Evaluating Wearable Devices for Predicting Mental Health Symptoms in Neurodiverse Children

Shrena Sribalan[1,2], Mahsa Bagheri[1,2], Azadeh Kushki[1,2]

[1] Neurodiversity and Personalized Health Lab, Bloorview Research Institute, Holland Bloorview Kids Rehabilitation Hospital

[2] University of Toronto

Background and Rationale

- Externalizing symptoms **(aggression, rule-breaking)** are common challenges that affect **daily** functioning. [1]
- Current assessments rely on **caregiver reports** and **clinic visits**, which may miss **day-to-day** symptom variability. [1]
- Wearables allow **continuous, objective monitoring** in real-world settings. [2]

Objective

1. Assess wearable-based **prediction** of elevated externalizing symptoms.
2. Compare **deep learning** vs. **feature-based models.**

Research Questions

Can wearable physiological data identify children with clinically elevated externalizing symptoms?

Design and Method

112 Neurodiverse children (ages 4-19; mean 11.7 ± 3.5 years, 62.5% male) participated in a 3-week community trial.

Wearable devices continuously collected:

Heart rate | Heart rhythm variability (RR intervals) | Movement data

- Caregivers completed the Child Behaviour Checklist (CBCL). [4]
- Children were classified using the Externalizing Problems scale of the CBCL clinical cutoff score (T-score ≥64).

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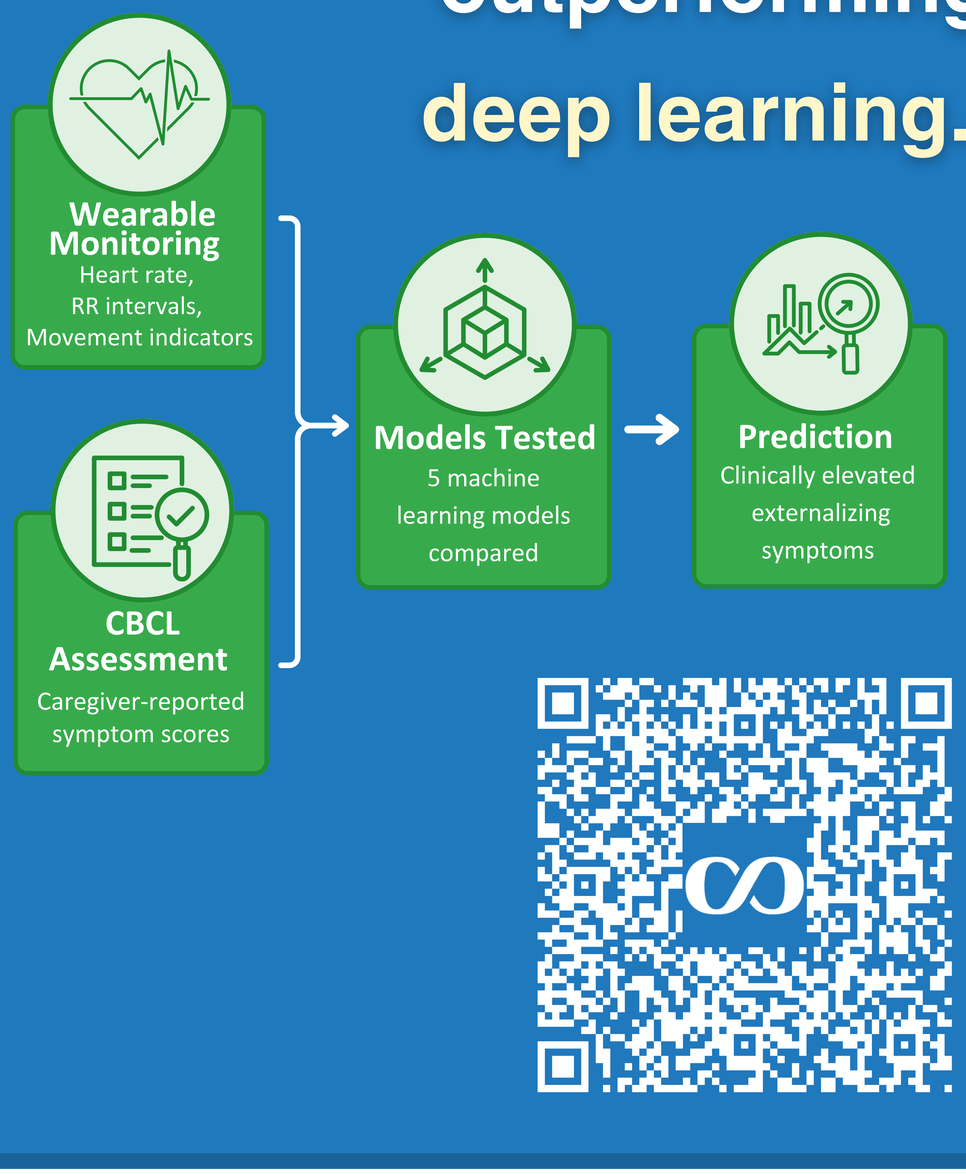
Wearable signals show promise for predicting externalizing symptoms in neurodiverse children, with simpler hand-crafted **feature-based models outperforming deep learning.**



Data Analysis

Feature-based models used handcrafted physiological and motion features.

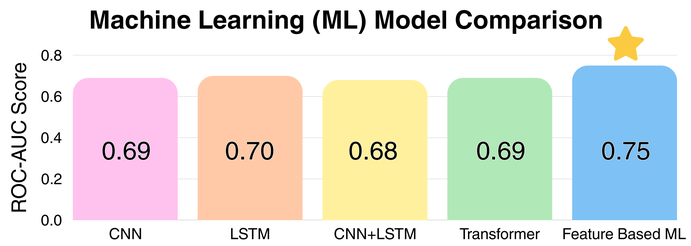
Four deep learning approaches were evaluated: CNN [5], LSTM, hybrid CNN-LSTM models [6], and Transformer architectures [7].

Performance metrics include:

- ROC-AUC
- F1 score

Models were evaluated using stratified **5-fold cross-validation**.

Results



Feature-based models outperformed the **best deep learning model (ROC-AUC of 0.75 vs 0.70)** despite lower complexity.

Relevance to Holland Bloorview

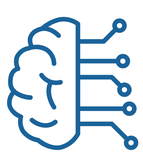
Clients & Families:
Wearables can monitor symptoms in daily life and support **identification**.

Clinical Teams:
Objective monitoring complements caregiver reports and enables more **responsive care.**

Research Community:
Simpler models may outperform deep learning on **small clinical datasets**.

Conclusions & Next Steps

- **Feature-based models** may be more **reliable** than **deep learning** in **small pediatric datasets**.
- Expand the **labelled cohort** to evaluate whether larger datasets improve **deep-learning performances**



Acknowledgements

This work was supported by the Ward Summer Student Research Program, the Ontario Brain Institute, the Canadian Institutes of Health Research (CIHR), and the Canada Research Chairs Program.

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