



A Classification Algorithm Detecting Major Depressive Disorders in Wrist Actigraphy Data

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Presentation Outline

- Research Motivation
- Discuss data source and relevant background
- Describe constructed features
- Present Model Performance

Motivation for Algorithm Development

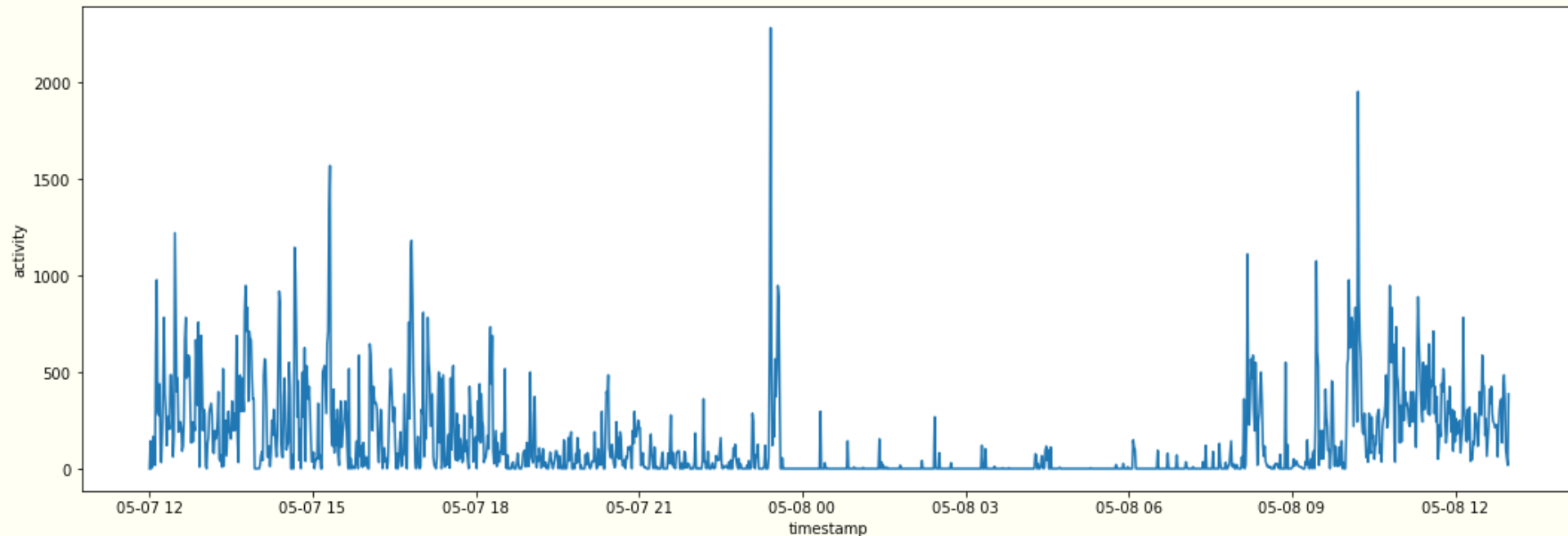
- From the National Institute of Mental Health (NIMH), over 20% of US Adults have mental illnesses meeting clinical diagnostic criteria
- Of the 20%, more than half did not receive Mental Health Services
- Wearable sensors rise in popularity; People have phones!
- Proof of concept: Additional health recommendations and alerts to broadly benefit the health of society through quantitative validation and early detection of illness

A Brief Literature Review

- Altered, usually reduced, motor activity is an integral component of clinical diagnoses of depressive states
- Circadian rhythms are often disrupted in those afflicted
- Actigraphy is a non-invasive method of collecting long term data from which information on activity levels and sleep quality can be derived

Actigraphy Data

- Data was sourced from the Depresjon Dataset, originally collected for a study on the motor activity of schizophrenic and majorly depressed subjects
- 23 Unipolar or Bipolar patients and 32 healthy controls wore a wrist actigraph on their right wrist constantly for anywhere between 13 and 35 days
- Activity is recorded as a sum of movements greater than 0.05g over every minute

