Keystroke and Sensor Heat Maps

Figure 1 shows examples of extracted heat maps for up-down speed, down-down speed, and down-up speed. Up-down speed is larger than down-down speed and down-down speed is larger than down-up speed. From the heat maps, it is also visible that the highest up-down speed (see Figure 1A) is concentrated in the bigrams (space bar, D),(E, N), and (space bar, shift key). The bigram (space bar, D) has the largest down-down speed (see Figure 1B). The highest value for down-up speed (see Figure 1C) is associated with the bigram (N, symbol key).

Figure 2 shows examples of extracted heat maps for the three-axis combinations. The linear acceleration in the direction of the x-axis and the y-axis shows a large spread. The largest linear acceleration is contributed to the z-axis (i.e., moving the smartphone forth and back). The rotation around the x-axis and y-axis was slightly larger than around the z-axis.

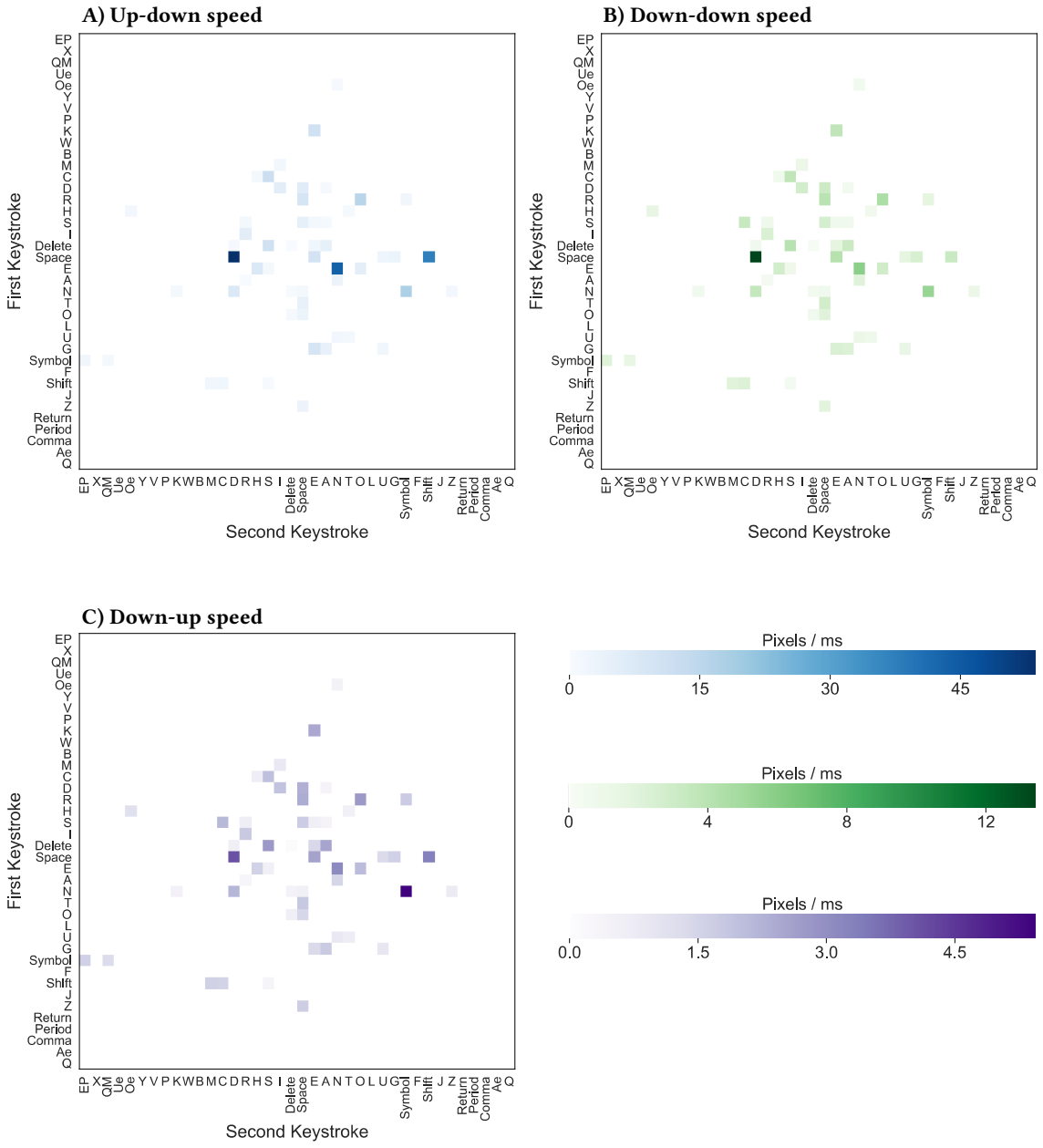

Figure 1: Examples of keystroke heat maps extracted from 80 keystrokes. Abbreviations: exclamation point (EP), question mark (QM), ü (Ue), ö (Oe), and ä (Ae). Color saturation indicates the average up-down speed (A), down-down speed (B), and down-up speed (C) between consecutive keystrokes. The colors are for visualization purposes only.

