CS 3300 Project2 Writeup

Overview

For this project, we implemented a visualization tool of that relates the percentage of body fat to dimensions of different body parts such as waist, chest and thigh diameter. Body fat percentage is an useful indicator of health. Various methods exist that provide an estimate of body fat percentage, such as skin-fold measurement and table look-up. In our project, we try to provide a vivid way to show body fat percentage in relation to the dimensions of various body parts. Using D3, jQuery, we created two humanoid shapes that changes size to reflect change in body part dimension. We also created a diagram with body part dimension (measured as diameter) as horizontal axis and body fat percentage as vertical axis. The graph allow us to see the statistical correlation between the percentage and dimension. Together, our visualization tool allow us to see both the change in body figure and the change in body dimension as we vary body fat level.

Data

The data we obtained from CMU statistics library (http://lib.stat.cmu.edu/) were taken from 252 males in the United States. The measurement of each individual contains the following factors: body density, weight, body fat percentage, and {height, neck, chest, abdomen, hip, thigh, knee, ankle, biceps, forearm, wrist} circumference. The data were originally hosted on a webpage, so we wrote a program to parse the page and turn the data into JSON format. We used all the circumference data as well body fat percentage data in our presentation. We left out body density as it's not a relevant parameter in our visualization.

Mapping

For our visualization, we wanted users to be able to intuitively understand the numerical data in our dataset. Since we were working with human body measurements, we decided that it would be easiest for user to visually see the measurements in a pictorial form, thus we created two human figures whose proportions correspond to the data measurements.

The first human figure on the left was created by appending various path elements to an SVG parent. The paths were created using functions that relied on measurement variables and are scaled to a ratio of 800 pixels to 180 cm. The functions use a variety of commands in the SVG path mini-language including cubic/quadratic Bezier curves and ellipses to create the anatomically-correct, cartoon-like figure. Since the paths were created using functions, we were able to easily make the figures dynamic by using d3 transitions and updating the path attributes.

The purpose of the figure to the right is to give the user a fast, accurate representation of an human, allowing the user to judge the proportions of the figure and quickly obtain a sense of the relative size of the figure and underlying measurements. However, due to the pictorial representation, the left figure fails to convey specific, detailed information of the measurements. For this task, we created another figure, seen on the right that gives a more detailed representation containing quantitative details of the dimensions.

We wanted to maintain the intuitive nature of a pictorial representation, however we needed to give the user more specific, quantitative details based on our underlying dataset. To accomplish these two objectives, we created a schematic of an human figure and labeled various parts of the figure with measurements. This allowed the spatial/pictorial placement of measurements to inform the user of what exactly is being measured as well as tell the user the specific measurement through the written text.

The third element in our visualization was a graph of the user-selected body part and body fat percentage. This visualization was made using a path extrapolation function called bundle, which is essentially a closed B-spline basis with tension parameters to weight control points. We choose this path function because it was able to highlight the general trend and relationship between the user-selected body part and percent body fat as well as give the user a sense of the variance in the data through the localized oscillations of the path.

Story

From our visualization, we could see that the sizes of all body parts have a positive correlation with the individual's percentage of body fat, although some body parts have stronger correlation than others. For example, the size of abdomen has the strongest correlation with body fat percentage, which corroborates with everyday observation. What's surprising is that the size of forearm varies only slightly over a wider range of body fat percentages. One possible explanations is that since hands are used by humans in almost any action, they get a lot of exercise and therefore do not accumulate as much fat, leading to a relatively smaller increase in size.