# HARTH: A Human Activity Recognition Dataset for Machine Learning

A. Logacjov, K. Bach, A. Kongsvold, H. B. Bårdstu, and P. J. Mork, "HARTH: A Human Activity Recognition Dataset for Machine Learning".

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# How to perform HAR?























# How does machine learning work in HAR?









































Human Activity Recognition Trondheim Dataset (HARTH)



22 participants
1-2 hours each



Human Activity Recognition Trondheim Dataset (HARTH)



22 participants
 12 activities
 1-2 hours each
 Free-living setting



































#### Experiments Tree-based



Extreme Gradient Boost (XGB)





#### Experiments Tree-based





#### Experiments Tree-based









#### **Results**





#### Results

- Leave-One-Out Cross-Validation
- Metrics:

•  $F_1 = 2 \times \frac{\text{precision} \times \text{sensitivity}}{\text{precision} + \text{sensitivity}}$ 



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- Leave-One-Out Cross-Validation
- Metrics:

•  $F_1 = 2 \times \frac{\text{precision} \times \text{sensitivity}}{\text{precision} + \text{sensitivity}}$ 

|    | k-NN         | SVM          | RF           | XGB          | BiLSTM       | CNN          | mCNN         |
|----|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Se | $0.75\pm.26$ | $0.79\pm.22$ | $0.73\pm.31$ | $0.78\pm.24$ | $0.77\pm.21$ | $0.79\pm.20$ | $0.79\pm.20$ |
| Pr | $0.83\pm.15$ | $0.85\pm.13$ | $0.83\pm.14$ | $0.84\pm.15$ | $0.81\pm.17$ | $0.82\pm.17$ | $0.82\pm.15$ |
| F1 | $0.78\pm.22$ | $0.81\pm.18$ | $0.76\pm.25$ | $0.80\pm.20$ | $0.79\pm.19$ | $0.80\pm.19$ | $0.80\pm.18$ |











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► Goal: HAR on HUNT4 to get physical activity behavior of a population Inference (desired) (trained) SVM





► Goal: HAR on HUNT4 to get physical activity behavior of a population HUNT4 ŵ ? HUNT4 to get physical activity behavior of a population (trained) SVM (Prediction) (Prediction)

**Now:** Physical activities of  $\approx$  30,000 using ML-based HAR



HARTH: https://github.com/ntnu-ai-lab/harth-ml-experiments/



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- Future Work: Walking intensity prediction



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HAR research to gain knowledge about the influence of PAB on PH



# Thank You!

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#### References

- A. Logacjov, K. Bach, A. Kongsvold, H. B. Bårdstu, and P. J. Mork, "HARTH: A Human Activity Recognition Dataset for Machine Learning," Sensors, vol. 21, no. 23, Art. no. 23, Jan. 2021, doi: 10.3390/s21237853.
- 2. K. Bach et al., "A Machine Learning Classifier for Detection of Physical Activity Types and Postures During Free-Living," Journal for the Measurement of Physical Behaviour, vol. 1, no. aop, pp. 1–8, Dec. 2021, doi: 10.1123/jmpb.2021-0015.
- 3. https://github.com/ntnu-ai-lab/harth-ml-experiments/