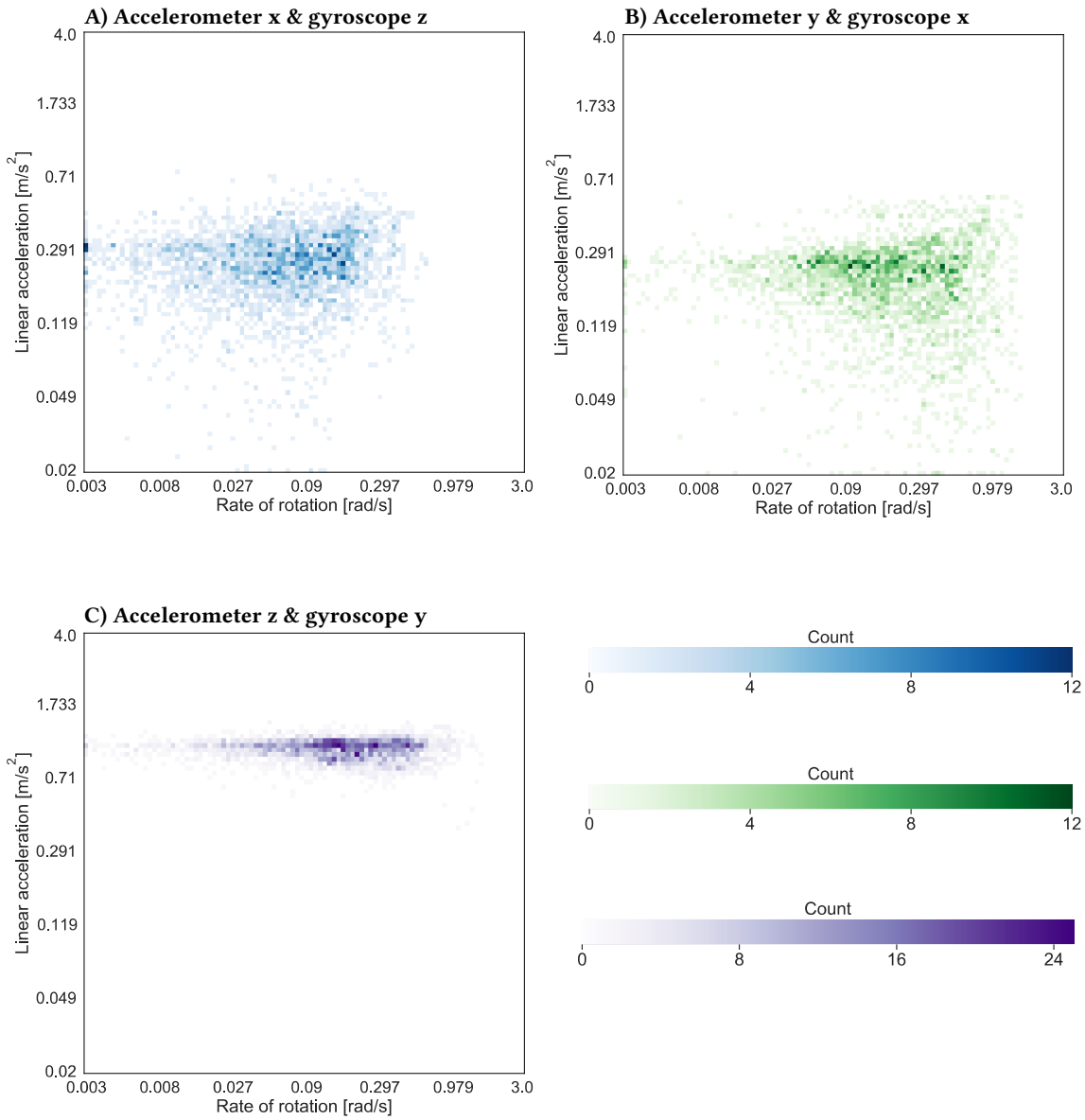

Figure 2: Examples of sensor heat maps extracted over 30 seconds from the gyroscope and accelerometer measurements. The color saturation indicates the number of sensor measurements for the combinations of linear acceleration along the x-axis & rate of rotation around the z-axis (A), linear acceleration along the y-axis & rate of rotation around the x-axis (B), and linear acceleration along the z-axis & rate of rotation around the y-axis (C). The colors are for visualization purposes only.