Graph layout stability in process mining

Process mining enables organizations to analyse data about their (business) processes. Visualization is key to gaining insight into these processes (represented as graphs) and the associated data. Process visualization requires a high-quality graph layout that represents the semantics of the process intuitively. Process analysis additionally requires interactive filtering to explore the process data and process graph. The ideal process visualization therefore provides a high-quality, intuitive layout, and preserves the user’s mental map during visual exploration by keeping the layout stable. The current state-of-the-art and industry standard for process visualization does not satisfy either of these requirements.

In this work, we developed a novel layout algorithm for processes based on the Sugiyama framework. Our approach consists of novel ranking and order constraint algorithms and a novel crossing minimization algorithm. These algorithms make use of the process data to compute stable, high-quality layouts. In addition, we use phased animation to further improve mental map preservation.

Quantitative and qualitative evaluations show that our approach computes layouts of higher quality and preserves the mental map better than the industry standard. Additionally, our approach is substantially faster, especially for graphs with more than 250 edges. Videos of our algorithm can be found online: robinmennens.github.io/StableGraphLayouts

Figure 1: A process visualized using the industry standard. Figure 2: The same process visualized using our algorithm.