CSE 403 Project Proposal
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Pattern

Motivation

People often log their lives in diaries of one sort or another. Writing down what happens to them every day allows people to document their lives and look for patterns in what they do on a day-to-day basis. People often use their written personal history to attempt to identify trends that define how they live their lives. The problem with written diaries is it's difficult to visualize complex or long-term patterns. To look at their annual sleeping patterns a person would have to flip through hundreds of pages of diary or journal entries.

Food diaries are a common form of life logging that people use to look for patterns. They log what and when they eat to search for relationships between eating and other aspects of their lives. These relationships can be too complex to see in text, however.

Diary apps are everywhere, but they generally serve only to replace written diaries. They cannot help users look for the patterns they want to know about. The more complex diary apps are tailored toward specific events. A food diary app exists that allows users to track what they eat, what they weigh, and other health metrics related to losing weight. Many sleep diary apps allow users to log and visualize how much they sleep. There is no easy way to use these apps to see the relationship between diet and sleep, however. Generic event loggers are also out there, but they are simplistic and limited in scope. They list custom events chronologically but offer no visualizations that would allow patterns to emerge. Existing event loggers also lack the ability to assign meaningful values to events – hours of sleep, for example.

Vision

Pattern is an application that allows users to define and log arbitrary events. Events are user-defined and can be linked to arbitrary user-defined values. For example, an event could be "slept" with a numeric value indicating number of hours, or "ate" with a value from "least healthy" to "most healthy", or "met someone" with a name value. The users logs these events as he or she goes about her day by opening the app, selecting an event, and inputting relevant data.

The app then allows the user to visualize the event log using graphs, tables, and other visual tools, allowing the user to see relevant patterns between arbitrary sets of events. It also points out patterns it sees, like "three days after you sleep for fewer than three hours you tend to be in a bad mood". These long-term, temporally offset patterns would be very difficult for someone to pick up on flipping through their diary. It can then offer suggestions when it notices the user logging events that tend to lead to a negative outcome.

Architecture

For ease of development the app will be written in Java for the Android platform. Event data will be stored in files locally. Visualizations will be handled by a third party charting library like ChartDroid, AndroidPlot, or AChartEngine, so that we don't have to reinvent this functionality.

Pattern recognition is the complex part of the project. The diverse pattern recognition we're aiming for doesn't exist in a convenient library; it is very application-specific. We will have to develop it ourselves. There are well-documented ways to find patterns in specific kinds of data, for example, the relationship between two numeric data series plotted on the same axis, but we will need to combine many of these methods to find a wide variety of patterns between diverse kinds of data.

Less complex but still a concern is how to convey patterns to the user. The pattern recognition algorithm determines a mathematical relationship between two variables, which we need to translate into English. This will likely be solved using template pattern messages like "When {A}, {B} tends to happen n days/hours/minutes later". To develop these templates we will need to identify and program a diverse list of common patterns to check against.

Challenges

Developing a powerful and robust pattern recognition algorithm will be incredibly challenging. There is a significant risk of identifying false patterns in the pursuit of a powerful algorithm, which would make the user lose faith in the app's results. If the user can't distinguish between real patterns and hallucinated patterns, the app is of no use.

The user interface needs to be simple and intuitive for this application to be effective for its intended purpose. If the app requires too much interaction or gives too little feedback, the user will either feel burdened by the app or will forget about it. Event logging needs to take less than a few seconds to not be burdensome. We also need to research what frequency of pattern recognition notifications balances accuracy with user involvement.

Graphing diverse data will be a visualization challenge, as well as an API interaction challenge. We are using a third-party library for the visualization, but we will need to chart arbitrary values on the same plots. For example, we might need to graph food eaten at particular times and time spent asleep on the same chart.