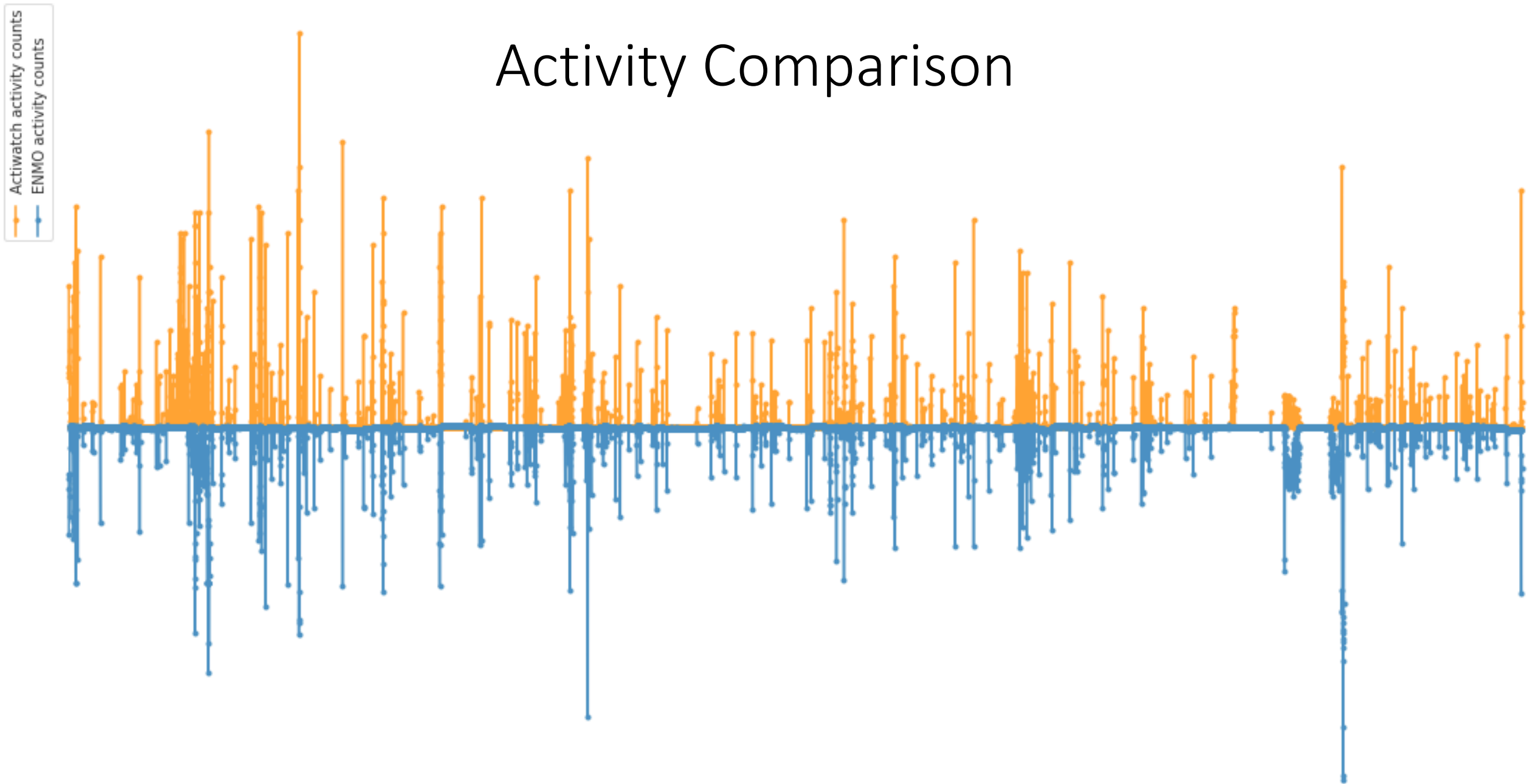
```
Omnibus:          64396.197                Durbin-Watson:      1.899
Prob(Omnibus):    0.000                    Jarque-Bera (JB):   2762056226.612
Skew:            -10.477                    Prob(JB):          0.000
Kurtosis:         1330.797                  Condition No.:      62
=====
```

# Model

# Confusion Matrix and Regression Fit



# Activity Comparison



# Findings



Accuracy 96%



Recall 83%



Specificity 98%



Precision 89%



F1 Score 86%

More modelling required



# Limitations



Not Generalised



Less Accuracy in  
capturing inter-night  
waking



Built off Actiware  
results not ground  
truth

# Future Work



Classification of Abnormal  
Sleeping Data



Additional Comparative  
Analysis on higher order  
sleeping classification  
equipment

# Questions