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Dirichlet-Based Touch Discrimination on Vehicle Panels via Multimodal Force Sensing

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***Abstract*—As touch panels become more common in vehicles, the risk of accidental inputs has grown. We propose a method to classify touch intent using a force sensor attached to a tablet with similar properties to in-vehicle panels. Six features—including peak forces and impulses—were collected for three touch types: intentional, accidental-weak, and accidental-strong. A multivariate declustering model was trained using a Dirichlet distribution. The model achieved over 90% accuracy in distinguishing the touch types. Users can test the system by touching the panel and viewing classification results through a simplex graph, which intuitively shows their touch location within the distribution. This approach enhances tactile input reliability in vehicle interfaces.**

Keywords—Haptic interaction, Haptic feedback system, Automotive touch panel, Touch sensitivity, Force sensing,

I. Introduction

As in-vehicle touch panels become common[1], the risk of accidents from mistouches increases[2, 3]. Distinguishing intentional and accidental touches is now essential. One method uses a force sensor behind the panel to separate F_z distributions, but this is often unclear. In this demo, we expand sensing modalities and apply declustering to classify normal touches, weak accidental touches, and strong accidental touches.

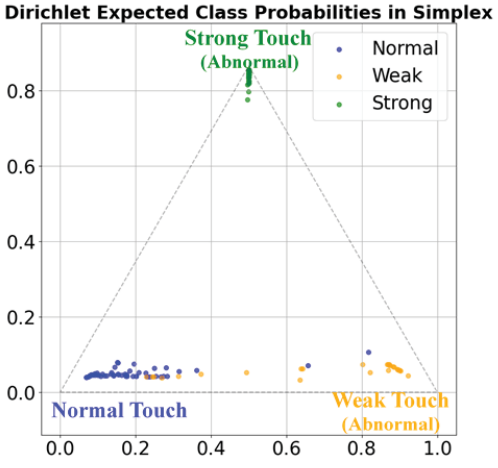

Fig. 1. An example of converting data from three touch types into a Dirichlet distribution.

II. Methods

We used a tablet PC with similar size and sensing to a car touch panel. A force sensor was attached to the back to capture touch forces. For three touch types, we recorded six features: peak F_z, and F_x, F_y at that time, and impulse in three axes. These data were used to build a Dirichlet distribution[4] (a multi-variate declustering model, see Fig. 1). The model classifies each touch by selecting the highest-probability class.

III. Conclusion and Future Work

The model classified normal and two accidental touches with over 90% accuracy. A triangular simplex plot gave an intuitive view of both training and online test distributions (see Fig. 1). This classification approach also contributes to the haptics field by enhancing tactile interaction reliability, especially in safety-critical environments such as vehicles.

IV. Demonstration Plan

Participants can touch the tablet and see if their inputs are classified as intended. A triangular simplex graph shows which class each touch belongs to in an intuitive way.

V. Acknowledgment

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