Sleep Study

Monitoring Sleeping Position

A student in the Yale School of Medicine is planning a study to compare a promising new iPhone/iTouch App (called SomnoPose) to a customized medical device (called the Embletta) for monitoring sleeping position. She's not actually interested in sleep, but is studying eye health. Her long-term research plan is to explore whether pressure on the eyes (perhaps due to sleeping position) could be related to various aspects of eye health. For example, a patient who sleeps almost exclusively on his/her left side might be placing pressure on his/her left eye that is very different from the right eye. Although sleep position isn't a direct measurement of "pressure on the eye," she believes it might be a helpful indicator. The Embletta is considered to be the "gold standard" for the purpose of this study. However, the SomnoPose solution is far less expensive than the Embletta, and the iPhone/iTouch is less cumbersome to sleep with. This student agreed to conduct a pilot study before moving onto a formal study to compare these two devices.

Analyze the data from the pilot study and write a report presenting the results of your analysis. Specifically address the following questions:

- How well do the SomnoPose data compare to the Embletta data?
- Do you recommend constructing a study to formally compare these devices, or is this pilot study sufficient? Be explicit in making your recommendations, and explain what you think can be learned from the study.

Available data and notes

- The data are organized into folders by night, contained in this zip file. Nights through November 19 are for the first subject; November 23 and 24 are for a second subject.
- The SomnoPose data are organized in CSV files, with dates and times clearly marked. Both the **orientation** (left side to right side) and **inclination** (tilt of the body, probably due to use of a pillow or mistaken angling of the device on the body strap) are recorded every two seconds.
- The Embletta data provide only the **orientation** (in a single column, with no header row), but at a higher rate of 10 Hz (10 measurements per second). The position of the Embletta device on the torso may have been more stable than that of the iTouch because of the use of a special strap.
- Embletta recording started at 10 PM and ended at 7 AM (on Nov 17, 18, and 19) and at unknown times on Nov 15, 23 and 24; the SomnoPose App was started and stopped manually (though it was stopped accidentally during the night of Nov 17). Notes for individual nights are provided in each folder. Measurement angles of -90 and 90 degrees are supposed to represent sleeping on the right and left side, respectively, when the devices are worn properly; 0 degrees is "on the back" or "supine", while -180 and 180 degrees are "on the tummy" or "prone". A small number of measurements greater than 180 degrees or less than -180 degrees were called "artifacts" by the sleep center expert and should probably be ignored.

Picture

A picture of the devices on the second subject appears below. The Embletta is silver and is strapped firmly to the torso; the iTouch is black and is clipped onto the strap next to the Embletta. Both subjects attempted to wear the devices in the same position and orientation.