# Articles using Depresjon dataset

* This is a quick summary of each article – I may have missed points, so please refer to the original if necessary.
* Some potential avenues to explore (after we have got out bae modelling done):
  + Hybrid models (statistical features + deep learning), e.g. extracting features with deep learning and then using a traditional model
  + Ensemble models
  + Feature engineering (other features, different combinations, fewer features)
  + Improving performance on deep learning models (CNN, RNN)
  + Non-binary classifiers:
    - level of depression (mild, severe, etc.)
    - type of depression (uni, bi I, bi II, none)
  + Regression models – MADRS score
  + Focus on circadian rhythms, sleep, nocturnal activity, etc. and correlate to depression
  + Feature importance, reduction
* Formulated as research questions:
  + How do models using different portions of a 24H day compare in performance – e.g. 24H v 12H AM v 12H PM v 8H slices
  + Can we improve on level of depression classification or regression models?
  + How many days worth of activity is needed to make a reasonable classification?
  + What frequency of activity level data is needed to make a reasonable classification? What is the cost of resampling or downsampling (e.g. to first reading every hour)?
* Most suggestions for ‘future’ work is to get more data, apply it in clinical settings, etc. – i.e. not things we (or they) are in a position to perform.

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| Article | Author | Features | Models | Outcomes | Future | My Notes |
| Identifying digital biomarkers in actigraph based sequential motor activity data for assessment of depression: a model evaluating SVM in LSTM extracted feature space | (Arora, Chakraborty and Bhatia, 2023) | High level activity from LSTM  Statistical features  24 hour | LSTM (feature extraction) + SVM | Accuracy: 95.57%  Compared hybrid LSTM-SVM against CNN and LSTM models and better than base deep learning | Transfer learning models | Hybrid model |
| Actigraphic registration of motor activity reveals a more structured behavioural pattern in schizophrenia than in major depression | (Berle *et al.*, 2010) | Interdaily stability Intradaily variability Relative amplitude  (time series) | N/A | Statistically significant differences between groups (also schizophrenia and depression) |  | Night, sleep, circadian rhythms, time series  Statistical analysis of dataset |
| Two-Dimensional Convolutional Neural Network for Depression Episodes Detection in Real Time Using Motor Activity Time Series of Depresjon Dataset | (Espino-Salinas *et al.*, 2022) | Generate data Balance classes  Normalise data  Must be 1week full days | Classification:  2D CNN  DNN  Regression:  CNN | Simple CNN:  Accuracy 76.72%  F1: 72.72%  Sensitivity: 0.75  Specificity: 0.77  ROC/AUC: 0.75/0.77  F1: 0.72 |  | Real-time depression detection is their contribution |
| One-Dimensional Convolutional Neural Networks on Motor Activity Measurements in Detection of Depression | (Frogner *et al.*, 2019) |  | 1D CNN  Ex1: classification  Ex2: classification depression levels (madrs) Ex3: madrs score prediction | Classification:  Mod1:  Accuracy 0.71  Precision: 0.71  Sensitivity: 0.60  Specificity: 0.70  F1: 0.70  Mod2: (3way class)  Accuracy 0.72  Precision: 0.30  Recall: 0.35  Specificity: 0.71  F1: 0.30  (not good)  Mod3: MSRE 4.0 | Room for improvement | No preprocessing  No oversampling  Leave one out  Predicting MADRS score and/or depression levels |
| Depresjon: A Motor Activity Database of Depression Episodes in Unipolar and Bipolar Patients | (Garcia-Ceja *et al.*, 2018) |  | NN  Linear SVM  RBF SVM  Gaussian Process  Decision Tree  Random Forest  Neural Net  AdaBoost  Naïve Bayes  QDA  ZeroR Baseline | **See Figure 1 below…**  These are the baselines. |  | Baselines that everyone compares against |
| Applying machine learning in motor activity time series of depressed bipolar and unipolar patients compared to healthy controls | (Jakobsen *et al.*, 2020) | Mean  Standard deviation  Proportion zero activity | Random Forest  DNN CNN  Leave one out (to avoid overfitting) | **See Figure 2 below**  Two runs, first and second (without misclassifications) |  | Circadian rhythm  DNN best |
| Comparison of Night, Day and 24 h Motor Activity Data for the Classification of Depressive Episodes | (Rodríguez-Ruiz *et al.*, 2020) | Day/Night/Full  Fast Fourier Transform  **Time domain:** Kurtosis, median, coefficient of variance, minimum, trim mean;  **Frequency domain:** median, standard deviation, coefficient of variance, spectral flatness  **See Figure 3 for best features.** | Random Forest | Accuracy as high as 99.7%  **See Figure 4 below** |  | Nocturnal motor activity  Sleep investigation |
| Unipolar and Bipolar Depression Detection and Classification Based on Actigraphic Registration of Motor Activity Using Machine Learning and Uniform Manifold Approximation and Projection Methods | (Zakariah and Alotaibi, 2023) | Generated new data (SMOTE)  4x classes (healthy, bipolar I, bipolar II, unipolar)  Normalised data  UMAP (unsupervised machine learning dimension reduction) | Random forest  Decision Tree  Classifying: Depression and Bipolarity | Model 1 (no umap)  Accuracy 0.634  F1 0.5694  Cohen Kappa 0.1058  Model 2 (umap)  Accuracy 0.991  F1 0.9887  Cohen Kappa 0.9772 | Dimensionality reduction: t-SNE, PCA | Dimensionality reduction could be interesting. |
| Feature Extraction in Motor Activity Signal: Towards a Depression Episodes Detection in Unipolar and Bipolar Patients | (Zanella-Calzada *et al.*, 2019) | Statistical features (14)  Took 1st minute of each hour only | Random Forest | Accuracy: 89%  Sensitivity: 86.7%  Specificity: 91.9% |  |  |

A table of numbers and a number of numbers

Description automatically generated with medium confidence

Figure 1 Garcia-Ceja et al.

A table of data with numbers and letters

Description automatically generated with medium confidence

Figure 2: jakobsen et al.

A screenshot of a computer

Description automatically generated

Figure 3 Rodriguez-Ruiz

A table with numbers and percentages

Description automatically generated

Figure 4 Rodriguez-Ruis results