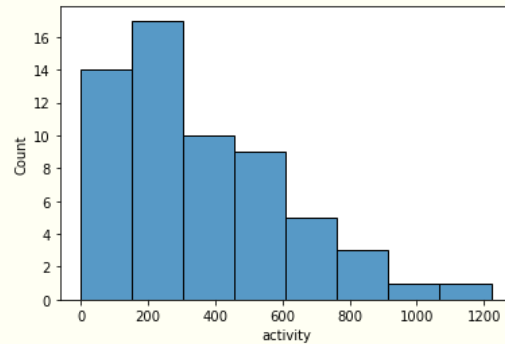


Constructed Features Based on Domain Knowledge

Time Domain

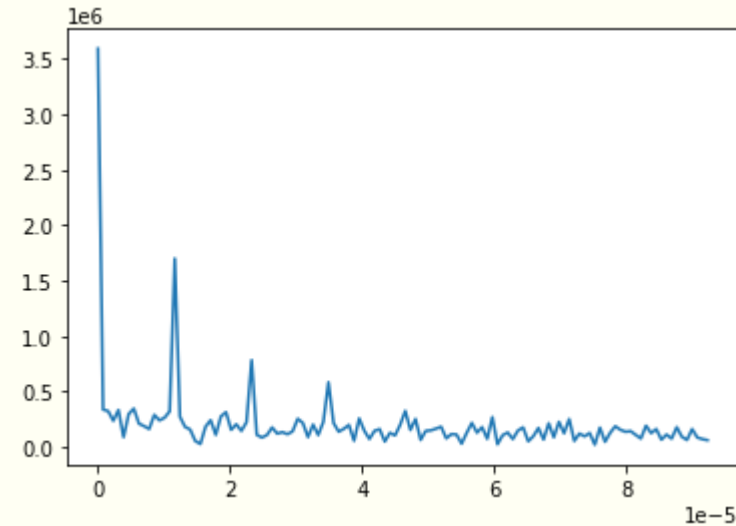
Statistics generated from half-hour lapses in the subject's actigraphy time series:

- Total
- Maximum
- Median
- Average
- Standard Deviation
- Variance



Frequency Domain

- The strength and period in hours of a subjects three strongest circadian cycles determined by DFT analysis

