NeuroDetect V2.0: Smartphone Sensor-Based Detection of Chemotherapy-Induced Peripheral Neuropathy in a Longitudinal Cohort

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Introduction

- Due to the inconvenience of clinic-based **objective** assessment, CIPN monitoring relies primarily on patients' reporting **subjective** symptoms.

- Our prior study found evidence that remote, **objective** functional assessments via NeuroDetect V1.0 iPhone app may differentiate patients with and without CIPN **after treatment**.

Objective

Determine whether remote functional assessment via NeuroDetect V2.0 can predict CIPN **during treatment**

Methods

- **Data Collection**
- Patients initiating taxane or platinum treatment
  1. **NeuroDetect V2.0 functional assessments** collected before each cycle
     1. Gait/balance Tasks
        1. Natural and Tandem walk
        2. Tandem and Romberg stance
     2. Manual Dexterity Tasks
        1. Finger tapping speed
        2. Hole-peg test
  2. **Clinical neurological examination** at end of treatment to diagnose CIPN

- **Statistical Analysis**

- 3700 features generated from NeuroDetect assessments via mhealthtools in R

- End-of-treatment features filtered via minimum redundancy maximum relevance (MRMR)

- Elastic net classification models trained using 70% training dataset with cross validation

- Model performance evaluated in the unbiased 30% testing dataset

Results

- Of 45 patients, 29 (64%) had CIPN in hands, 24 (53%) had CIPN in feet.

- Model with 300 gait/balance features detects foot CIPN (Fig 1)

- Model with 20 dexterity features detects hand CIPN (Fig 1).

- CIPN detection diverges after 60 days of treatment (Figure 2).

Conclusion

Remote functional assessment via NeuroDetect may improve CIPN detection.

Future Work

- Explore the individual contribution of each functional assessment

- Evaluate prediction performance at earlier treatment time points

- Further improve NeuroDetect CIPN prediction model for use in practice

Figure 1. Predicted CIPN probability at end of treatment. Red dots indicate patients with CIPN.
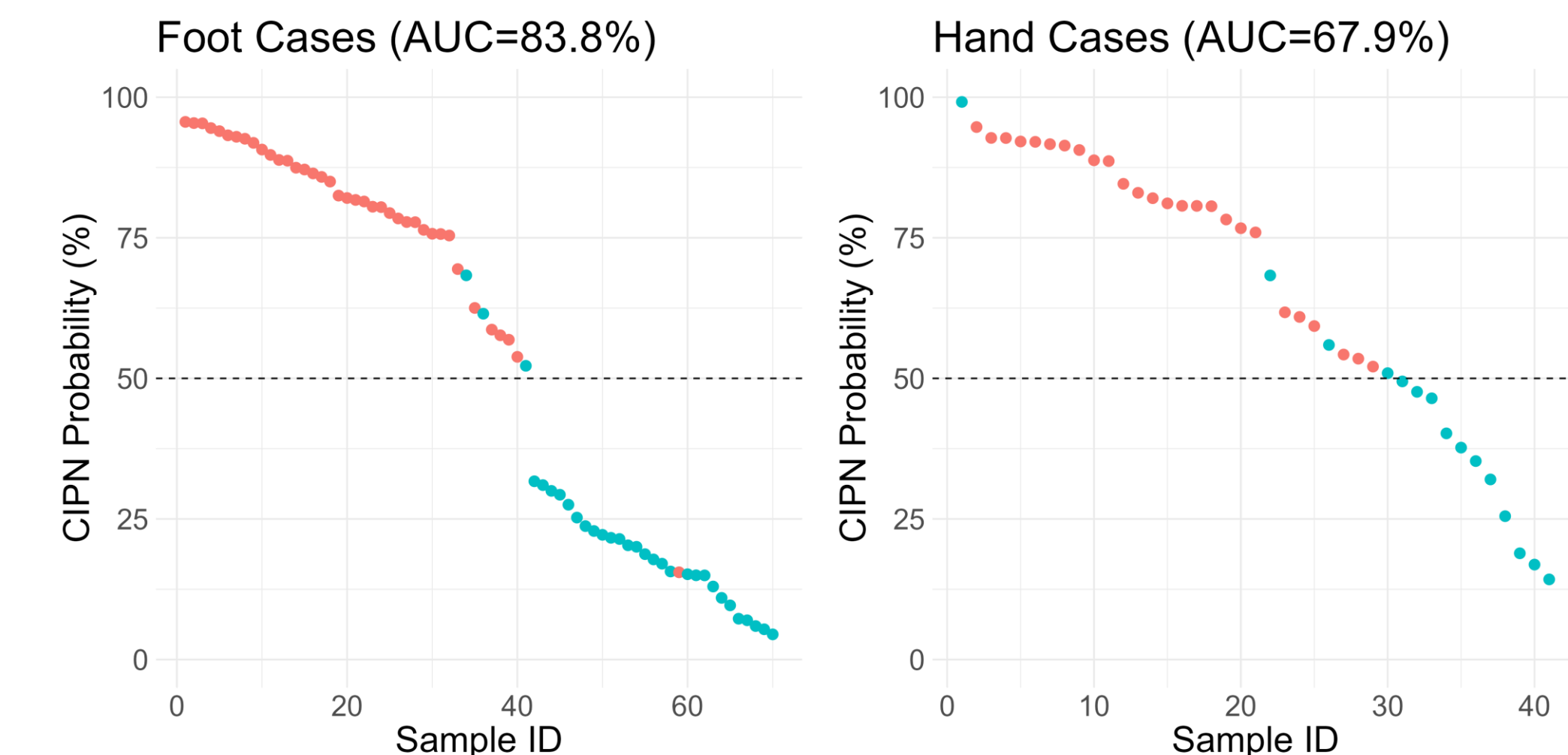

Figure 2. Percentage of patients detected with CIPN over time. Red lines indicate patients with CIPN.