



## GPU Implementation of Parallel Coordinates

Today's collected data sets are mostly complex and large, be it in climate research, engineering, or social sciences. Data items are often characterized by many attributes, making them challenging to explore for insights. A prominent visualization technique to analyze such high-dimensional data are Parallel Coordinates. Attributes are represented by equally spaced vertical axes and data items are visualized as polylines that intersect each axis in their corresponding attribute value. For a visualization technique to be helpful for data analysis, it needs to be interactive in real-time, meaning that its appearance updates upon any user input within at most one second.

We, the [chair of Visual Analytics](#), are using the technique in our web-based decision support tool [PAVED](#) and recently published [an extension for temporal data](#) that embeds line charts into the axes. These implementations make heavy use of [D3.js](#) with SVG to render the data items. While rendering a small three-digit number of multi-dimensional items allows for real-time interaction, the performance drastically decreases with thousands of items to be rendered. We are therefore seeking a curious and committed student to work with us on re-implementing the technique with a web-based technology stack that is better suited for rendering large numbers of data items. Your project will center around the following question: How to improve the current tool's scalability w.r.t. the number of items while keeping its interaction functionality?

### Your job

- Profile the tool's code to diagnose the heaviest impact on rendering performance
- Research and conceptualize appropriate mitigation strategies
  - Which computations can be sped up?
  - Is it beneficial to switch from SVG to Canvas?
  - What computations can and should be outsourced to the GPU?
- Implement the identified mitigation strategies
- Evaluate the software performance improvement

### Your background

- Enrolled student in visual computing, computer science, or a comparable field
- Interest in data visualization, software performance, and GPU-based programming
- Experience with web-based and GPU-based programming (e.g., D3.js, WebGL)

**How to apply** If you are interested, please introduce yourself to Dr.-Ing. Lena Cibulski ([lena.cibulski@uni-rostock.de](mailto:lena.cibulski@uni-rostock.de)). We look forward to receiving your application!