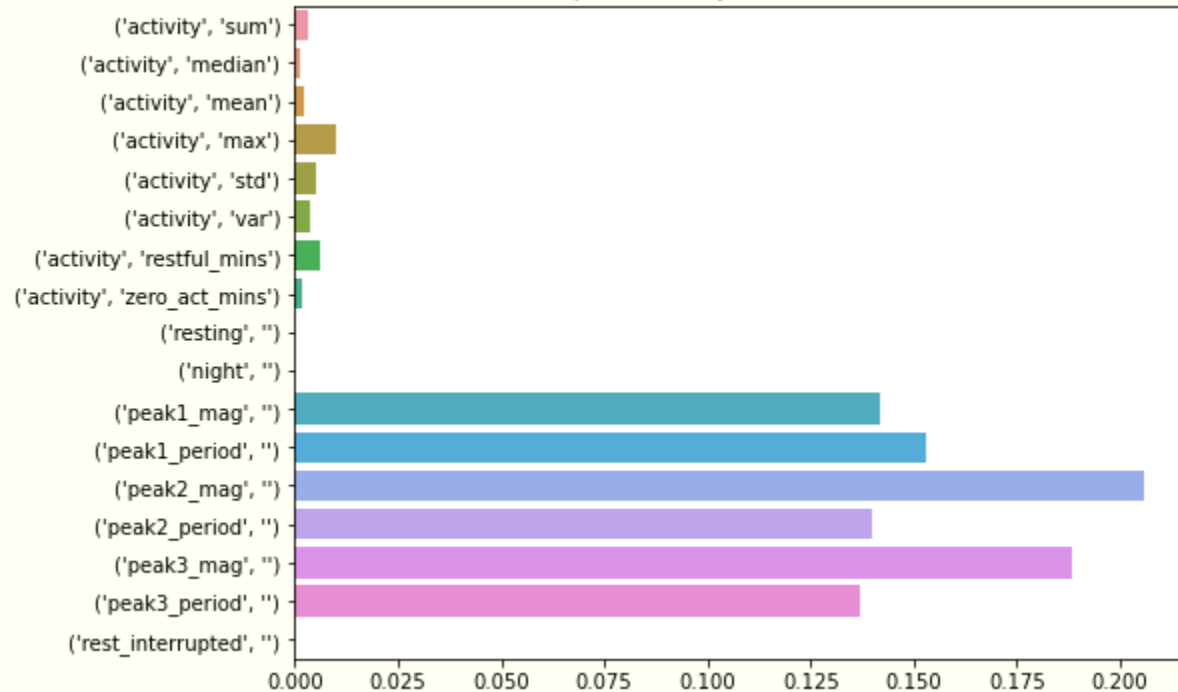


In addition to the statistical measures, features were generated identifying blocks occurring during traditional nighttime (9pm-7am), whether or not the patient was likely asleep or interrupted sleep, the number of restful minutes, and the number of minutes of zero activity

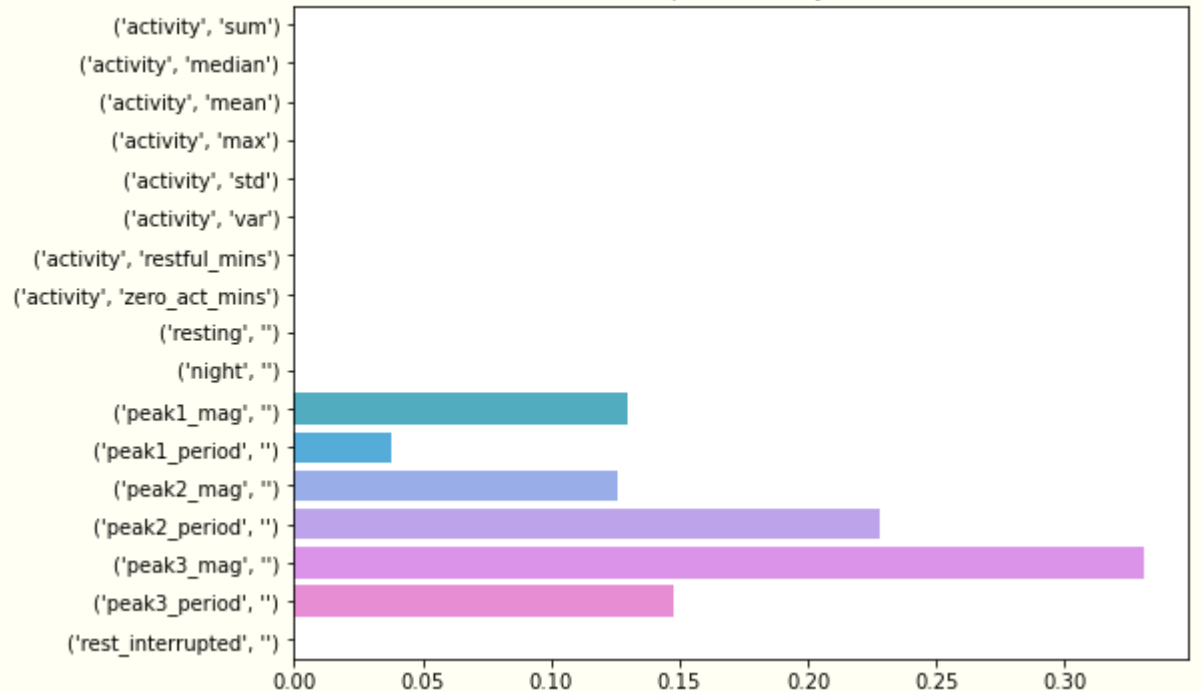
Model Performance

- Standard XGBoost and Random Forest classifiers achieved 100% accuracy in classifying half hour lapses as belonging to healthy or afflicted individuals

Feature Importances by Random Forest Classifier



Feature Importances by XGBoost



Summary

- Two classification algorithms were trained and were able to correctly classify with 100% accuracy actigraphy data sourced from healthy subjects and patients affected by Major Depressive Disorders
- The major factors in classification are presence and strength of circadian rhythms
- In the future, investigate other features and algorithms for improving efficacy of classifier without frequency analysis

Thank You!

- Questions?

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