Using EventFlow and CoCo to explore classroom activity patterns and learner performance

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In this session I will present a work-in-progress use case of a complementary pair of temporal data analysis tools – EventFlow[1] and CoCo[2]. Developed by Dr Ben Shneiderman and team at the University of Maryland's Human Computer Interaction Lab[3], both tools remain actively under development. Together, they offer the possibility of exploring the temporal and sequential nature of a wide range of temporal sequence data sets, and of uncovering relationships between sequence patterns and outcomes of interest (for example, learner achievement).

The Use Case

I have been testing both tools in analysis of data collected using the 'COPUS protocol' in selected courses at the University of British Columbia. (COPUS, the 'Classroom Observation Protocol for Undergraduate STEM' (Smith et al., 2013), allows observers to generate rich sets of temporal data describing in-class instructor and learner activity, with the goal of "reliably characterize how students and instructors were spending their time in undergraduate STEM classrooms"
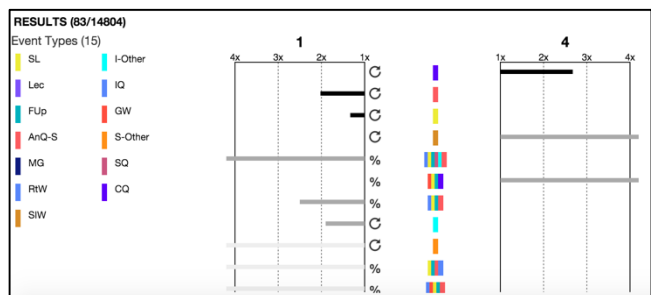
EventFlow

Originally developed to allow visual analysis of temporal data from medical settings, EventFlow was developed by Dr Catherine Plaisant, Dr Ben Shneiderman and team at the University of Maryland's Human Computer Interaction Lab[4]. EventFlow offers a timeline window which can display point and interval events for each record, while the overview window computes and visualizes an aggregated view of all the sequences in the dataset. The development team write: "Multiple graphical search capabilities enable users to find records that exhibit specific temporal patterns. Interactive features allow users to review patterns, find anomalies or construct cohorts, but also allow them to simplify the data in order to sharpen the analytic focus and answer questions about the data." They have subsequently published extensive advice on managing volume and heterogeneity in temporal data analysis using EventFlow (Shneiderman & Plaisant, 2015)
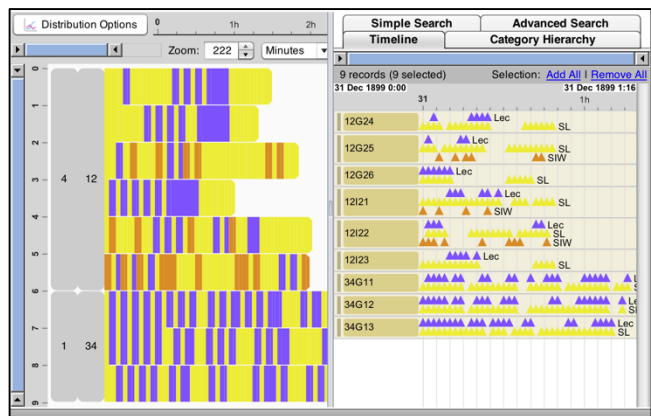
CoCo

Malik et al. (2015) point out that visual analytic tools capitalize on the power of human visual cognition, which allows us to discern context, patterns and anomalies in large sets of data. However, visual analytic tools such as EventFlow which support exploratory and open-ended visual analysis are typically unable to also offer reliable descriptive statistics and automated statistical analysis. Also developed by the HCIL team, CoCo seeks to bridge this gap. It is a visual analytics tool that implements non-parametric tests to allow pairwise statistical comparison of sets of temporal sequence data. % prevalence of events and attribute significances are calculated using Chi-squared tests; time significance metrics use a Wilcoxon sum-rank test across the distribution of values (Malik et al., 2015). Results (comparative statistics for measures such as prevalence and frequency) are displayed visually.

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[1] http://www.cs.umd.edu/projects/hcil/eventflow/
[2] http://hcil.umd.edu/coco/
[3] http://www.cs.umd.edu/hcil/
[4] http://www.cs.umd.edu/hcil/